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Evolution of Architectural Engineering and Infrastructural Baselines in the Riverfront: Tracing Processes and the Power Dynamics that Shaped Them

A Comparative Study of HafenCity, Neckarbogen, and 3Land Riverfront Redevelopments

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SUMMARY

Contemporary riverfront redevelopments are complex urban transformations that combine engineering, environmental, social, and economic objectives. Many human and non-human actors shape these projects: national and local authorities, engineering offices, experts, funding mechanisms, laws, technical requirements, natural systems, heritage infrastructures, and the river itself. To achieve a successful transformation that meets the requirements of sustainable and resilient urban development, these transformations unfold as a lengthy process of negotiation and setting trade-offs among the various actants involved in the redevelopment.

The aim of this dissertation is to investigate how infrastructures in contemporary riverfront redevelopment projects evolve, are negotiated, and become stabilized throughout the redevelopment process. The research compares three cases: HafenCity in Hamburg, Neckarbogen in Heilbronn, and 3Land in Basel–Weil am Rhein–Huningue. To successfully investigate the evolution of infrastructures, from idea to implementation, this dissertation examines how architectural engineering and infrastructural baselines evolved, as well as how governance structures and power dynamics influenced these processes. To trace the change of power relations and heterogeneous relationships between infrastructures and other actors in the process, Actor-Network Theory was employed as a theoretical approach.

Methodologically, the study follows a comparative, qualitative, multi-case study research design. Data on the cases were collected through systematic literature and document analysis, semi-structured qualitative interviews, and field visits. To structure the case study analysis, a phasing framework was developed. In this framework, each process was structured chronologically and deconstructed into phases of change, referred to as *translations*. For each translation, technical baselines emerged as gates – infrastructural requirements that had to be met for the process to proceed. Four key infrastructural dimensions in riverfront redevelopments were elaborated: flood protection infrastructure, blue-green infrastructure, active mobility infrastructures, and architectural superstructures. Finally, after each case was analyzed according to the established protocol, a further comparative analysis was conducted to identify convergences and divergences across the three cases.

The results of the empirical analyses and the comparative analysis showed that each project unfolded gradually from vision to measurable parameters. The projects operated in distinct legal, planning, and hydrological contexts, which influenced how different infrastructural priorities were set: flood-related baselines were prioritized in HafenCity, blue-green infrastructures were prioritized in Neckarbogen, and active-mobility infrastructures were a priority in 3Land. The evolution of baselines into measurable parameters and the focus on requirements for infrastructural and architectural performance made architectural engineering

a mediating discipline in this process for turning those requirements into tangible spatial outcomes. Moreover, flexible governance and management structures, phased implementation, and the early establishment of strong connectivity within the redevelopment areas have proven to be key factors in their success.

The contribution of this dissertation is methodological, theoretical, and empirical. Methodologically, the research proposes an innovative framework for analyzing complex urban developments beyond riverfronts by combining process-based research with actor-network mapping. Theoretically, this research advances the understanding of how architectural engineering and process phasing contribute to shaping resilient infrastructures. Empirically, it provides original insights into the three cases and offers practical, policy-relevant implications for the planning and implementation of such long-term, large-scale projects.

ZUSSAMENFASSUNG

Die heutigen Sanierungsmaßnahmen an Flussufern sind komplexe städtische Umgestaltungen, die technische, ökologische, soziale und wirtschaftliche Ziele miteinander verbinden. Viele menschliche und nicht-menschliche Faktoren beeinflussen diese Projekte: nationale und lokale Behörden, Ingenieurbüros, Experten, Finanzierungsmechanismen, Gesetze, technische Anforderungen, natürliche Systeme, historische Infrastrukturen und davor noch der Fluss selbst. Um eine erfolgreiche Transformation zu erreichen, die den Anforderungen einer nachhaltigen und widerstandsfähigen Stadtentwicklung gerecht wird, ist ein Langzeitverfahren der Verhandlung und des Kompromisses zwischen den verschiedenen Akteuren im Sanierungsprozess erforderlich.

Ziel dieser Arbeit war es, die Entwicklung, Aushandlung und Stabilisierung von Infrastruktur in zeitgenössischen Ufersanierungsprojekten zu untersuchen. Diese Forschung vergleicht drei Flussufer-Sanierungen: HafenCity in Hamburg, Neckarbogen in Heilbronn und 3Land in Basel–Weil am Rhein–Huningue. Um die erfolgreiche Entwicklung von Infrastruktur vom Konzept bis zur Umsetzung zu ermitteln, untersuchte diese Arbeit, wie sich Architekturtechnologie und Infrastruktur entwickelt haben, und betrachtete auch den Einfluss von Governance-Strukturen und Machtdynamiken auf diese Prozesse. Die Akteur-Netzwerk-Theorie wurde als theoretischer Ansatz verwendet, um die Veränderungen der Machtverhältnisse und heterogenen Beziehungen zwischen Infrastrukturen und anderen Akteuren in diesem Prozess zu verfolgen.

Methodisch folgt die Studie einem vergleichenden, qualitativen Forschungsdesign mit mehreren Fallstudien. Die Daten zu den Fällen wurden durch systematische Literatur- und Dokumentenanalyse, halbstrukturierte qualitative Interviews und Feldbesuche erhoben. Um die Fallstudienanalyse zu strukturieren, wurde ein Phasenrahmen entwickelt. In diesem Rahmen wurde jeder Prozess chronologisch strukturiert und in Phasen der Veränderung, sogenannte Übersetzungen, zerlegt. Für jede Übersetzung wurden technische Grundlinien als Tore definiert – infrastrukturelle Anforderungen, die erfüllt sein mussten, damit der Prozess fortgesetzt werden konnte. Es wurden vier wichtige infrastrukturelle Dimensionen bei der Sanierung von Flussufern herausgearbeitet: Hochwasserschutzinfrastruktur, blau-grüne Infrastruktur, aktive Mobilitätsinfrastrukturen und architektonische Überbauten. Nachdem jeder Fall gemäß dem festgelegten Protokoll analysiert wurde, wurde abschließend eine weitere vergleichende Analyse durchgeführt, um Konvergenzen und Divergenzen zwischen den drei Fällen zu identifizieren.

Die Ergebnisse der empirischen Analysen und der vergleichenden Analyse zeigten, dass sich jedes Projekt schrittweise von einer Vision zu messbaren Parametern entwickelte. Die

Projekte wurden in unterschiedlichen rechtlichen, planerischen und hydrologischen Kontexten durchgeführt, was sich auf die Festlegung unterschiedlicher infrastruktureller Prioritäten auswirkte: In der HafenCity standen hochwasserbezogene Grundlinien im Vordergrund, im Neckarbogen wurden grün-blaue Infrastrukturen priorisiert und im 3Land standen Infrastrukturen für aktive Mobilität im Vordergrund. Die Entwicklung von Grundlinien zu messbaren Parametern und die Fokussierung auf Anforderungen an die infrastrukturelle und architektonische Leistung machten das Architektur zu einer vermittelnden Disziplin in diesem Prozess, um diese Anforderungen in konkrete räumliche Ergebnisse umzusetzen. Darüber hinaus haben sich flexible Governance- und Managementstrukturen, eine stufenweise Umsetzung und die frühzeitige Schaffung einer starken Vernetzung innerhalb der Sanierungsgebiete als Schlüsselfaktoren für ihren Erfolg erwiesen.

Der Beitrag dieser Dissertation ist methodisch, theoretisch und empirisch. Methodisch schlägt die Forschung einen innovativen Rahmen für die Analyse komplexer städtischer Entwicklungen über Flussufer hinaus vor, indem sie prozessbasierte Forschung mit Akteur-Netzwerk-Mapping kombiniert. Theoretisch fördert diese Forschung das Verständnis dafür, wie Architekturtechnik und Prozessphasen zur Gestaltung resilienter Infrastrukturen beitragen. Empirisch liefert sie originäle Erkenntnisse zu den drei Fallbeispielen und bietet praktische, politikrelevante Implikationen für die Planung und Umsetzung solcher langfristigen Großprojekte.

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1. INTRODUCTION

1.1. Research Background

The morphodynamical development of riverfronts in Europe is correlated with five historic periods of industrial development from 1801 to the introduction of the EU Water Framework Directive (Wolf et al., 2021). Each period exhibits a distinct influence on the river corridors, driven by human interventions. Historically, riverfronts in many German cities have played a central role in their economic and social development. Post-WWII reconstruction efforts, industrial decline, and shifts in urban planning paradigms have resulted in underutilization and disconnection of riverfronts from the urban fabric. As a result of economic restructuring, industrial zones, ports, and transport routes have been relocated, leaving behind brownfield sites (Hersh et al., 2012). These brownfields are predominantly located in central urban areas and along rivers.

As a result of the shifting landscape of the post-industrial era and growing emphasis on commodification, sustainability, and urban resilience, European cities over the past few decades have undergone a transformative process of their riverfront brownfields. This is especially evident in cities in Western Europe, with Germany, France, Spain, the UK, and the Netherlands as the forerunners in this process (Rode and Valette, 2019; Tort-Donada et al., 2020). Due to the proximity to existing urban infrastructure, the complexity of the land uses, the historical and economical evolution, the restructuring of waterfront brownfields represents a unique phenomenon (Hersh et al., 2012).

Contemporary waterfront redevelopment projects are influenced by global actors, private investors, multinational corporations, and international quality and sustainability standards. These kinds of *extrastate* forces (Easterling, 2014) shape decisions on land use, financing, and governance in such areas. Riverfront redevelopments are long-duration processes that can span over several decades. Over this period, economic, environmental, and social conditions can change. In recent decades, climate change awareness and rising flood risks have led to a paradigm shift in planning and engineering, promoting flood-resilient and environment-conscious solutions (Restemeyer et al., 2015; Urbane Gewässer - Forschungsverbund, n.d.). Through strategies such as spatial stacking and time-shifting for enabling different uses, riverfronts are designed as multifunctional spaces that can significantly contribute to achieving resilience in multiple aspects (Ahern, 2023). Waterfronts are places that host an interplay between natural systems and urban infrastructures.

Consequently, redevelopments are constrained by flood management, zoning regulations, and economic networks, which operate beyond the visible design.

In Germany, numerous riverside industrial zones are being transformed into mixed-use areas (Wolf et al., 2021) shaped by contemporary real estate demands and often are dominated by high-end residential projects (Schubert, 2010). Their governance mechanisms increasingly rely on public-private partnerships and professional development management that coordinates financing and implementation. The real estate sector also plays a key role by supporting the implementation of attractive riverside infrastructures, such as promenades, cultural facilities, and open spaces, which would improve the marketability of the new neighborhoods and attract buyers. Many of the initially observed riverfront projects share similar development patterns and goals, like urban branding, real estate value creation, and use of flagship architecture to achieve these goals. Nevertheless, their long implementation horizons indicate that there were deeper layers of negotiation between technical, environmental, and political actors. Thus, contemporary riverfronts can be seen as arenas where questions of resilience, sustainability, public accessibility, and economic goals are confronted. In this context, this dissertation aims to uncover how these competing objectives become stabilized over time and how they are translated into the architecture and infrastructures we see today.

This dissertation perceives riverfronts as complex infrastructural systems and frames the transformation process as the process of establishing multiple, interlinked networks. The research is informed by Actor-Network Theory (ANT) perspective (Latour, 2007) to investigate the relationships among heterogenous actors. Three different cases are analyzed: the HafenCity project in Hamburg, the Neckarbogen development in Heilbronn, and the 3Land project spanning Basel, Huningue, and Weil am Rhein. These cases were selected because they represent transformations of former port sites of different scales located in highly urbanized areas. Each case is situated along a major river (waterway), but within distinct hydrological, legal, ecological, and organizational contexts. The cases exhibit clear sequences of project phases, diverse governance structures, varying flood management strategies, and different quality ensuring mechanisms, all of which can be systematically compared in the final stage of the research. Additionally, the availability of extensive public documentation enabled detailed tracing of the processes. Official planning for the redevelopments started around the 2000s while the first feasibility studies were conducted as early as the 90s (HafenCity) with each project unrolling at a different pace. At the time of research, the cases were at different implementation phases, which provided opportunities to examine how projects behave in various stages in today's context.

1.2. Problem Statement and Research Aim

Redevelopment projects often face challenges reconciling competing priorities, such as providing public spaces for diverse social needs, managing flood risks, contributing to the city's image, building sustainably, ensuring access and connectivity, and preserving the area's ecological corridors. Existing research offers limited insights into project sequences and how they stabilize technical baselines within the long planning and implementation process. Despite the growing number of urban redevelopments along rivers, the conflicts, trade-offs, and the dynamics of the processes remain unexplored. Understanding how these dynamics affect the implementation of these projects is crucial for understanding the outcomes. Therefore, the aim of this dissertation is to investigate how different infrastructural systems in contemporary riverfront redevelopment projects evolve through negotiations among actors throughout the planning and implementation process.

1.3. Research Questions and Objectives

The dissertation sets three main objectives: Identification of the trajectory of negotiation and stabilization of infrastructural and architectural systems across different redevelopment phases; Comparison of the stabilization processes in order to identify similarities and differences across the three case studies; and contribution to advancing the methodological use of actor-network mapping in architectural and infrastructural engineering research.

The main research question guiding this dissertation is:

How does gate-based phasing in large riverfront redevelopment projects stabilize technical baselines across infrastructural systems, resolve cross-system conflicts, and does it lead to alignment or difference across the cases?

1.4. Scope and Limitations

The scope of this dissertation focuses on the implementation processes of riverfront redevelopment projects in Germany and their complex actor-networks. This study has several limitations that should be acknowledged. First, the research is geographically limited to Germany, France and Switzerland, which may restrict the applicability of findings to other contexts or regions with different social, environmental, or regulatory frameworks. The chosen cases may not fully capture the diversity of approaches and challenges faced in other global riverfront projects. Second, the research employs a qualitative methodology, focusing

on in-depth case study. As a result, the findings are context-specific and may not be generalized to other urban contexts or projects operating under different conditions. The reliance on qualitative data, including secondary sources, interviews, and observations, also introduces the potential for subjective interpretation, although efforts were made to triangulate data sources.

1.5. Structure of the Dissertation

This dissertation is structured into ten chapters. *Chapter 1* introduces the research background, identifies the problem statement, presents the research objectives, and the main research question. This part also defines the scope and limitations of the research and presents an outline of the dissertation structure. *Chapter 2* provides an extensive literature review, which firstly presents the historical and contemporary perspectives on riverfront redevelopments. This chapter explores the historical evolution of riverfronts and the research topics related to riverfronts identified through scientific literature. Moreover, theoretical and methodological gaps in existing research were identified, and the relevance of this dissertation in addressing these gaps was explained.

Chapter 3 establishes the theoretical and methodological framework of the dissertation. The chapter describes the data collection and data management methods and presents the analytical framework through which the selected cases were analyzed. *Chapter 4* presents the empirical analysis of three cases. Each case study section goes through an overview of the project's historical context; it deconstructs the development process from the initial planning phase until the present time; it shows the power relations in the processes using the actor-network mapping method; it presents the evolution of architectural and infrastructural baselines; and it summarizes the findings for each case study.

Chapter 5 presents a comparative analysis, first between the three cities, then between the three cases. *Chapter 6* discusses the empirical findings on the integration of infrastructural baselines and the role of architecture in the riverfront as a complex system. *Chapter 7* is dedicated to discussing the results, answering the research questions, and exploring theoretical, methodological, and empirical implications. Finally, *chapter 8* concludes the dissertation by summarizing the key findings, discussing the study's contributions to knowledge, acknowledging its limitations, and offering recommendations for future research. The last two *chapters – 9* and *10* list all references cited throughout the dissertation and include appendices with supplementary material relevant to the dissertation.

2. LITERATURE REVIEW

2.1. Introduction to the Literature Review Chapter

This chapter firstly provides background information on the historical evolution and functions of riverfronts in European industrial cities by tracing the transformation and redevelopment of riverfronts since the industrial era, and the shifts in their functions and uses. Furthermore, the chapter reviews existing scientific literature to identify the dominant roles that riverfronts play in contemporary urban contexts in Western Europe and, more specifically, in Germany. In the last part of this chapter, theoretical, thematical and methodological approaches for studying riverfront redevelopments are reviewed and a research gap in scientific literature is defined.

2.2. Purpose and Scope of the Review

The purpose of this review is to critically assess the existing literature on contemporary urban redevelopment projects in riverfronts, to examine the process of their transformations, and identify gaps in current research. The review included scientific literature that covers empirical studies, theoretical frameworks, and case-based research on governance, design, and infrastructure in riverfronts. In addition, contemporary cases of riverfront redevelopment were examined to identify emerging trends and understand the characteristics and dynamics of these transformation processes. This serves as an initial step toward defining the three case studies to be investigated more in-depth. In the review of scientific work and existing cases, the focus was on riverfronts in urban areas and projects located in Germany, as well as in the wider context of Western Europe. Scientific literature published in the last two decades (2000-present) was mainly covered because the dissertation focuses on recent developments, trends, and methodologies.

The following review questions are addressed in this chapter:

a) How did urban riverfronts in Europe, and particularly in Germany, evolve historically?

b) What are the prevailing trends in urban riverfront planning and redevelopment in Germany in the last three decades?

c) How were European urban riverfronts researched over the past 20 years (theoretically, methodologically and thematically)?

d) How are the riverfront redevelopment processes been investigated, and what research gaps remain?

Organization of the Literature Review

The literature review is structured to systematically address the review questions and is organized into the following sections:

The section *Tracing the Transformation of Rivers and Riverfronts* introduces the topic of riverfront redevelopment in cities and provides historical context for understanding the evolution of urban riverfronts and addresses the first two review questions. The section highlights key historical shifts in urban planning and riverfront design, especially in Germany. The *Review of Riverfront Redevelopment Research* section provides a comprehensive review of the scientific literature on riverfront redevelopment and addresses the thematic, methodological, and theoretical aspects of the existing research. Finally, by assessing the existing literature across these dimensions, with a particular focus on the redevelopment processes, this section identifies areas that require further investigation. In the *Summary from the Literature Review and Research Gaps* section, the existing literature's gaps are discussed.

2.3. Tracing the Transformation of Rivers and Riverfronts

Rivers profoundly influenced the layout and development of cities worldwide. That is because rivers served as essential conduits for trade, transportation, and defense, and provided people with access to natural resources. Thus, rivers played a role in shaping the morphology of cities not only on the profile of the corridors, but also in the wider context of the city (Pattacini, 2021), which resulted in morphological distinction between river and non-river cities (Abshirini & Koch, 2016). Cities have an evolving relationship with the river, forming a cycle where the river initially supports the growth of settlements as an economic resource but later becomes a hazard due to flooding and pollution. In Europe, interventions in water bodies to support industrial activities began during the pre-industrial phase, which spanned from the mid-18th to mid-19th century and was defined by extensive mining operations (Brown et al., 2018). Five management phases apply universally to the morphodynamical development of rivers and riverfronts, and they are closely related to the five historic periods of industrial development between 1801 and 2019, each period exhibiting a distinct influence on the watercourse, driven by human intervention (Wolf et al., 2021).

Impact of Industrialization on Urban Riverfronts

The transformation of rivers into controlled channels in European cities dates to the early industrial era. Over the past 150 years, most rivers and streams in Central Middle

Europe, particularly in densely populated areas, were heavily modified (Binder et al., 2015). The *industrial* phase, spanning from the mid-19th century to World War I, was a period when rivers supported water-intensive industries, which led to water crises and channelization (Brown et al., 2018; Wolf et al., 2021). Rapid urban growth in some cities demanded housing, industry, and trade, necessitating transformations in sanitation, flood protection, river engineering, water supply and sewage systems. These transformations led to construction of artificial riverbeds and flood walls, which restricted public access but left lasting legacies in city landscapes that are still visible today (Hoyle, 1989; Winiwarter et al., 2016). With the transition of energy sources from wood to coal and from kinetic to heat energy, urban metabolism shifted significantly, which led to the emergence of railways in Germany by the end of the 19th century (Fremdling, 1977; Winiwarter et al., 2016). Industrialization transformed waterfronts by introducing linear infrastructure, such as highways and railroads, and port infrastructure, and by channelizing rivers to improve navigability (Pattacini, 2021). The rivers lost their topographical and landscape value, becoming infrastructures surrounded by industrial zones. The previously continuous riverside spaces became fragmented and disconnected from their natural context (Bruni, 2016; Wolf et al., 2021). Historic uses of riverfronts were segregated, leading to monofunctional waterfronts (Winiwarter et al., 2016).

Over 90% of German rivers and streams were straightened and reinforced with fixed banks and weirs for irrigation and hydropower. During the *agricultural* phase, from the end of World War I to the 1980s, the focus was on floodplain reclamation for agriculture and settlements, which further straightened rivers to facilitate land reclamation (Wolf et al., 2021). These changes disrupted longitudinal and lateral continuity and rivers' natural flows, fragmented habitats, and blocked the migration of aquatic organisms. Industrialization, agriculture, and population growth further deteriorated waterways with urban wastewater and agricultural runoff, degrading ecosystems and water quality (Binder et al., 2015). The extent of these impacts varies across historical periods and depends on geographical factors, such as landform configurations.

Post-Industrial Riverfront Regeneration

Port closures, deindustrialization, abandoned land, and the desire for open space resulted in start of waterfront regeneration (Hoyle, 1989) which was accelerated by social, community and environmental concerns (Roberts, 2000). In 1960s, the redevelopments for new uses for derelict port areas first emerged in North America with facilities, hotels, and offices being built on former brownfields (Schubert, 2010). The possibility of using former industrial areas and ports assured a qualitative and economic improvement for the city. New

uses in redevelopment areas were usually assigned to trigger the acceleration of development of the city as a whole.

In the early 1980s, containerization technologies that started to dominate the shipping, led to large-scale mixed-use developments like offices and leisure facilities, but the planning of these transformations was characterized as weak (Schubert, 2010). During the 80's revitalizing obsolete industrial waterfront areas became a priority, and the projects aimed at attracting businesses and residents to drive economic growth. The London Docklands development became one of the first and largest waterside regeneration projects which aimed to attract private investment, create a global financial center, improve infrastructure, and address the area's economic stagnation through the development of commercial spaces, housing, and transportation links (Brownill, 2010).

In the. early 1990s, European seaports like Oslo and Gothenburg introduced participative planning, master plans, and competitions (Briers, n.d.). Redevelopments were catalyzed by flagship architectural projects or by events of national or international character like the Expo '92 in Seville and the 1992 Olympic Games in Barcelona. New riverfront uses included housing which helped reduce the reliance on fluctuating tourist numbers (Schubert, 2010). Such an example is the city of Bilbao which faced economic collapse in the 1980s**,** but through a regeneration strategy that included redeveloping industrial sites, the city successfully revitalized itself. Key project in Bilbao was the Abandoibarra District that included the Guggenheim Museum - Frenk Ghery's iconic building (Álvarez Mora, 2019)

During the *ecological improvement* phase in Germany (1980s to 2000) the focus of the redevelopment projects shifted to water quality and environmental considerations. The water bodies were recognized as part of ecosystems in the 1986, first time by the *Federal Water Act* in Germany (Wolf et al., 2021). By the late 20th century, in context of increased ecological and social wellbeing awareness, restoration projects began to improve flood control, ecology, and the rivers' recreational appeal (Binder et al., 2015). During the 1990s, Germany witnessed a series of noteworthy riverfront redevelopment projects. A notable example is the Rheinuferpromenade in Düsseldorf, where a key aspect of the transformation was the relocation of the traffic underground in order to create a more pedestrian-friendly public space along the river. The former industrial area of Duisburg also underwent a fundamental transformation into a mixed-use development. This process began as part of the *International Building Exhibition Emscher Park* (IBA), which ran from 1989 to 1999 (Foster and partners, n.d.) and was based on plans by British star architect Sir Norman Foster. The restoration of the heavily polluted Emscher River was a key ecological component of this transformation - the project aimed to re-naturalize the river, and to improve water quality,

biodiversity, and flood protection. Rheinauhafen in Cologne was one of the biggest redevelopments initiated in the 90s (Maliene et al., 2012). Moreover, some smaller size redevelopments like the one of Elster and Pleiße Millraces in Leipzig (since 1996) occurred which involved uncovering rivers to reconnect them with the urban landscape (Prominski et al., 2017).

From 2000 to the present, the *Water Framework Directive* (EU-WFD) phase has taken place. Sustainable water management and the restoration of water bodies are in focus, even though industries remain influential stakeholders on the riverbanks. Despite efforts during both the *ecological improvement* phase and the *EU-WFD* phase, significant changes have yet to be observed, given the relatively short timeframe since their implementation (Wolf et al., 2021). Since the 2000s, projects have been led by private-public partnerships, and mixed-use developments and luxury housing dominated the plans (Schubert, 2010). These projects aim to build a better image of the cities, thus, important events are still used as instruments to catalyze their implementation, like Expo 2008 in Zaragoza, BUGA 2019 in Heilbronn, or the 2024 Olympic Games in Paris (Bauer-Babef, 2021; Tort-Donada et al., 2020).

What Makes Successful Riverfront Redevelopment?

Before 2010s many waterfront redevelopments did not prioritize connecting the city to the water and mainly put emphasis on stimulation of the visual senses. The redevelopments in waterfronts became so popular that cities wanted to do it to chase prestige. Large-scale and highly visible redevelopments offer a chance for redefining the city image. Waterfronts are prime locations for city marketing through landmark projects by renowned architects (Schubert, 2010) because they can provide 'more monumental setting' for the buildings by reflecting them and with that, they contribute to the picturesqueness of the cities and their aesthetic (Robinson, 1901). Up to 2001 flagship architectural projects and tourist attractions were placed on riverbanks, as a key element of the city's identity. Creating artificial urban waterfronts can benefit city marketing and sense of place for the locals (Stevens, 2009).

However, there is always a danger of *Disneyfication* or gentrification of the redeveloped area, and loss of the local identity (Pinto and Kondolf, 2020) caused by providing experiential effects in the waterfront through spectacularizing of architecture, landscaping and even land use (Stevens, 2009). Globalization also can lead to standardized placemaking, where one waterfront looks like any other. Improving the lack of sense of place with local heritage, artworks, and street life can end up commercializing local authenticity for a global

audience. Paradoxically, these standardized waterfronts can acquire new and authentic uses and meanings precisely because they become global (Stevens & Dovey, 2004).

There are cases where the human interventions on the riverfront were inspired by interventions from other contexts. Examples for this are cities in Asia taking western models of waterfront redevelopments, too expensive or out of scale projects for the context (mostly buildings of *starchitects*), wrong programs for the context (monofunctional, commodified waterfronts), inappropriate timing of the project, incorrect phasing of the project, using too much grey infrastructure for flood management instead of green infrastructure, ignoring the water quality and health of the rivers (Pinto and Kondolf, 2020). In these newly redeveloped areas nature reappears but in a controlled way, cleaning up the image of the city and cleaning up these polluted sites. This infrastructure not only controls the water, it also controls people that try to access the water and enjoy it.

Recently, many projects focused their attention on people's experience with water which shifted the attention from pure spatial design offering different leisure activities, more touristy and escapist experiences and a possibility for the people to engage with the water. In 2002, mayor Delanoë of Paris transformed parts of the Seine expressway into the seasonal *Paris Plage*, reconnecting neighborhoods with the water by sacrificing longitudinal social connectivity to create better lateral connectivity [1] to the river. Mayor Hidalgo, later permanently closed the expressways, prioritizing pedestrians and cyclists over high-speed car traffic (Freemark, 2019a).

Similar types of waterfront reclamations have appeared across Europe. Newly emerging city beaches are a form of reclamation of the waterfront (En-Nejjari, 2020; Madanipour, 2017; Stevens, 2018) that illustrate processes, forms, and flexibilities that might change how planners, designers, and managers think about the production of urban open space more generally (Gale, 2009). In Germany there are numerous comparable initiatives for improvements of public spaces along rivers. Among many examples is the Wupper River in Wuppertal which underwent transformation between 2004 and 2007 (Prominski et al., 2017). Complementary to these top-down projects, initiatives such as *Flussbad* in Berlin and *Pool is Cool* from Brussels emerged in the last 15 years, promoting swimming, sunbathing and pointing to the significance for the people to have access to the water. While city beaches provide artificial interventions to draw people closer to water, the tradition and resurgence of swimming in urban rivers show the potential of rivers as shared public spaces. Swimming in the city waters is something that has been a tradition in some cities due to the clean waters.

[1] Concepts of social connectivity along rivers are described by Kondolf & Pinto (2017)

Switzerland is considered a pioneer of the city swimming movement; cities like Basel, Bern, and Zurich have successfully reclaimed their rivers as natural and public resources within the built environment over the past few decades. Other cities like Copenhagen also regained the swimming tradition due to the decline in water pollution. The resurgence of swimming in urban rivers highlights the need for urban river restoration approaches that go beyond waterfront design to integrate ecological and urban needs. By this, both, the river and the city as adaptive systems, can be improved (Veról et al., 2020).

In Germany, examples of multifunctional riverbank design which combines flood protection to other functions emerged in the last decades. Notable examples of this integrated approach include the Rhine project in Brühl (since 2004), which integrated flood protection with habitat restoration and the *Isar Plan* Munich (since 2000), which restored floodplains, reinforced flood safety, improved biodiversity, and created new recreational areas (Binder, 2010; Kondolf et al., 2021; Pugliese et al., 2020). Comparable approaches that rely on multifunctional design, not to improve the biodiversity, but to strengthen flood protection are evident in *Niederhafen Promenade* transformation along the Elbe in Hamburg (2006-2015), which combined a flood barrier with a public promenade, and the Main River development in Wörth am Main (2001), where a dike also serves as a multifunctional park (Prominski et al., 2017). These examples showcase that a successful riverfront planning is not defined by iconic architecture, but the interplay between architecture and different infrastructural systems that can enable a balance between the ecological needs, public accessibility, social inclusivity and flood protection.

In a context of diverse programs and conflicting interests, the key question becomes how to successfully redevelop a riverfront? Hersh et al. (2012) and Wang (2002) summarize the important points for successful contemporary riverfront transformation: a development framework or a vision, the delivery mechanism, the involvement of public-private partnerships, good timing and marketing of the redevelopment - all of this to ensure an economic and social balance in the outcomes and to define the waterfront's future role in the city. Their further points include: an inclusive master planning that involves communities and developers in early development stages; creating favorable physical and economic conditions; collaboration with public authorities, private organizations, and community groups, ensuring sufficient funding from governmental and public sources, flexibly reviewing master plans to adapt to market changes and mitigate financial risks, ideally led by an powerful and independent development agency, incorporating sustainable practices and infrastructure that takes into consideration the climate change (particularly the increased risk of flooding), improving the ecological corridors and natural features in the rivers and

riverbanks, creating good quality and accessible public spaces on the waterfront, resolving ownership issues, and successful blend of new functions into existing historical areas to improve the local identity.

New Roles of Urban Riverfront Redevelopments: A Summary

Riverfronts have undergone significant transformations in the last two centuries. Firstly, rivers were straightened and channelized. Enclosure of rivers with concrete degraded the ecological corridors and reduced the river's water quality. Urban growth has also pushed rivers to become underground infrastructures which separated them from the urbanscape. Due to deindustrialization, city riverfronts lost their primary function as industrial areas and became dilapidated brownfields. Germany's industrial history left a legacy of disused riverfronts, which led city officials and urban planners to envision a new chapter in the evolution of riverfront areas especially since the 1980s, driven by a growing awareness of ecological and social issues. The redevelopment movement gained momentum with the 2000 *Water Framework Directive*, which put focus on achieving good ecological status for rivers. Climate change and rising flood risks have resulted in a paradigm shift towards embracing flood resilient solutions as integral components of the design of the riverfronts

Redevelopments in the last 20 years aimed to make improvements in flood protection, biodiversity, urban aesthetics, and quality of life by providing better public spaces, more sustainable building practices and better active mobility along rivers. Waterfront regeneration can also help increase real estate property values and preservation of historical and local heritage, as well as re-use of historic buildings. They provide opportunities for new uses and activities, create new economic regeneration opportunities for declining inner-city areas, and attract tourists on regional, national, and international levels. Furthermore, waterfront regeneration contributes to the provision of new homes, the creation of jobs, the improvement of environmental conditions, and the advancement of better transport and social services. They also help forge a relationship between water and the city, encourage economic investment in degraded areas, enhance the city's image, and facilitate effective city-marketing strategies (Jones, 2006; Papatheochari, 2011). However, to design and engineer complex urban spaces such as riverfronts, there are a lot of underlying competing interests (Pinto and Kondolf, 2020). These conflicts are further highlighted by global trends in port logistics and economic activities, resulting in clash between architects, real estate industry and urban developers (Schubert, 2010).

2.4. Review of Riverfront Redevelopment Research

A significant portion of the research reviewed during the explorative phase of this research concentrated on specific aspects of riverfront area planning and design. In contrast, this section of the literature review focuses specifically on studies addressing the transformation processes of riverfronts. This section is divided into two parts:

- Theoretical and thematic review: This part elaborates on the theoretical frameworks and emerging themes identified in literature.
- Methodological review: This section discusses the most used methods in research that focuses on the process of redevelopment and transformation of rivers and their surrounding areas.

Theoretical and Thematical Review

This section reviews the body of literature on riverfronts and their transformations from the last two decades. Scientific literature focuses on transformations of the riverbed and the immediate area along rivers - the riverbanks (Prominski et al., 2017) or explores the redevelopment of entire settlements located within the broader urban river corridor (Desfor & Laidley, 2010; Forgaci, 2018; Winiwarter et al., 2016). The focus of this review is on scientific books, articles, and reports that address the redevelopment of urban rivers, riverfronts, and river corridors.

In the 90s new theories emerged which changed the way we look at cities. *Landscape Urbanism* (Waldheim, 2016) looks into integration of ecological and urban systems through multifunctional design (Chou, 2016). *Landscape urbanism* has influenced many other urban theories, like the *Resilience theory* - an important framework in the literature on riverfront redevelopment, as these areas are often vulnerable to flooding. The concept of urban flood resilience has undergone changes: the shift from hard to soft infrastructure and integration of ecology in urban design (use of floodable parks, green corridors etc.) and focus on systems thinking (the importance of interplay between different systems). Literature influenced by this theoretical background largely discusses how flooding risks and rising water levels shape the waterfront (Macdonald, 2017; Prominski et al., 2017; Schubert, 2010). Much of this literature consists of catalogues that map and systematically present the good examples of riverfront design (Bigga et al., 2012; Kampa et al., 2016; Prominski et al., 2017). *Resilience theory* is not only concerned with risks of flooding but also the ability of urban riverfront interventions to withstand and adapt to economic, environmental, and social pressures. Therefore, the multifunctional design of riverfronts is favored over monofunctional

approaches (Pinto and Kondolf, 2020). Multifunctionality and integration of aesthetic, ecological, and recreational functions in riverfront (Podolak, 2012) are principles of landscape urbanism and sustainability frameworks which are also observed in context of riverfront restoration (Espinosa et al., 2016; Mariano & Rossi, 2023; Prominski et al., 2017). Xiong & Nijhuis (2018) explore urban river deltas as complex systems and observe their change over time, but their focus is on the landscape change and not on the relevant actor-networks that shaped it.

Ecological Urbanism (Mostafavi, 2013; Ruano, 1999) is a critique of landscape urbanism that aligns with the concept of resilience and advocates for nature-based solutions in riverfronts to improve urban resilience. Research that focuses on concepts from ecological urbanism, trade-offs between urban development and ecological functions of riverfronts (Avni & Teschner, 2019; Zingraff-Hamed et al., 2018, 2022) is complemented by studies that elaborate on how industrialization, channelization and flood protection alter river morphologies and how riverfront's natural dynamics can be re-established (Binder et al., 2015; Guzelj et al., 2020). Closely connected concepts such as *blue-green infrastructure* (Alves et al., 2020) and *Ecosystem Services Theory* (Elmqvist et al., 2015) promote the integration of engineered and natural systems for improving not only resilience to floods but also of water quality, biodiversity, and recreational spaces. Building on these ecological and resilience-oriented standpoints, other strands of research emphasize the climatic role of riverfronts in mitigating urban heat island effects (Hathway and Sharples, 2012; Manteghi et al., 2019). These strands of literature are eco-centric, rarely describing how ecological requirements become stabilized and embedded in riverfront redevelopment processes.

Rivers influence the morphology and street network of cities. Theories such as *Urban Morphology* and *Spatial Configuration* are tackling river and riverfront redevelopments focusing on their integration within the city (Abshirini and Koch, 2016; Qi and Feihong, 2019). Connectivity and accessibility of the riverfronts are a frequent topic of research (Che et al., 2012; May, 2006), including the concepts of *social connectivity* (Kondolf & Pinto, 2017; May, 2006). Che et al., (2012) and Prominski et al., (2017) investigate accessibility and amenities offered by public spaces created in riverfronts, but the question of how these interactions shape redevelopment processes remains open. Riverfronts and rivers have a role in developing emotional and symbolic connections within urban communities. The literature that investigates river-city interaction also covers topics on behavioral patterns and user experiences in urban waterfronts (Yang et al., 2021). Additionally, the redevelopment of riverfronts is frequently examined through the lens of Henri Lefebvre's *The Right to the City* (1996). This cluster of literature critiques the exclusivity of access to redeveloped riverfronts

and advocates for the democratic right of all citizens to shape and use urban spaces. *Temporary Urbanism* investigates the role of short-term interventions in riverfronts (En-Nejjari, 2020; Gale, 2009; Stevens, 2010, 2018). Additionally, the concept of *Heterotopia* (Foucault, 2008) provides a lens for analyzing how temporary uses create spaces of alternative possibilities within riverfronts, (Stevens, 2009, 2010; Stevens & Dovey, 2004). Nevertheless, these lines of research are often too focused on image building, are user-centric or experience driven.

Literature addressing concepts of *globalization* and *neoliberalism* critiques the tendency of redevelopment projects to prioritize real estate interests over ecological and social considerations, as it is often resulting in gentrification and displacement (Cvetinovic et al., 2017; Schubert, 2010). Similarly, the Soja's concept of *Spatial Justice* questions whether these redevelopments genuinely cater to diverse urban populations or primarily serve affluent groups. Waterfront revitalization projects can be tools for urban renewal and tourism (Grant & Scott, 1996), challenging the combination of modernization with heritage preservation (Avni & Teschner, 2019; Kondolf & Yang, 2008). *Globalization* and *Urban Transformation* theories extend the discussion by investigating how riverfronts are redeveloped to project a competitive urban image (Čamprag, 2019; Freemark, 2019b; Stevens, 2009). In this process, redevelopment becomes a symbolic strategy aimed at attracting international investment and tourism. Parallelly, scholars such as Tommarchi (2025) put the focus of how these dynamics contribute to the weakening of ties between the ports and the cities, while others (Avni & Teschner, 2019; Kondolf & Yang, 2008) advocate for the need to preserve the balance between modernization and authenticity. The concept of *fixity and flow*, as developed by Desfor and Laidley (2010), examines the interaction between built environments, institutions, and cultural practices, and dynamic flows of capital, labor, and knowledge and link the spatial transformation with political and institutional mechanisms.

Governance mechanisms in riverfront redevelopments have been investigated through several theoretical perspectives, including *Post-Industrial Urban Theory* (Schubert, 2010), *Integrated Water Resource Management* (IWRM) (Rossi, 2022), *Actor Network Theory* (Cvetinovic et al., 2017) and *Entrepreneurial Governance theories* (Bruns-Berentelg et al., 2022; Hermelin & Jonsson, 2020). Complementary to these perspectives, research has elaborated the management of the riverfronts and the institutional arrangements in transforming ports into sustainable waterfront zones (Daamen & Vries, 2013; Lerner & Holt, 2012). This section of literature touches upon actor-networks and governance mechanisms

but does not include a comprehensive overview into the complexity of riverfront infrastructures.

Methodological Review of Transformation Process Tracing in Urban Riverfronts

Reviewed research on riverfronts development employs both qualitative and quantitative research designs, interdisciplinary perspectives, and a variety of analytical techniques. A first observation from the reviewed research was that there is a strand which primarily focuses on assessment of the outcomes of riverfront transformation rather than understanding the process. Quantitative approaches, in particular, capture measurable morphological and ecological changes in riverfronts and utilize methods like: spatial analysis, hydrodynamic modelling, habitat suitability modelling, and statistical analysis, to assess the physical, ecological, and environmental impacts of river and waterfront interventions (Che et al., 2012). Mapping, visualization and spatial analysis methods are used to examine the spatial and temporal dynamics of rivers and riverfronts (Guzelj et al., 2020; Huang, 2017; Wolf et al., 2021; Xiong & Nijhuis, 2018; Zingraff-Hamed et al., 2018). Additionally, numerical modelling and simulation techniques, including hydrodynamic, hydraulic, and microclimate models, are used to assess the impacts of river and waterfront interventions (Lin et al., 2016; Manteghi et al., 2019; Schmidt, 2018; Zingraff-Hamed et al., 2018).

In contrast to outcome-oriented research, there is a body of research that tackles process behind the transformation. This literature relies predominantly on qualitative methodologies that focus on success factors of the transformation, interaction between actors, governance mechanisms, and decision making (Daamen & Vries, 2013; Paula et al., 2024). Some studies also apply actor-network mapping to trace how human and non-human actors influence transformation trajectories (Cvetinovic et al., 2017). Part of the reviewed qualitative methodologies rely on comparative analyses to examine differences and similarities between case studies (Hermelin & Jonsson, 2020; Maliene et al., 2012; Paula et al., 2024; Zingraff-Hamed et al., 2017). Nevertheless, despite the valuable insights produced by this research, there is a lack of comprehensive, longitudinal mapping of timelines that illustrates how decisions evolve and how they influence the evolution of infrastructure.

Process oriented research on riverfronts commonly adopts interdisciplinary approaches, integrating perspectives from urban planning, landscape architecture, ecology, hydrology, and other relevant fields (Binder et al., 2015; Pinto & Kondolf, 2020). Collaborative approaches, where researchers work closely with practitioners, policymakers, and local communities, are also evident in the research (Binder et al., 2015; Lin et al., 2016). Some studies involved participatory methods, such as stakeholder workshops, public surveys, and

community engagement, to incorporate diverse perspectives and knowledge into the research process (Lerner and Holt, 2012; Lin et al., 2016).

Commonly used qualitative methods, such as literature reviews, document analysis, interviews, and field observations, are widely used to gather in-depth insights into the social, cultural, and governance aspects of river and waterfront management (Kondolf & Yang, 2008; May, 2006; Stevens & Dovey, 2004) while historical maps, plans, and documents help in understanding the long-term evolution of urban rivers and waterfronts (Valette & Carozza, 2013; Vingelli, 2018; Wolf et al., 2021). Despite the methodological diversity, a small body of literature combines comparative and relational analyses to trace actor networks, spatial arrangements, engineering solutions and how they evolve over time.

2.5. Summary from the Literature Review and Research Gaps

Identified Gaps and Critiques in Literature

The first gap refers to the temporal representation and reconstruction of processes of riverfront redevelopments. Many existing studies discuss the outcomes (the before and after) and focus on the transformation of industrial areas or the integration of socio-economic objectives; but only a few explicitly focus on the redevelopment processes (Avni & Teschner, 2019; Cvetinovic et al., 2017). Historical and archival analyses provide insights into past transformations (Wolf et al., 2021), but lack temporal mapping approaches to represent how physical and social landscapes have changed throughout the redevelopment timeline and do not visualize and document the sequential phases, stakeholder interactions, or decision-making processes during redevelopment. This creates a gap in understanding how decisions at various stages, institutional shifts, planning regulations, or environmental laws, change over the project duration and how they influence long-term project outcomes.

The second gap refers to the evolution of infrastructural baselines. Research on the complexity of interactions between human and non-human actors (Cvetinovic et al., 2017) as well as on governance models and management approaches (Lerner & Holt, 2012) for urban riverfront transformations has been conducted in few cases. Knowing that the decisions on technical matters are continuously negotiated with governance structures and the public, a gap remains in understanding how these dynamic networks of developers, communities, and market forces interact. Moreover, research could also investigate informal discussions on these matters, together with political influence and its effect on development trajectories.

Given the lack of comprehensive process mapping that focuses on how infrastructural baselines in riverfront redevelopments change over time, and the limited research on the ecosystems that shape design decisions in these transformations, there is a significant gap which allows further exploration. Considering that each riverfront is specific context that relies on the hydrological nature of the river and the lack of comparative studies between riverfront redevelopments, it is essential to investigate between cases and compare them in a coherent analytical framework that also includes the temporal dimension of the transformations. Therefore, there is a methodological and theoretical gap in the literature that this dissertation will address.

Relevance and Contribution of the Dissertation

This dissertation primarily aims to fill the gap in research on large-scale and long-term urban redevelopments, specifically located in urban river corridors, as well as to show how these redevelopment projects navigate the trade-offs and synergies between different urban riverfront functions. Furthermore, the dissertation employs a novel way of looking into interconnected relationships between human and non-human actors in riverfront projects which will enrich the existing research on different actors' engagement in shaping waterfronts.

This dissertation also contributes to understanding what role architectural engineering plays in riverfront redevelopment and its interplay with engineering of other infrastructures. In parallel, architectural and urban engineering encompass transport planning, public spaces, green infrastructure, and environmental impact assessments, bridging the gap between individual buildings and the broader urban context. Finally, the dissertation will provide empirical evidence with context specific insights on specific practices that can inform future projects and academic research. Finally, the research will contribute to theoretical discussions on integrating resilience and sustainability in urban planning, and urban and architectural engineering practices.

3. METHODOLOGY

3.1. Introduction to the Methodology Chapter

Overview of Methodological Approach

This dissertation is based on qualitative, multiple-case study research design (Figure 1). Qualitative research allows in-depth investigation of the socio-historical contexts in which a phenomenon occurs (Merriam, 2002). To trace the entire trajectory of a process, the *big picture*, the research required a diverse range of primary and secondary data sources. Qualitative data collection methods such as semi-structured expert interviews, spatial analysis, media and document review, and secondary scientific literature review were employed to collect data for the case studies. Next, the data was coded and used in tracing timelines and actor-networks in specific and important phases of the transformation process. This research design provided a lens through which the roles of diverse actors from the process could be uncovered. Limitations to this approach also exist, as mapping of actor-networks relies on detailed analysis, which can be time-intensive and data-dependent, and can lead to gaps in representing all actors. Nevertheless, through the triangulation of diverse data sources, the study was able to reconstruct and capture the overall dynamics and a comprehensive view of the processes which were the focus of the dissertation.

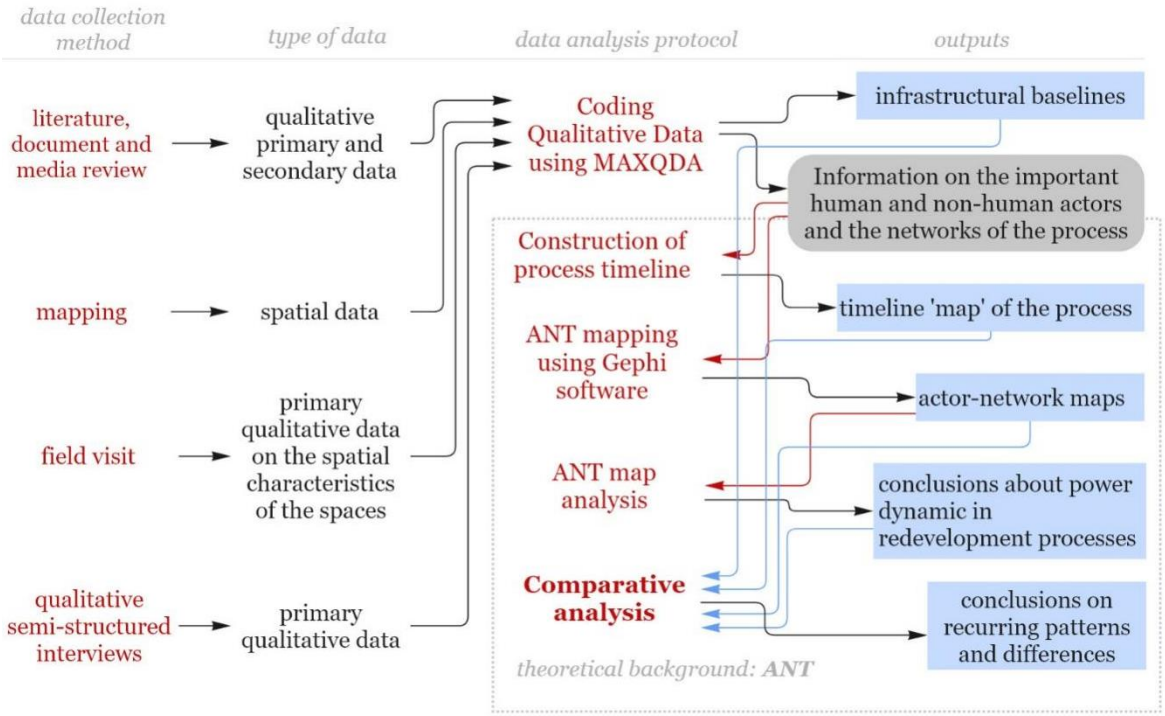


Figure 1: *Methodological framework. Made by author.*

Research Questions, Objectives and Alignment with Methodology

The following sub-questions stem from the main research question and objective:

1. How and when did the sequencing of planning gates in each riverfront project shape the stabilization of technical baselines, and did the sequencing produce alignment or divergence across cases?
2. How did design manuals, certifications, and other codification tools influence development of infrastructural systems in riverfronts - which became binding design parameters, which stayed soft?
3. When did cross-system conflicts in the riverfront areas appear, how were they resolved and what were the trade-offs of this process?
4. Which actors played a decisive role in stabilizing infrastructural baselines in each riverfront project?

Importance of Methodology in Addressing Research Questions

A *case* can be any object of research, such as people, events, processes, places, or networks (Christmann and Baur, 2024). Case study research (CSR) involves deep explanatory analysis of cases. Multiple CSRs investigate a single issue or phenomenon empirically in a real-life context through multiple cases by applying a similar procedure to each case, and generalizing or comparing the results at the end of the study (Yin, 2003). This methodology was chosen because of the importance of complex phenomena to be investigated within real-world contexts and its suitability for longitudinal and process-oriented research. Moreover, the use of multiple cases enables comparative analysis that is helpful in identifying patterns, differences, and transferable insights.

This dissertation focused on medium-term spatial developments. Temporally, the cases were analyzed from their initiation until 2025. The use of observations and ethnographies is limited when studying this kind of phenomena. That is why the chosen methods involve collecting data through interviews, archival records, maps, and artifacts. The research focuses on spatial change, a transformation of brownfields near rivers, which should be traced back to their historical origins. That is why the methodology foregrounds temporality and treats past, present, and future as an open continuum (Hergesell, 2024). All selected cases are still ongoing projects that were initiated decades ago.

The mapping of the process is broken down into phases that focus on events reshaping the process, such as introduction or updates of masterplans, implementing

important codes and frameworks before starting construction, or during the construction of the projects.

Data Collection and Management

Since the dissertation uses qualitative, multiple case study approach where long-duration processes are elaborated, most of the data used was document-based. The materials that directly informed the process mapping and provided empirical grounding were official planning documents and agreements, competition briefs, explanatory reports, policy and strategical documents, media coverage, press releases, maps, drawings, spatial datasets, qualitative semi-structured interviews with stakeholders, on site observations and photographic documentation.

To attain initial knowledge of the physical characteristics of what was already implemented on-site, field visits were conducted in 2023 and 2024. In the initial stage of the research, multiple explorative interviews with key stakeholders from the planning processes of riverfronts were conducted (including an interview with stakeholder from *Isar Plan Project* in Munich). After the research framework was established, the research process began first with detailed review of available primary and secondary sources related to the three cases. Semi-structured qualitative interviews and interviews through written questionnaires were done with several involved stakeholders which acted as supporting data and a means of triangulation of the information gathered from the previous step of document review.

Process of Data Management

As Langley (1999) argues - process data is messy and it is hard to make sense from it. MAXQDA software was used to code the obtained data. The software allows grouping of similar types of data or information together. The following categories were used to code the data, separately for each of the case studies:

A: Flood resilience infrastructures' baselines.

B: Active mobility infrastructures' baselines.

C: Blue-green infrastructures baselines.

D: Architectural (Superstructures) baselines.

E: Key moments that shaped how the process evolved.

T1-T8: Actants and connections between them, for each separate translation per case.

3.2. Theoretical Framework

Cities as Complex Systems

To transition towards sustainable urban futures, it is important to understand cities as integrated ecological and social systems, and because of that, it is necessary for the urbanization processes to incorporate knowledge of both (Cruz et al., 2013). In this dissertation, cities are considered as complex adaptive systems, characterized by dynamic interactions constructed from the bottom up, and constantly in an out-of-equilibrium state (Batty and Marshall, 2012). This viewpoint enabled a comprehensive understanding of the urban environment, considering cities' social, economic, and physical components. Systems thinking was pioneered by thinkers like Ludwig von Bertalanffy (1969) and soon entered the field of architecture and urbanism - projects by Cedric Price, Gordon Pask, Nicholas Negroponte, Archigram, Yona Friedman, Charles Eastman, or the Metabolists treated architecture as a system of elements. Systems thinking can also be recognized in the work of Kevin Lynch - *The Image of the City* where he abstracts the city system into five types of elements, namely: paths, edges, districts, nodes, and landmarks (Jaskiewicz, 2013; Wohl, 2018). However, these views on cities have their limitations because closed systems do not exist in reality.

Jane Jacobs (1961) criticized ideas like garden cities, green belts, uniform zoning, segregated corridors of movement, etc., as they were simplistic in nature and inappropriate to solve the problems of contemporary cities. In *Death and Life of Great American Cities*, she focuses on understanding the very complex, heterogeneous processes that take place in urban systems. Cristopher Alexander in *A City is Not a Tree* (1965) resonates in various ways with Jacobs. He criticized the urban developments as very simplistic in nature, with simplistic tree-like hierarchy in systems. Open systems, on the other hand, are intricate, dynamic entities that can evolve and adapt over time and can interact with the environment.

The study of open systems constitutes a fundamental aspect of *Complexity Theory* - a collection of theories that focus on the behavior and evolution of complex systems (Portugali, 2011). *Complex* implies diversity - a great number of connections between a wide variety of elements - the physical components are the ones that form the body of the system - its skeleton, veins, and muscles, and the social components act as the brain that responds and learns (Desouza & Flanery, 2013; Godschalk, 2003). The complex domain is characterized by weak central connections, strong distributed connections, and is governed primarily by co-operation between agents, mutual goals, and competing forces. It is from these infinite interconnections and dependencies that un-order emerges (Dahlberg, 2015).

The interconnected social, economic, and physical components that constitute the urbanity demand a theoretical framework that can grasp the multitude of actors and relationships that shape it. Alberti et al. (2018) argue the need to take a complex system approach to understand urbanization and its impacts based on complexity variables and drivers: agents, emergence, self-organization, and criticality. This is where *Actor-Network Theory* (ANT) can be valuable because it enables a more holistic understanding of how urban systems function and recognizes that the diversity and interdependence in cities are not produced only by human agency but also by the agency of non-human actors.

Process Research for Urban Development

The process represents a sequential and negotiated unfolding of events. The process tracing logic can be used in qualitative research for theory building based on empirical data analysis (Beach & Pedersen, 2011). Process research deals with how things evolve and why they evolve in certain way (Van de Ven & Huber, 1990) instead of what is the outcome. Process theories provide explanations in terms of sequence of events that lead to a certain outcome where the temporal ordering and interaction between entities is important (Mohr, 1982). Langley (1999) argues that analysis of processes must translate them into meaningful patterns, such as sequences, cycles, turning points, or temporal bracketing. Her framework is useful for studying evolution of urban projects and it also enables the integration of temporal mapping and mechanism identification. Specifically useful for representing processes behind spatial transformation can be the visual mapping strategy where complex process data can be temporally organized into diagrams that illustrate events, actors and causal links between them – drawing instead of narrating. Moreover, the strategy of temporal bracketing can be useful in dividing long processes into theoretically meaningful periods, as Langley calls them – brackets. They can be used in making causal relationships between phases instead of seeing the whole process as a continuous one.

ANT for Tracing Processes and Temporal Change in Architectural and Urban Research

ANT was initially developed within the sociology of science and technology and emerged in the 1980s, spearheaded by scholars Bruno Latour, Michel Callon, and John Law. ANT challenges traditional distinctions between human and non-human agents, and argues that both play vital roles in the creation of sociotechnical systems (Callon, 1984; Latour, 1987; Law, 1992). Latour's *Science in Action* (1987) introduced the concept of networks as dynamic associations where actors, both human and material, interact to produce outcomes. Callon's study on scallop fisheries (1984) showed the ability of ANT to illustrate how biological

entities, scientific instruments, and human stakeholders form interdependent networks. In the flat ontology of actor networks, there is no a priori distinction between human and non-human actors, or between micro and macro levels of analysis (Law, 1992). Over time, ANT has been adopted in urban studies and architecture to analyze complex urban systems that shape the architecture and space around us.

ANT rests on two claims: Indeterminacy of actors - entities become actors only through processes of translation and trials of force; and indeterminacy of contexts - actor-networks continuously produce their own contexts, times, and spaces; there is no need for a predetermined context. Farías and Paulos (2024) describe ANT as less a theory of the social than a theory of the spaces. Scholars such as Yaneva (2016) have demonstrated the utility of ANT in studying architectural practice. Buildings emerge from interactions between designers, materials, and regulatory frameworks. Latour and Yaneva (2008) describe buildings as *moving projects* that are shaped by negotiations among various actors.

In design, architecture and urban planning process-based research focuses on the negotiations between different actors and stabilizations of decisions through which visions can become a built reality. In that context, ANT provides a useful framework for examining how technical, material, and environmental elements become active actants in shaping spatial outcomes. Engineering solutions, choice of construction materials, and performance standards can act as non-human agents that can equally influence design decisions, formal regulations, and the implementation of infrastructures as much as human actants. Thus, ANT allows the analysis of social and engineering aspects of a redevelopment process, not as separate domains, but as interdependent processes of translation that stabilize the infrastructures within the built environment. In urban studies, ANT has emerged as an important framework that can be used for analysis of the complexity of cities as dynamic systems. Furthermore, the framework sees urban phenomena as networks of associations where the roles of all elements (actors) are equally important (Latour, 2007). By focusing on the interaction between the elements of the network, the approach makes it possible to investigate redevelopment processes. Finally, the ANT framework is especially valuable for addressing urban issues in transitional contexts.

Actor-Network Mapping as a Methodological Tool

> "Maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes or events in the human world." (Harley and Woodward, 1987)

Architects and urban planners face the challenge of representing conflicts and controversies that shape spatial configurations. Visualization, as a means to reveal the social

world and hidden practices, is advocated by Latour as a way to give non-humans a voice and to situate them as actants in socio-technical networks. ANT mapping is a method used to visualize the complex networks of interactions between human and non-human actors within a sociotechnical system by providing means to trace relationships, negotiations, and power dynamics across various domains (Latour, 2007). In ANT terms, mapping consists of three steps: identifying the actors of a system being studied; identifying the roles of each actor within a network; and determining the relations between the identified actors (Cresswell et al., 2010). For the general public to understand complex issues, visual tools that represent sociotechnical debates are necessary, and methods like controversy mapping are suitable for understanding complex issues by the general public. Venturini (2010) notes that controversy mapping serves as a practical extension of ANT for representing, simplifying, and organizing the interconnected aspects of social and technical debates into a format that is easy to understand and interpret.

Key Concepts in ANT

There is specific terminology used in ANT that helps researchers describe complex networks and the relationships between the actors within a network. It is a vocabulary that is particularly suited to describing sociotechnical assemblages without imposing any a priori assumptions or privileging human agency over non-human agency, and is referred to as *infra-language* (Latour, 1996). Most of this language - *problematization*, *interessement*, *enrolment*, and *mobilization* - was initially introduced by Callon (1986). In his paper, he describes the relationships between scallops, fishermen, and researchers, and much of the terminology he introduced has persisted over time. In this section, terms specific to ANT terminology will be explained.

Actor (actant) is a central concept in ANT. An *actor* is any human or nonhuman entity that is part of a network of associations and relations (Watson, 2007). The term *actor* implies a human individual or humans in general, and therefore, the term *actant* that is broader is used for the abstract entities and the term *actor* for the more concrete ones. Human actors can be individuals, organizations or communities. Non-humans, as Latour (1997) states, *include anything that is not human* and that means that actors can be objects, statements, inscriptions, technologies, animals, concepts, organizations, professions, skills, money, and so on. Any actor is capable of *modifying state of affairs* and world building (Latour, 2012). Buildings themselves can be seen as actors that navigate users through spaces and choices. An *actor-network* is not just a network established between humans, but all relevant entities - people, objects, technologies, policies etc. The human and non-human actors are temporarily

aligning and form a network that appears stable. Actor-networks are always evolving and each actant plays an active role in the network.

Translation is a *social process of aligning interests* between different actors, both human and non-human, to create a network (Hanseth and Monteiro, 1998). There are two types of translation: First one is *intermediary*, where inputs are enough to define the outputs as well (no transformation of meaning) and this type of translation can be perceived as a *black box*. Second type of translation is *mediatory*, where inputs and outputs are never equal due to the transformative role of the translator (Latour, 2007). In short, a translation is the link between an idea and its durable materialization. As showed by Callon (1986), the translation process consists of four non-linear moments: *Problematization*, *interessement*, *enrolment* and *mobilization*. *Problematization* is the step in the translation process where actors define a problem or goal, and in doing so define each other's roles/identities in the actor-network. *Interessement* is the second moment of translation and is the process where one actor attempts to interpose itself between another actor and everything else in order to claim that actor's attention. Successful interessement leads to enrolment of actors into the network. By *locking* the other actor, its identity and actions are directed in a specific way. For example, an architect might use certain design tools or codes to lock engineers into a particular approach. *Enrolment* is when actors accept the roles and identities attributed to them by interessement and aligning their interests with the network being built. Enrolment is not a linear process and is a key part of the translation process, where actors position and interrelate the roles, they have allocated to others. *Mobilization* is when actors become representatives or *spokespersons* for each other. In a successful mobilization, a small number of *spokespersons* come to represent a larger set of actors. For example, a published study speaks for the roles of the actors that played a role in conducting it.

The concept of a *detour* in ANT is related to the idea of translation. A detour happens when an actor-network is no longer capable of pursuing its interest independently on the trajectory it was headed on. This allows the network to find an alternate route to achieve its goals by enrolling new actors and associations (Latour, 1987). This *re-routing* is part of the translation process and illustrates how networks adapt when their original plan hits a dead end. An *intermediary* is an entity that transports meaning or force between different actors in a network without transforming it (Latour, 2007). Intermediaries can take various forms such as texts, technical artifacts, human beings, or money. A *mediator* is distinguished from an intermediary. They can change relationships, re-interpret instructions, or alter decisions. Unlike intermediaries, mediators are unpredictable; their presence can shift how actors interact or what outcomes emerge, unlike intermediaries which merely pass along

information without altering it (Latour, 2007). Mediators play a coordinating and translating role, bringing relevant actors together. They are essential for maintaining and adapting networks over time.

The concept of the *Obligatory Passage Point (OPP)* refers to a critical node or narrow channel in a network where different actors and elements must pass through to achieve their goals. The OPP acts as a focal point that directs and aligns the interests of the various actors (Watson, 2007) and by it shapes the entire network's strategy. *Punctualization* is a concept that describes the process of treating a complex heterogeneous network as a single, simplified entity (a macro-actor). This allows the network to be more easily understood and engaged with, even though the underlying complexity remains. This process is also known as *black-boxing* (Law, 1992). A *black box* refers to an entity whose inner workings are so unknown and hidden that its functioning is taken for granted (Roy, 2015), and is treated as a single, stable, and uncontested unit (Silvis and M. Alexander, 2014).

Benefits of Actor-Network Mapping for Investigating Riverfront Redevelopments

Riverfronts are areas where actors like the river, flood management strategies, or the interests of various stakeholders can alter the planning and development processes. By tracing controversies and visualizing dynamic interactions, actor-network mapping enables researchers and practitioners to understand the conflicts and compromises that shape riverfronts. Importantly, ANT gives an agency to non-human actants like flood defenses, biodiversity, and river systems. This approach can also help uncover hidden relationships and dependencies, such as how ecological systems like rivers influence urban planning decisions, and is valuable for addressing the context-specific complexities of riverfront projects. Finally, ANT map gives the possibility to visualize the temporal dynamics of redevelopment and to easily compare networks of redevelopments for different case studies, which is important because of the long periods these processes take.

Analytical Protocol and Methodology for Case Study Analysis

Step1: Temporal mapping of the process

Each of the three cases were analyzed in several steps. First, each case was deconstructed chronologically and represented on a timeline that shows the unfolding of the process through translations, illustrating how key actors are connected to each other and when they appear as active shapers of the redevelopments. The timelines map the process since its initiation until 2025 (Figure 9, Figure 22 and Figure 37). Following ANT logic, each translation is a moment where actors, such as governance structures or documents, re-align

around some OPP. These are moments of the process when ideas, legal instruments, and physical artefacts are realigned to stabilize a new order in the transformation process. As can be seen on the timelines, translations can be problematized and mobilized in parallel; actors can be active actants in two different translations, and not all the translations become stabilized in the end. Nevertheless, they are all a part of the overall redevelopment process, and it is important for each to be represented and described.

To illustrate the process clearly, for each identified translation (T1, T2…) a trigger event, important actors and stabilizations were presented in a descriptive way. These are presented in a storyline of how these networks took shape, how the alliances formed in time and what their influence on the outcomes was. Next was identifying the key trajectories that led an infrastructural baseline either to change or to become stabilized in a specific artifact. As would be expected, not all networks that influenced the overall redevelopment process were decisive in shaping infrastructural decisions. Therefore, the next objective was to determine which translations were significant enough to become the subject of a more detailed examination. In this dissertation riverfront redevelopments are treated as processes based on decisions where visions translate into binding engineering parameters- gates.

Step 2: Translation Analysis

Translations in some cases function as gates that admit some options and fix baselines (reference values) that the design at later stages must respect. Progressively gates *black box* choices and this research traces exactly this process. *Gate* is always a document-anchored decision and not any translation is a gate. If a translation reframes the problem, but does not harden some parameter, it is a non-gate translation. At the entry to a gate, problems or performance are still not fixed, while at the exit they are hardened into requirements. Therefore, across cases, gates offer a comparable unit such as public inscriptions. Translations (and gates) in the following chapters are simply coded from T1 - on and are

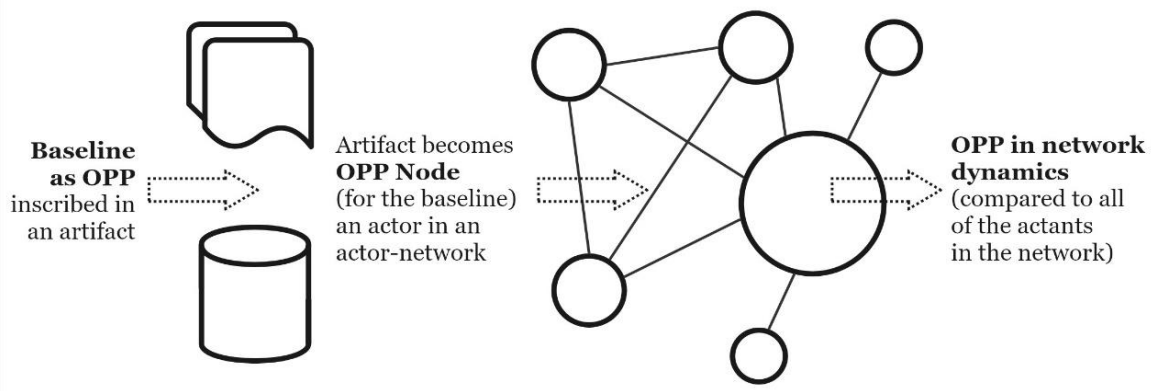


Figure 2: *Analyzing baselines development through the concept of OPP. Made by author.*

aligned to specific project sequences - from vision to design brief, to masterplan concept to legal embedding, to permitting and finally implementation. ANT could allow the tracing of countless translations in such redevelopment processes, but in this dissertation, focus is put on major translation moments where visions became binding or infrastructures stabilized. This selective approach was necessary for analytical clarity and case comparability without drowning in detail.

To observe how processes are structured and stabilized, the methodology further draws upon the concept of OPP (Figure 2). In analyzing translations, OPPs are treated in three complementary ways. Firstly, *OPP as Baseline* identifies a baseline or condition without which redevelopment could not proceed. Second, *OPP as Node* traces where this baseline was inscribed into artefacts (competition briefs, masterplans, ordinances, or contracts). These function as unavoidable nodes in the actor-network maps constructed. Third, *OPP in Network Dynamics* examines relations among actors or which human actor is the responsible for implementing certain baseline (can be developers, local governments etc.) Thus, this approach clarifies the *what*, the *where*, and the *so what* of OPPs.

Baselines (finding OPPs as baselines and OPPs as nodes)

One of the analytical steps for each case study is to follow where and when a parameter transitions from soft to hard (when compliance to the parameter is a condition for approval, allocation, payment etc.). Thus, it is possible to observe if visions and aspirations were translated into engineering baselines and to see which visions never acquired such hard parameters. For example, a requirement is inscribed in policy, label criterion, masterplan objective or competition brief, but only becomes engineering parameter when it is inscribed in framework plan, development plan, contract or permit. This framework helps to deconstruct diffuse processes into decision sequences which show how sustainability ambitions can be turned into traceable engineering specifications.

This protocol firstly consists of systematizing baselines from documents into tables (10.2). A baseline in this dissertation represents the smallest set of qualitative - vision based or quantitative and rule-based parameters sufficient to reproduce a design decision. For each document, there is a distinction between measurable baselines, which can be translated into concrete numbers, maps, or standards, and non-measurable baselines, which express guiding aims, design visions, or qualitative goals. Summarizing the baselines in a standardized table format enabled tracing their evolution over time and comparing them across projects in a structured manner. The most relevant documents associated with each project were systematically reviewed, and infrastructural baselines were extracted from them. These

documents included master plans, local development plans (further referred to as B-Plans), framework plans, design manuals, and technical guidelines. The extraction of baselines from planning documents was not a purely descriptive exercise; it was a way of capturing how actors become stabilized in the network and how a baseline became an OPP in a network.

Riverfronts are complex systems, so the baselines are defined by system type. In this dissertation baselines connected to infrastructural systems such as flood infrastructure and river edges (in the further text referred as Fl-I), active-mobility (in the further text referred as AMI), blue-green infrastructures (in the further text referred as BGI), and vertical superstructures were traced. Flood-infrastructure dimension examines the hydraulic defense system which is embedded in everyday fabric and serves as a critical infrastructure under storm-surge stress, but it also looks at the non-structural measures for flood resilience. As the redevelopments take place along rivers, the river edges are also a key aspect of the flood infrastructures. Active-mobility dimension follows how cycle tracks, walkways, foot and cycle bridges and transit interfaces are technically integrated into the ground layer. B-GI traces the water-and-vegetation systems into this redevelopment: retention basins, bioswales, green roofs, ecological corridors etc. Finally, vertical superstructures refer to the buildings as infrastructures. The evolution of infrastructural baselines for each translation is then described in a respective section. Ultimately, in the redevelopment process, existing infrastructures, technical requirements, and legal obligations that initially acted as negotiations or obstacles were progressively translated into binding baselines the moment they are codified in masterplans, B-plans, ordinances, or they become non-binding guidelines inscribed in design manuals or certification handbooks. These artifacts where baselines were inscribed represent *OPP as Node*. In this sense, the documents represent more than guidance for designing infrastructure: they mark the moment when fluid elements are fixed into standards that, finally, structure the implementation of infrastructures.

Constructing and analyzing actor-network maps (finding OPPs in network dynamics)

As a second step of the protocol, for every pivotal translation, an actor-network map was constructed. The map visualizes translation network where each actor represented on the map was active at a certain time during that translation (Figure 3). These maps help in uncovering the *OPP in Network Dynamics* on a wider scale. The Gephi *Multi Gravity Atlas Force 2* layout algorithm was applied to the maps, which uses linear attraction and repulsion forces. Where necessary, graphs were expanded for better visibility using the *Expansion*, *Noverlap* and *Label Adjust* algorithms. Nodes are scaled according to degree centrality and color-coded by actor type. Edges are color-coded by relationship type. The goal of this analysis is to

identify communities and conflict clusters which can also help to identify controversies or alliance groups within the network.

The metrics used to analyze the networks are *degree*, *betweenness* and *closeness centrality*. *Degree centrality* represents the number of direct connections that a node has and reveals which actors are most connected within the network. A high degree of centrality could mean that a node is an OPP or a potential hub. Combined with the *Multi Gravity Atlas Force 2* layout algorithm, these nodes will often end up in cluster centers appearing larger than the rest of the nodes. *Betweenness centrality* is the extent to which a node lies on the shortest paths between other nodes. These nodes will lie along *corridors* where they connect clusters. A high betweenness centrality in a node could indicate that the node acts as a broker between different groups. A high betweenness can indicate a site where the network translates or a point of vulnerability of the sub-network. In case the actor is removed from the network it could fragment. *Closeness centrality* measures how on average an actor is close to all other actors. This metric can show how quickly a node can reach all parts of the network. An actor with high closeness can rapidly influence or get information from any part of the network and their actions can have high agency in the network.

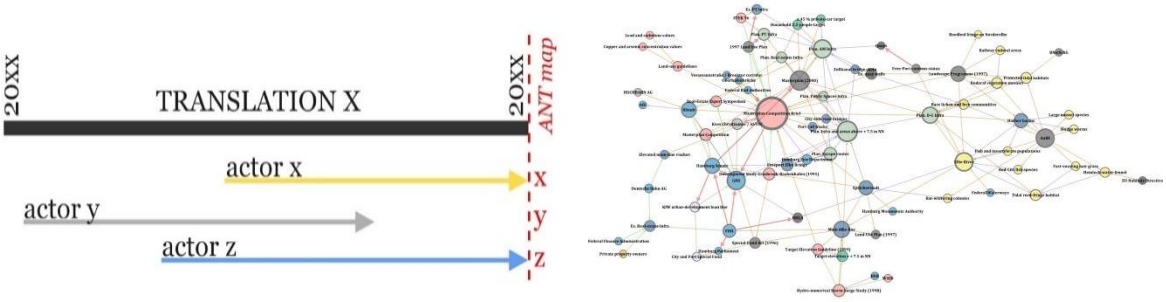


Figure 3: *Representation of a "section" in the timeline and ANT map (on the right), Made by author.*

Final step is the analysis of the actor-network maps. How the *baselines as OPPs*, as well as the *nodes as OPPs* in which these requirements were inscribed, change across successive translations is examined through the four stages of translation (problematization, interessment, enrolment, mobilization) and for each infrastructural system. These developments are then synthesized at the end of the chapter. The chapter summary concludes with an analysis of the shifting power dynamics of all actants across the relevant translations, in order to demonstrate the progression of *OPPs in the network dynamics.*

Comparative Analysis of Case Studies

After analyzing each case using the same protocol, a multi-step comparative analysis between the case studies follows. Firstly, a general comparison of the cities was conducted where the broader, historical, and geographical contexts were reconstructed. Moreover, the

role of rivers in shaping the economic development, risk exposure, and urban identities of Hamburg, Heilbronn, and Basel/Weil am Rhein/Huningue was investigated. This initial step provided the context for understanding how natural and infrastructural conditions framed the redevelopment approaches. Secondly, comparisons between the redevelopment sites themselves were made. Each site was introduced through its scale, physical characteristics, and symbolic position in the urban fabric of the respective cities. This comparison illustrated the diversity of challenges that had to be overcome for implementing each of the projects. The third step involves comparing development strategies. For each case, the lead institutions and governance models were identified. Besides institutional arrangements, the comparative analysis included the quality-assurance instruments deployed in each of the cases. This stage revealed how governance mechanisms, political context, and instruments conditioned project trajectories. The fourth part of the analysis elaborates timelines and project phasing. The timelines constructed for each phase serve as the basis for comparison, which will illustrate the distinct temporal logic of the processes. Finally, the comparative analysis continues to cross-case comparison where, the power dynamics across network and the trajectory of evolution of infrastructural baselines were examined in parallel. This part enabled the identification of both recurring mechanisms and context-specific variations and allowed for the extraction of transferable insights for urban riverfront redevelopment processes.

4. EMPIRICAL ANALYSIS OF CASE STUDIES

4.1. HafenCity - Hamburg

Historical Background and Context

Hamburg is Germany's second-largest city. Despite being located 100 km from the North Sea, Hamburg's port is the third-largest seaport in Europe and remains one of the busiest in the world (Bruns-Berentelg et al., 2022). HafenCity is a district in Hamburg-Mitte, located on Grasbrook Island on the Elbe River, in the area of the former Port of Hamburg. Initial port growth was sparked by Hamburg's customs exemption by Emperor Barbarossa in 1189, and by the 14th century, Hamburg had emerged as a critical trade center within the Hanseatic League. Throughout the 19th century, the HafenCity area was expanded and modern harbor basins such as Sandtorhafen, Grasbrookhafen, Magdeburger Hafen, Brooktorhafen, and Baakenhafen were created (HafenCity.com, n.d.).

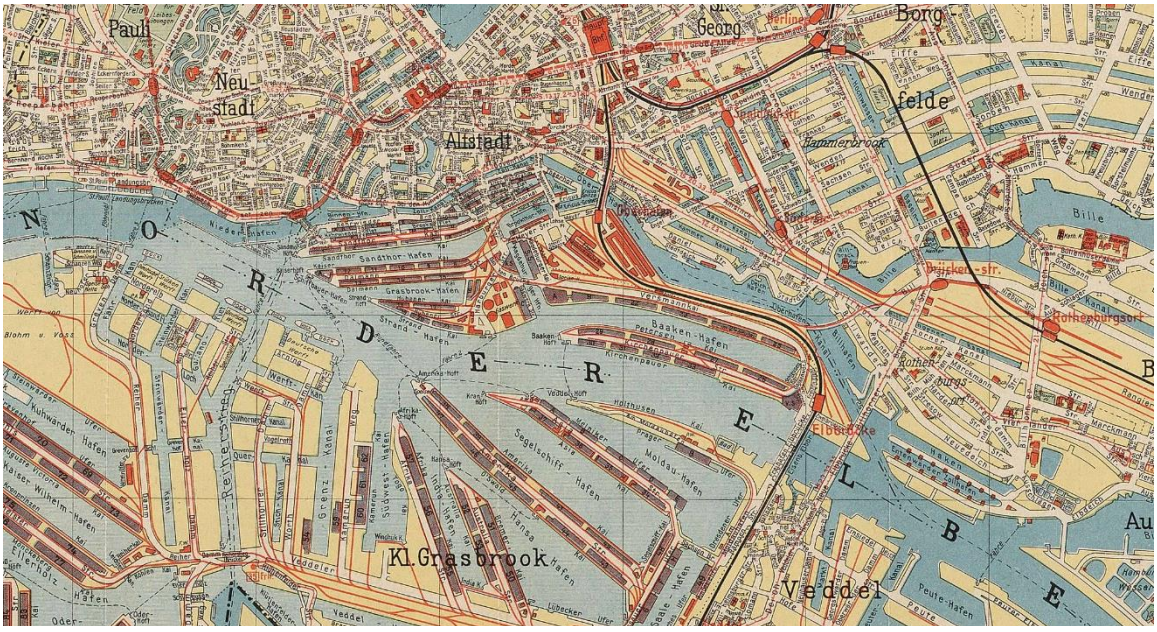


Figure 4: *Plan of Hamburg, [Elfha-Plan / Stadtplan; printer: Gustav A. Schmidt, Hamburg], 1930. Public domain in the EU. Universiteitsbibliotheek Vrije Universiteit, Amsterdam.*

In 1871, Hamburg became part of the German Reich, and its port was transformed into a centralized free-trade zone, leading to the construction of the Speicherstadt warehouse district between 1883 and 1927 (Figure 4) (HafenCity.com, n.d.). Following extensive damage during World War II, when about 70% of the warehouses were destroyed, and the rise of container shipping in 1956, the old port basins, located near the city, became too small and shallow. As a result, the harbor quickly shifted to the south banks of the Elbe River (Prinzleve, 2023). Throughout the post-war period, Hamburg's development had shifted away from the

Elbe (Gelfond, 2021) and a 75 km^2 city center zone dedicated solely to harbor use was created (Bruns-Berentelg et al., 2022). During the third Industrial Revolution, HafenCity's significance as an industrial center further declined. By the fourth Industrial Revolution, driven by cultural and creative industries, the area's industrial facilities were no longer in use (Bruns-Berentelg et al., 2022) and Speicherstadt was finally added to the UNESCO World Heritage List in 2015.

By the early 2000s, the port facilities had moved west to accommodate large vessels (Gelfond, 2021). Because of this, Hamburg undertook two major regeneration projects: *HafenCity* (initiated in 1997) and *Wilhelmsburg Island* by IBA-Hamburg (which began in 2006). Both projects were a part of the *Hamburg Spatial Vision 2020*. The HafenCity project is Germany's largest urban reclamation initiative aimed at expanding downtown Hamburg by 40%. The project spans approximately 155 hectares and transforms former port facilities into a mixed-use area (Petrow, 2011). The plan aimed to preserve the historical and natural features of the context while adding socio-economic value to it (Gelfond, 2021).

Physical Infrastructures Complexity of HafenCity

HafenCity is located within the Elbe's flooding zone. The key flood protection measure in HafenCity involves elevating buildings on artificial mounds or plinths (Figure 6-a) (Ge et al., 2014). The warft model, which raises streets to 7.5-8.5m above sea level, integrates flood protection into urban design and creates multi-level public areas (Figure 6-b, c, d, e). HafenCity's physical infrastructure was conceived as a multilayered system that combines the transport infrastructure, public spaces, B-GI, and AMI into overlapping layers. This vertical zoning allows bridges, bike lanes, and open spaces to overlap into one coherent urban fabric. In this introductory section the complexity of HafenCity's infrastructure is described, so the reader can better grasp the evolution of actor-network maps and how infrastructures are represented in the case study analysis.

The urban open space consists of public squares and streets, semi-public plazas and walkways, parks, and waterfront promenades, which are free of motorized traffic (Figure 6, Figure 7). Quays are positioned 4-5.5 meters above sea level and are accompanied by cafés, seating steps, and tree-planted terraces at the same level (Figure 6-i, f, d, c). Quays can accommodate water from occasional floods but serve as promenades when there is no flooding. Additionally, they are connected to floating platforms in the docks that rise and fall with tidal changes, serving as jetties for ships and boats. Pedestrian quays have multiple exits that lead to the elevated plazas (Figure 6-e) through stairs and slopes (Figure 6-d, h). Streets in HafenCity prioritize pedestrian mobility and minimize surface parking. Instead, parking is integrated within building plinths (HCH, n.d.-d). Finally, a defining feature of HafenCity is the

activation of ground-floor spaces. The compact urban design of HafenCity aims to ensure that important destinations, such as offices, residences, and recreational areas, are within walking or biking distance (HCH, n.d.-b). Local streets (Figure 7-i) support mixed traffic, and the main roads manage regional flows with designated cycle lanes.

One of the important aspects of connectivity is linking HafenCity to Hamburg's districts and ensuring emergency access during flooding. This is where bridges play a vital role. The Kibbelsteg and Baakenhafen bridges serve pedestrians, cyclists, and vehicles by integrating HafenCity into the city. Roads also accommodate separate wastewater systems and flood-resistant drainage (HCH GmbH, n.d.). To mitigate flooding, elevated pedestrian paths connect buildings and are accessible via ramps and slopes to ensure safe access to flood-safe areas (Figure 6-g, Figure 7-k, l). Finally, HafenCity is well-connected to Hamburg's public transport system, with many connections to subway stations, ferries, and bus lines (HCH GmbH, n.d.). To keep the ANT diagrams in the next chapters clear and readable, the planned infrastructures are labelled by their functional category and typology rather than by their local placenames. Figure 5 illustrates which infrastructure group each element belongs to by displaying the overlaps.

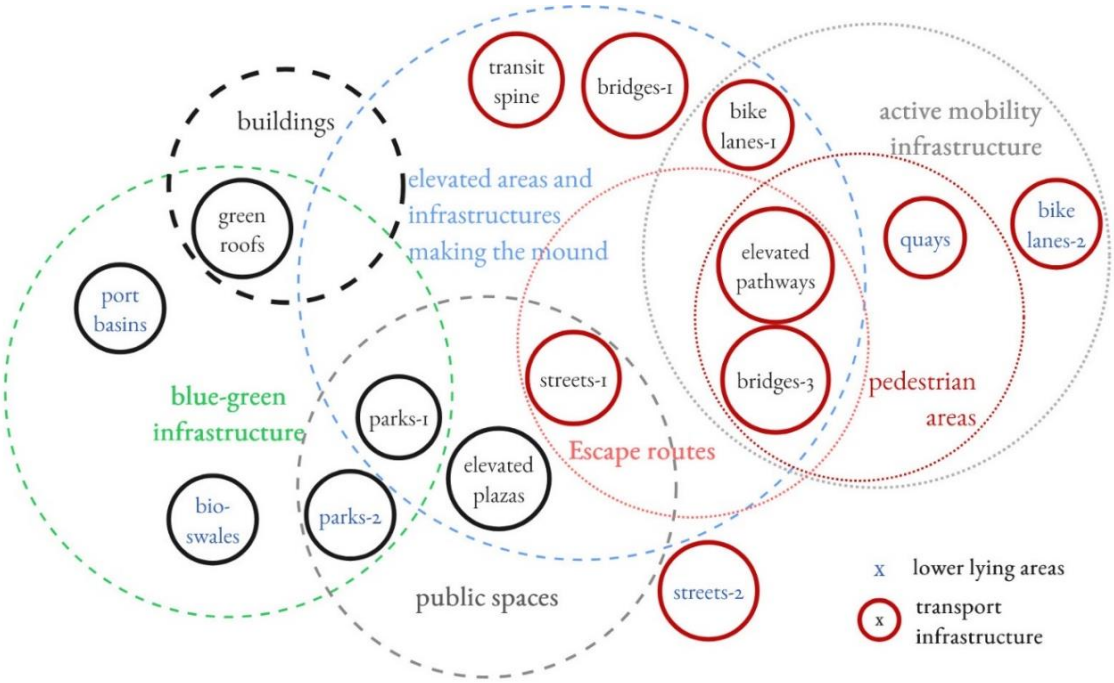
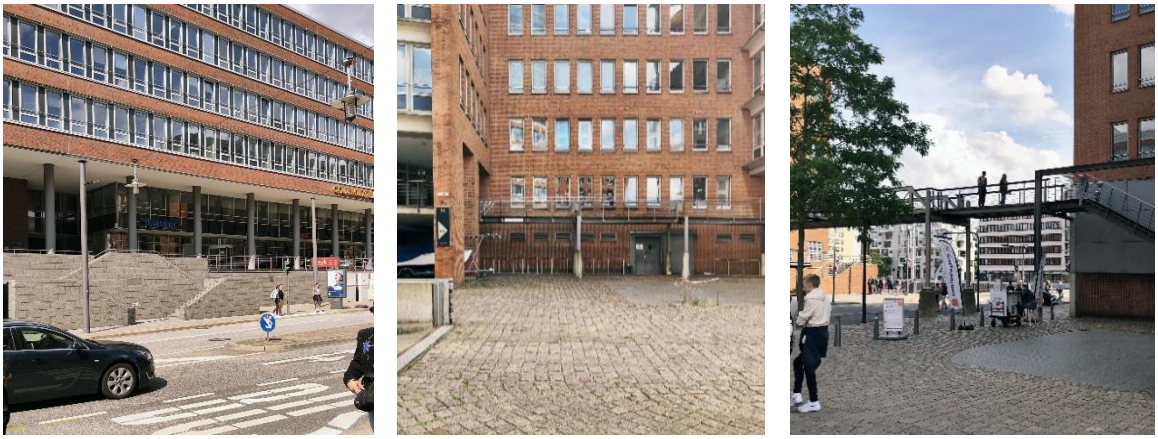


Figure 5: *Concept-map of HafenCity's physical infrastructures. Elements are grouped by function (colored/dashed bubbles) and by relative height: "-1" assets sit on the elevated mound, "-2" remain at existing level, and "-3" mark elevated and pedestrian. Made by author.*

***Figure 6**: HafenCity infrastructures. Photo by author, 2023.*



(j) (k) (l)

Figure 7: *HafenCity infrastructures. Made by author, 2023.*

Tracing the HafenCity Redevelopment Process and its Key Translations

The process of redevelopment of HafenCity has been traced as a series of ten translations in the ANT sense. These are moments when ideas, legal instruments, and physical artefacts were realigned to stabilize a new urban order. The translations' timelines overlap as actor-networks rarely change in neat steps, and the HafenCity project clearly reflects the complexities of such urban redevelopments. The timeline shows the process of redevelopment since the birth of the idea until today (Figure 9). Important translations are mapped with T1-T10 while key human and non-human actors are marked with circles (see legend in Figure 9). The important translations are further deconstructed in actor-network maps. The important infrastructures mentioned on the timeline are also spatially marked on the map below (Figure 8).

Figure 8: *Map of Hafen City representing the planned state. Made by author.*

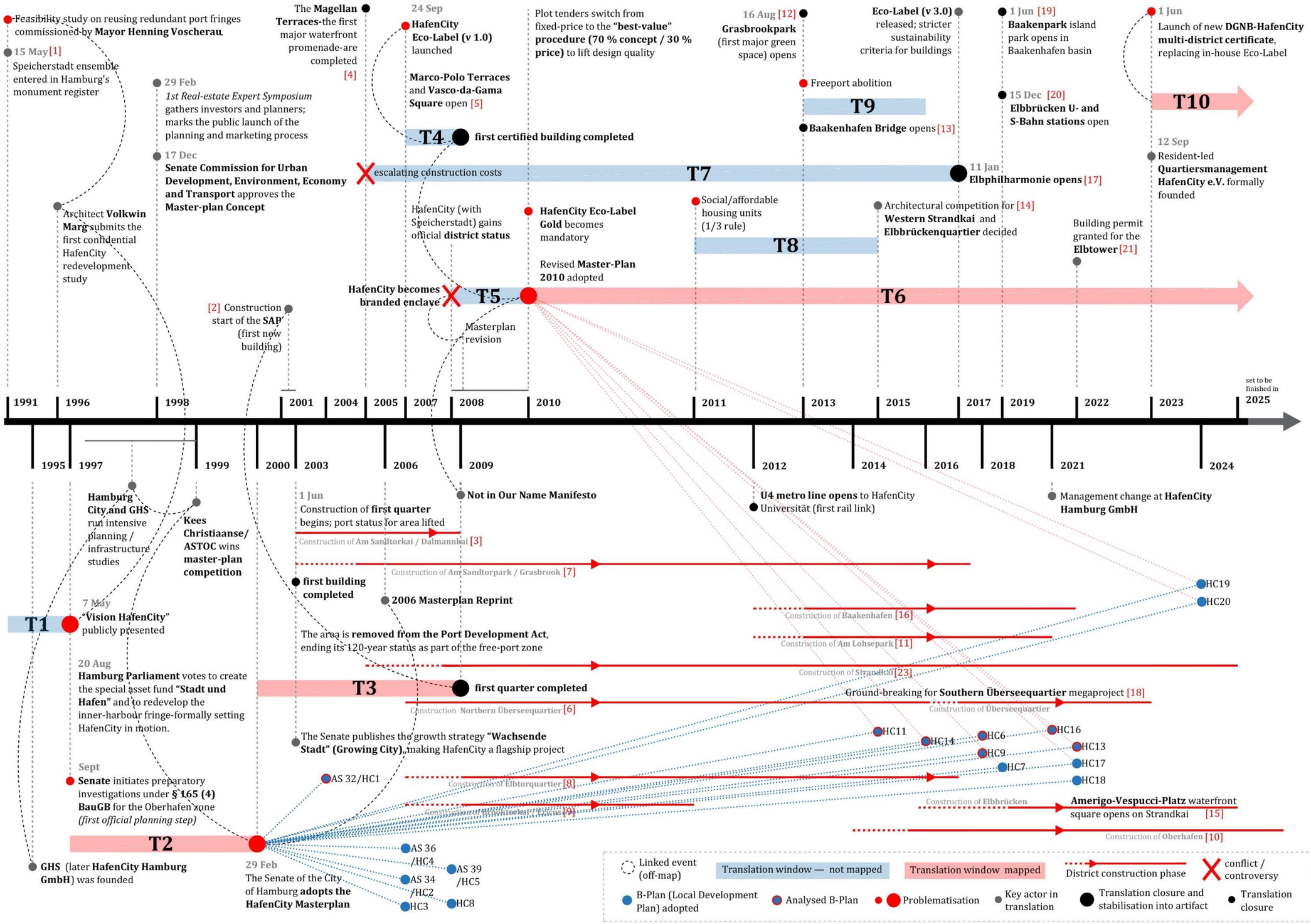


Figure 9: *timeline of HafenCity redevelopment. Made by author.*

Translation 1 (1990 - 1997): From Post-Wall Opportunity to Redevelopment Vision

The first translation (T1) begins in the 1990s, when the idea of HafenCity's redevelopment was problematized, driven by Hamburg's new geopolitical significance after the fall of the Iron Curtain. In 1991, Mayor Voscherau unofficially commissioned a feasibility study for the port redevelopment, particularly regarding flood protection using the warft concept (GHS Gesellschaft für Hafen- und Standortentwicklung mbH, 1999). In existing documents such as the *Hamburg Land-Use Plan* and *Landscape Program*, the area was recognized as a flood-prone port land that held the potential to be transformed (FHH, 1997a, 1997b). In 1996, Architect Volkwin Marg presented the first confidential redevelopment study. On May 7, 1997, a vision for HafenCity was publicly disclosed (Voscherau, 1997). The Hamburg's Senate adopted the vision in July 1997, which closed the translation (BSU, 2007).

Translation 2 (1997 - 2000): From Vision to Master-Plan

In 1995, the Corporation for Harbor and City Development (Gesellschaft für Hafen- und Standortentwicklung - GHS) was established to operate the idea of the redevelopment, and it became one of the first actors relevant for the second translation (T2). T2 was problematized in 1997 with the introduction of the redevelopment vision, which became a new OPP, and until 1999, there were intensive planning studies conducted. In 1998, interessment of new actors began with the first Real-Estate Expert Symposium (an expert mobilization event), which involved the property sector early. In the same year, the Senate Commission for Urban Development set the development framework (Masterplan Concept) and based on that, in 1999 an international competition was launched (GHS Gesellschaft für Hafen- und Standortentwicklung mbH, 1999). Brief was developed collaboratively between GHS and the Hamburg Urban-Development Authority (Bstadt). The urban competition was won by Kees Christiaanse/ASTOC in 1999 (Figure 10), and on 29 February 2000, the

Figure 10: *Competition result for HafenCity, 1999. Winning masterplan concept by ASTOC/KCAP (Meyhöfer et al., 1999).*

Figure 11: *Approved Masterplan HafenCity, 2000 (Bruns-Berentelg, 2016).*

Masterplan (Figure 11) was officially approved by the Hamburg Senate (HCH, n.d.-a), not as a law, but as a politically binding framework for the B-plans (HCH GmbH, 2006).

During T2, the political vision crystallized into the Masterplan through several interessment procedures, new actors were constantly enrolled through symposiums, competition, masterplan preparation, and in the end, the network produced an artifact which fixed several important baselines. Masterplan's design rules became the new OPP through which every later plot sale, permit, or infrastructure scheme must pass. At that time, the area could still not be developed under *BauGB* because of its Port status, so parliament discussions, in which the Urban Development Committee and the Environment Committee were involved, already discussed possible tensions with the *Port Development Act (Hafen EG)* (Bürgerschaft der Freien und Hansestadt Hamburg, 2000).

Analysis of the Network

Masterplan Concept sits at the center of the network (Figure 12), represented by the largest grey node, which also represents the highest betweenness value. The *Concept* was the groundwork for the competition brief literally passes most actor-actor relationships and transforms policy into concrete programmatic requirements. This means that almost every policy, infrastructure, engineering data, and natural system thread through it. In ANT terms, every competitor must accept its constraints, and every competition entry is black-boxing policy goals into material form. Competitors had to navigate through: *FNP (1997)*, constraints on *protected tidal habitats*, *Speicherstadt* adjacency, *Hamburg Monuments Authority* rules, *existing quay walls*, *main dike line*, existing *port-rail tracks,* etc. All these actors played roles as active nodes in the network and were inscribed in the brief as requirements.

Secondary central nodes include the development corporations (purple nodes) and local authorities (blue nodes). *GHS* is the municipality's development engine, and it creates links between *Bstadt*, the private design teams (like *ASTOC/Kees Christiaanse*), and the financing bodies (like *City and Port Special Fund*). *Hamburg Senate* and *Bstadt* also appear as secondary central nodes and form a governance-development cluster together with *GHS*. *BSH* and *Federal Waterways* appear on the periphery but inscribe the standards for the river corridor. *Private property owners* and the *Federal Finance Administration* appear as small nodes at the periphery.

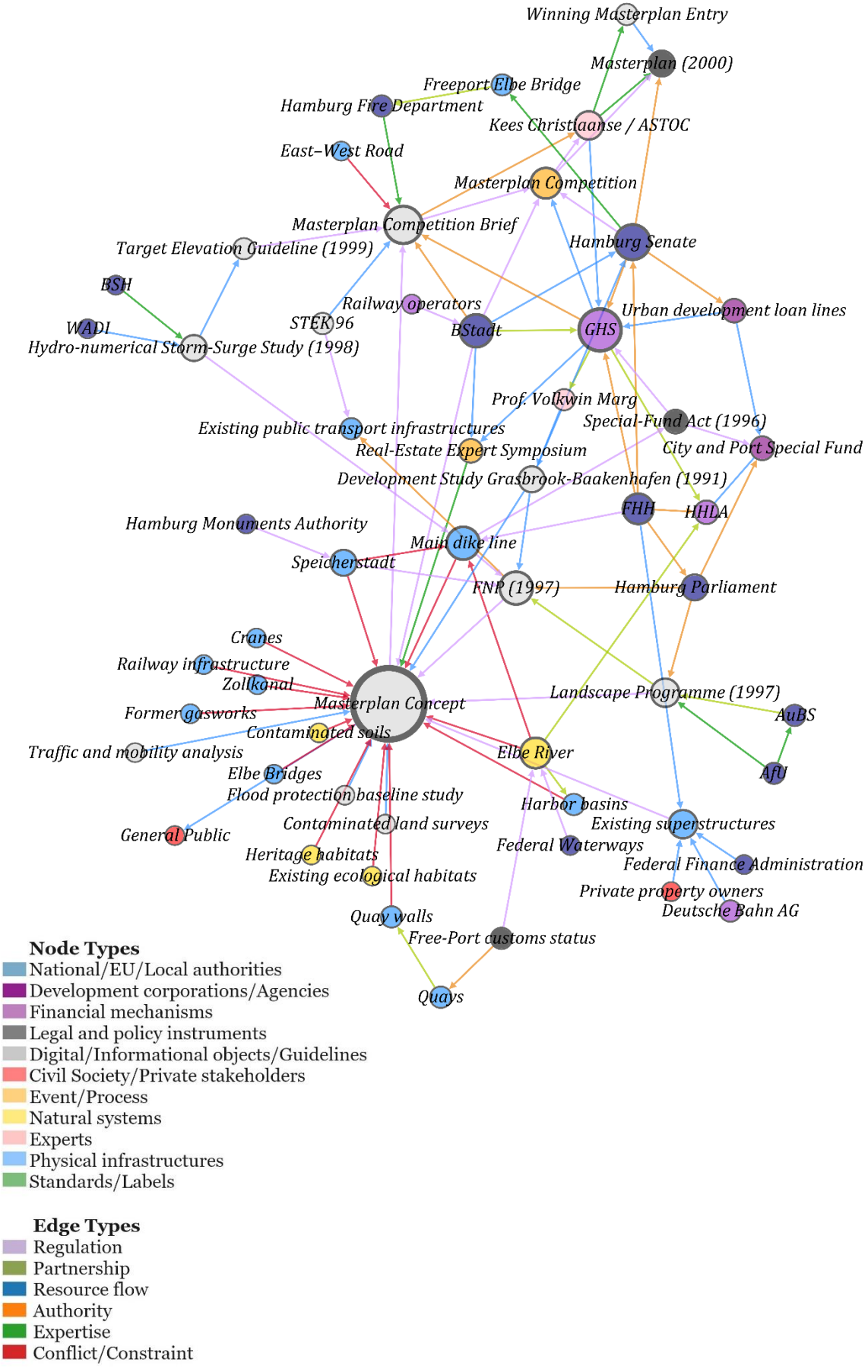


Figure 12: *ANT map of HafenCity's T2. Made by author.*

Existing infrastructures like the *main dike line*, *existing public transport infrastructure*, *Speicherstadt, harbor basins*, *existing quay walls*, *freeport Elbe bridge,* etc., are represented with light blue nodes. The natural systems (yellow nodes) are the *Elbe River*, *heritage habitats*, and *tidal habitats*. The infrastructural and natural systems are all active actors inscribed in the *Brief* as material, ecological, and flood constraints and sit at the periphery of the network. Digital and informational objects (grey nodes) are the *Development study on Grasbrook and Baakenhafen*, the *real-estate symposium* conclusions*, Hydro-numerical Study*, *Masterplan Competition Brief,* and the *Masterplan Concept,* and serve as evidence and data feeds that travel across the entire network. Civil society is not prominent in this translation, which shows that T2 was a primarily technocratic translation that was top-down shaped by institutions, laws, and expert planners.

The key OPPs of this network are clearly the *Masterplan Concept,* which sets the stage for the competition (event), or the arena where conflicts were negotiated. The *Brief,* as a continuation of the *Masterplan Concept,* incorporated the legal frameworks and consolidated ecological constraints. Stabilizers in this network were the approvals of *Hamburg Parliament* and *Senate* that formalize *HafenCity* as a flagship project, and the *ASTOC/Kees Christiaanse* spatial proposal that stabilized the vision and the requirements into the *Masterplan*. The constraints (edges marked with red) are mostly posed from existing infrastructure and port heritage towards the main OPP – the *Masterplan Concept*.

Evolution of Key Infrastructural Baselines Across T2

The raising of floor levels to 7.5 meters, fixed quay elevations and heritage constraints, contradicted the conventional continuous dike solution, and that is why priority was given to mounded elevated areas combined with an escape route network and raised plinths (GHS Gesellschaft für Hafen- und Standortentwicklung mbH, 1999) – a defining decision for the Fl-I dimension. These conclusions were later translated into the 1999 *Masterplan Concept*. Concrete baselines: the +7.5 m NN warft requirement, preservation of harbor basins, and provision of waterfront promenades were defined in the *Masterplan Concep*t (Table 3). The winning concept by ASTOC/KCAP operationalized these requirements (Table 4). Flood gates, floodable promenades system, warft heights and surface drainage as measurable and non-measurable baselines were fixed in the *Masterplan* (Table 5).

For the AMI dimension, the *Masterplan Concept* inscribes continuity of promenades and cycle paths that link bridges and quays. Furthermore, design evaluation criteria rewarded permeability and inter-modal integration. The *Masterplan* proposed a 10km quay promenade system, reduced parking ratios to discourage car dependence, and determined the pedestrian

and cycle bridges - new or adapted. For the B-GI, the *Masterplan Concept* required preserving and improving waterside habitat continuity, ecological compensation logic tied to any quay modifications, and linking of the green corridors to the first green ring. The *Masterplan* fixed the preservation of the harbor basins and the ecologically valuable areas. If needed, the Masterplan required compensatory green areas to be provided. The winning concept also defined public space and mobility (parks, promenades, bridges, etc.). Finally, the 2000 *Masterplan* codified these baselines into an official planning instrument (Table 5).

In the first discussions on the possible redevelopment of the area, the 1998 Expert Symposium, attention was directed toward economic positioning and governance of the area (Table 2). Fl-I and B-GI systems were barely featured in the discussions, while superstructures and mobility were framed through economic indicators (jobs, exports, service sector growth). The concept quantified housing, jobs, and built areas, which were later translated into the superstructure systems. The superstructures in the *Masterplan* were generally defined with the built-up floor space, block typologies, and the parking baseline - parking in ground-floor garages or underground parking near the waterside. HafenCity was framed as the *city of the 21st century* that must have high-quality architecture and to preserve the local identity through architecture.

Translation 3 (2000 - 2008): From Masterplan to Groundbreaking

The third translation (T3) began in 2000 with the *Masterplan* as a new OPP which problematized the redevelopment's implementation. This is a timeframe in the transformation process when certain rules and visions started to be translated into B-Plans and materialized, becoming visible in completed public spaces and buildings[2]. The SAP building was the first concrete building implementation, a test case, made possible under an exception clause in the *Hafen EG,* since HafenCity was still officially considered a port area (Bürgerschaft der Freien und Hansestadt Hamburg, 2000). This project exposed gaps and possible problems with the customs boundary (Bürgerschaft der Freien und Hansestadt Hamburg, 2001). In 2003, the HafenCity area was removed from port status, allowing it to be redeveloped. A *Flood Protection Ordinance* (FlSchVO 2002) and several B-Plans were introduced during 2001-2008. As this translation spatially focuses on the area of Am Sandtorkai / Dalmankai, the B-Plans for this specific district were taken as a reference for the analysis of T3 - *Hamburg-Altstadt 32 / HafenCity 1* (2004) B-Plan (Table 9). Spatially, the

[2] While, in theory, each neighborhood's trajectory (from planning to completion) could be analyzed as a separate translation, this dissertation instead traces the key translations that shaped the overall process and the development of infrastructural baselines, so that not every B-Plan-to-implementation step is tracked.

process became visible by the completion of the Magellan - and Marco-Polo-Terrassen (2005-07) and the first raised buildings, such as the SAP House.

By 2004, GHS became HafenCity Hamburg GmbH (HCH) (Bruns-Berentelg, 2014) and soon owned most of the land. The company used its influence to ensure that investors adhered to the broader planning vision. Instead of charging the highest possible price for land, GHS required investors and developers to contribute to the overall planning goals of HafenCity, which in turn raised the value of new land plots. This approach maintained the balance between the land sale profits and long-term planning goals (Bruns-Berentelg et al., 2022) and the public ownership in the area was maintained. The abstract *Masterplan* rules were translated into concrete rules that every architect and investor had to follow. Architects recall the high degree of coordination that was required between the superstructure developers and the public space designers:

> "All the plots had to agree with us. We had to coordinate about the public space and the connection with the wall (referring to the mound). The only thing we didn't intervene in were the private gardens... We had to agree about the open space and about the façade. Not a complete façade, but the intersection with our wall. ... We did different details for different situations… The main part was the city. They gave a subvention to the private developers, about 250 euros per square meter, to realize our design. They gave the subvention, they paid the part, but the developers had to deal with us." (Interview 2, 2025).

The completion of the first neighborhood (Am Sandtorkai/Dalmankai) marks the closure and stabilization of baselines in T3.

Analysis of the Network

T3 maps one long process of implementation, so naturally, implemented infrastructures (like *streets – 1*, *streets – 2*, *bridges – 1*, *bridges – 2*, *bike lanes – 1*, etc.) at one point in time become active actors in the network (Figure 13). In the T3 network, the legal and policy instruments (represented by black nodes) have become even more dominant than in T3. There are several central and high-betweenness actors on the map. First, the *B-Plans* node sits at the very core, as a primary regulatory node through which most *infrastructure*, *authority*, and *standards* actants are connected. Secondary central nodes are *GHS/HCH* and *Amt V/LSBG* which are mostly connected by partnerships and resource flow connections to the rest of the network. *Land-sale contracts* and *building permits* also sit at the center of the network, although not with a high betweenness value. There is a visible cluster of local authorities (dark blue nodes), *BSU*, *Amt V/LSBG*, *Hamburg Parliament*, *Senate,* and the *Fire Department* that are now more tightly interconnected, consolidating power. The legal and policy instruments *BauGB*, *HBauO*, *FlSchVO 2002*, *HafenEG*, and *HWaG* form a dense cluster

around the *B-Plans*. Some of them are peripheral and act through the plans, but some of them, like the *FlSchVO 2002*, are intertwined in the process of land sale and building permitting. The blue infrastructure nodes are now integrated nodes that show the physical implementation starts to take shape. The natural systems nodes (yellow) are still peripheral in this network.

The main OPPs for this network are the *B-Plans*, a key intermediary - every infrastructure actor: every institutional or financial actor (*GHS/HCH*, *Hamburg Senate*, *BSU*, *private developers*, *land-sale contracts*) must pass through the *B-Plan* to act. The *B-Plans* became the stabilized spokesperson of the earlier translation[3]. For the flood infrastructure implementation, the *FlSchVO 2002* acts as an OPP as no development can bypass its requirements. Finally, the *land-sale contracts* and the *building permits* act as OPPs for private investors. *Land-sale contracts* are also one of the central nodes. Land parcels are sold only when developers accept clauses that require co-financing of the mound solution. The first implemented infrastructure stabilizes the requirements into a physical form. *GHS/HCH* and *AmtV/LSBG* are bridging between these policy nodes and the hardline engineering nodes. The following reflection from one of the interviewed architects illustrates how these actor-networks translated the technical requirements into spatial baselines:

> "The first were the engineers for the heights and the limits. They made the first plan: here is the site limitation, here is the final height. That was the first part. The second was the planning of the public roads, because they gave the height of the public road, which is binding for the investors of the buildings, because you have to accept the road height. Then we had the framework planning, which was the B-Plan. The B-Plan defines exactly how much free space you have, what you have to do, for example, the trees you have to plant, the playgrounds for children. … And then you have the Port Authority, which is responsible for the quay walls and the port services." (Interview 2, 2025)

[3] B-Plans that are influenced by the first masterplan are still issued after 2010; however, for the buildings to be realized, new actors are mobilized. That is why the actor network represents a section of the timeline before 2008. The old masterplan is still an active actor after 2008.

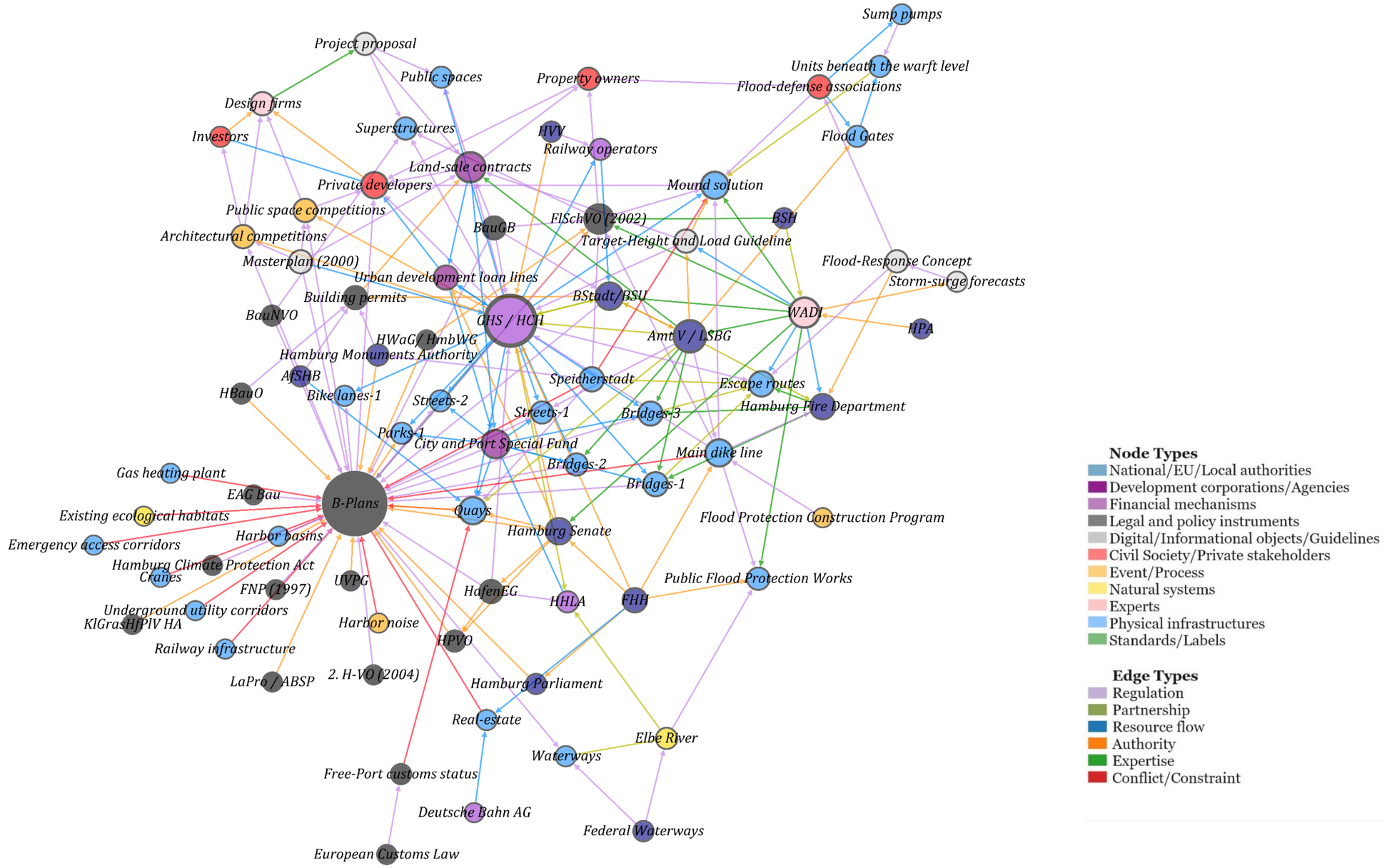


Figure 13: *ANT map of HafenCity's T3. Made by author.*

Evolution of Key Infrastructural Baselines Across T3

As described in the previous section, OPPs with most influence on the infrastructural baselines in T3 were the B-Plans and the 2002 FlSchVO. With the *2004 Altstadt 32/HafenCity 1* B-Plan (Table 9), flood safety was no longer abstract and became tied to development rights. The plinth rule has been written into regulatory documents that oblige the developers to raise ground floors (Bezirksamt Hamburg-Mitte, 2004, p. 32; FHH, 2002). Story heights, garage placements, and drainage were explicitly linked to flood levels. The City of Hamburg promised equivalent safety to inner-dike areas (Mees et al., 2014) while keeping the open waterfront character intact. On the other hand, the 2002 FlSchVO fixed the +7.5 m NN baseline and required closures, escape routes, and high-lying areas. Developers also had to construct floodproof buildings (with raised plinths, watertight walls, special edge details). Later plots simply inherited these standards rather than renegotiating them. Plans also secured escape and emergency routes that stay operable for hours during surges. Finally, drainage solutions are required to separate and directly discharge rainwater from public/green areas to the water basins or the Elbe, close combined sewers during floods, while pumps bridge the period and require private pumps wherever backwater levels can be exceeded.

AMI was legally structured via rights-of-way for pedestrians, cyclists, and emergency vehicles. The local development plans regulated maximum parking ratios, mandatory cycle bridges and lanes on specified cross-sections, and promenades along all quays. The B-plans define public space by legally fixing promenades, squares, passages, and footpaths. Plans lay out a graduated, networked system that links waterfront promenades, neighborhood squares, streets, and alleys with semi-public courtyards. Along the water, lower quayside promenades (≈4.3-5.5 m NHN) were paired with higher warft-level squares or so-called *city loggias*. Larger public spaces, such as squares, were planned as multifunctional, shaded by trees, and accessible spaces linked by paths.

B-GI dimension was shaped by enforceable planting quotas. B-plans also required precise footprints for parks and promenade widths. Superstructures were bound to renewable energy shares and noise thresholds. In this translation, dualities can be seen in the measurable baselines (flood height, energy quotas, tree ratios, noise levels) that provide hard resilience requirements, versus the non-measurable baselines (maritime openness, mixed urbanity, architectural quality – defined in the Masterplan) which sustain HafenCity's symbolic legitimacy.

Translation 4 (2007 - 2009): Institutionalizing Sustainability

The fourth translation (T4) was problematized when sustainability goals were institutionalized with the launch of the *HafenCity Eco-Label* (v1) on 24 September 2007. HCH commissioned the *Gesellschaft für ökologische Bautechnik Berlin mbH* (GföB; Berlin Society for Ecological Building Technology) to develop the certification system, and the certificates were afterwards granted by HCH. By meeting the specified criteria set by the label, buildings could be awarded either a *Silver* or *Gold* award (Gesellschaft für Ökologische Bautechnik Berlin mbH and HafenCity Hamburg GmbH, 2010).

The Eco-Label first appeared as a voluntary certification - an interessement device designed to enroll developers around a shared performance standard. One of the first projects to earn the label was the Katharinenschule primary-school complex, certified with Eco Label Gold in 2009 (HCH GmbH, 2017). During 2007-2010, the underlying actor-networks of tendering and implementation of building plots remained largely unchanged, except for the buildings that were voluntarily labeled. This process was re-problematized in 2010, when the label shifted from voluntary to a mandatory requirement. Consequently, the networks that formed around the certification system are analyzed as two separate translations. Nevertheless, the process can also be conceptualized as one long translation (T4+T6 - 2007-2014) where the voluntary T4 phase corresponds to problematization and interessement of new actors around the new Eco-Label, while the contract-bound T6 phase represents the enrolment and mobilization of the network.

Translation 5 (2008 - 2010): Master-Plan Revision

The fifth translation (T5) unfolded during the revision process of the Masterplan, from 2008 to 2010. Almost a decade after the start of the implementation, the 2000 Masterplan was reopened so that the weaknesses that started to emerge would be corrected. The HafenCity area started to become a branded enclave, which mobilized artists, academics, and local media to open up a debate (NiON, 2009) and to force the City of Hamburg and HCH to renegotiate the project. The unexpected success of HafenCity as a residential neighborhood increased demand for housing, so HCH, BSU, and the authors of the 2000 Masterplan- Kees Christiaanse and ASTOC collectively concluded that the Masterplan no longer matched the new needs and the increased demand for housing and problematized its update (Senat der Freien und Hansestadt Hamburg et al., 2011). Interessment and re-enrollment of actors expanded on housing cooperatives, public participation forums (Kesselhaus InfoCenter, exhibitions, etc.), expert groups, workshops, political representatives, and the Hamburg Council for the Future, which all became part of the new expanded network. New baseline

OPPs were established, like the increase of urban density, inclusion of social housing and housing cooperatives, mandatory EcoLabel Gold standard, and raising the flood-protection level.

The revised Masterplan for Eastern HafenCity (Figure 14) was adopted on 26 May 2010 (Senat der Freien und Hansestadt Hamburg et al., 2011), so the network became re-mobilized again. The revised Masterplan became a new OPP that problematized the next translation (T6). This process can be referred to as thickening of the previous translation - T3 because the OPP node changed, introduced new baselines, but the core flows remained intact, the revision did not spark any renegotiation (like ownership models). Additionally, a new layer of land-sale network connected to new sustainability standards emerged.

***Figure 14**: Revised masterplan for HafenCity (Senat der Freien und Hansestadt Hamburg et al., 2011)*

Translation 6 (2010 - 2015): Operationalizing the Revised Masterplan and Mandatory Sustainability Label

Since 2010, several new actors have entered the network. The revision focused on the eastern part of HafenCity, specifically the neighborhoods Baakenhafen, Oberhafen, and Elbbrücken. HCH began to require at least Eco-Label Gold for all new plots (KARMA, 2023). From that moment, every new land-sale contract and planning approval had to earn a minimum sustainability score as prescribed by the Eco-Label criteria. Therefore, the OPPs for the network changed. The revised 2010 Masterplan was translated from paper to ground first in Baakenhafen. The very first ground-breaking came in early summer 2015 with the JUFA Family Hotel (HCH GmbH, 2017).

This analysis treats the T6 as a single, continuous narrative that began with the introduction of the new Masterplan in 2010, which was the device that problematized the implementation process for eastern HafenCity. In this period, the network's core remained largely unchanged. Actors were mobilized around the creation of new B-Plans, land allocations, and implementation of the project. Each subsequently adopted B-plan introduced new standards and requirements specific to individual plots. All new constructions had to comply with the updated Eco-Label criteria (the mandatory Gold standard from 2010 and mandatory Platinum standard from 2017 (Petry, 2024). Therefore, a single actor-network map was constructed to illustrate the entire translation. The following B-Plans were analyzed in order to discover how baseline OPPs changed in this period: HC6, HC9, HC11, HC13, HC14, and HC16.

Analysis of the Network

The *B-Plans* remained a central OPP for the network in T6 (Figure 15). The node is represented by the largest, dark grey node. Every policy, existing infrastructure, or natural system constrains the outcome through the *B-plans*. *HCH* (large purple node) is now a central actor, managing *developers*, *investors,* and *contracts* for the building plots. *Eco-Label v. 3.0* emerges as a new normative OPP and is represented by a green node. *LSBG* appears as a secondary actor that controls mobility and flood infrastructures. It sits very close to *HCH* in the network, and both are connected to the infrastructure cluster. Finally*, FlSchVO 2002* remains an OPP for implementing flood baselines. Both *Masterplans* (2000 and 2010) are now active actors in this actor-network. The infrastructures further stabilize and appear as new active actants, resulting in a tangible physical manifestation of the network.

There are visible clusters of actors on the map. The *local authorities* and *governance* cluster (represented by darker blue nodes) include *BSU/BSW/BUKEA*, *FHH*, *LSBG*, and *Hamburg Parliament*, forming a governance backbone. This cluster connects the *policy* cluster with the development cluster, the *infrastructural* and *Eco-label/tendering procedure* cluster. Legal and policy instruments (represented with dark grey nodes) include: *BauGB*, *HBauO*, *FlSchVO 2002*, *BaumschutzVO*, *BNatSchG*, *Climate Protection Act*, *KampfflächenVO*, and *Monument Protection laws*. This dense regulatory cluster forms a belt around the master plans. *Standards and labels* nodes (pink), such as *Eco-Label (v1, v3)*, together with *DGNB GmbH*, *compliance certificates*, *experts*, and *architectural competitions*, are the new OPPs that introduce sustainability requirements. Infrastructures (light blue) represent newly built infrastructure, including *streets*, *bridges*, *bike lanes*, the *U4 subway*, *dikes*, *quays*, *pumping*

stations, and natural systems (yellow), such as the *Elbe River*, *shallow habitats*, and *ecological habitats*, which appear in the periphery.

Civil society is also lacking representation in this network. The flood infrastructure dimension remains central; it has become a stabilized baseline but now co-govern alongside sustainability standards. *Eco-Label* ties green roofs, water reuse, and biodiversity requirements into contracts. This translation marks the consolidation of flood protection and sustainability certification as dual governing logics.

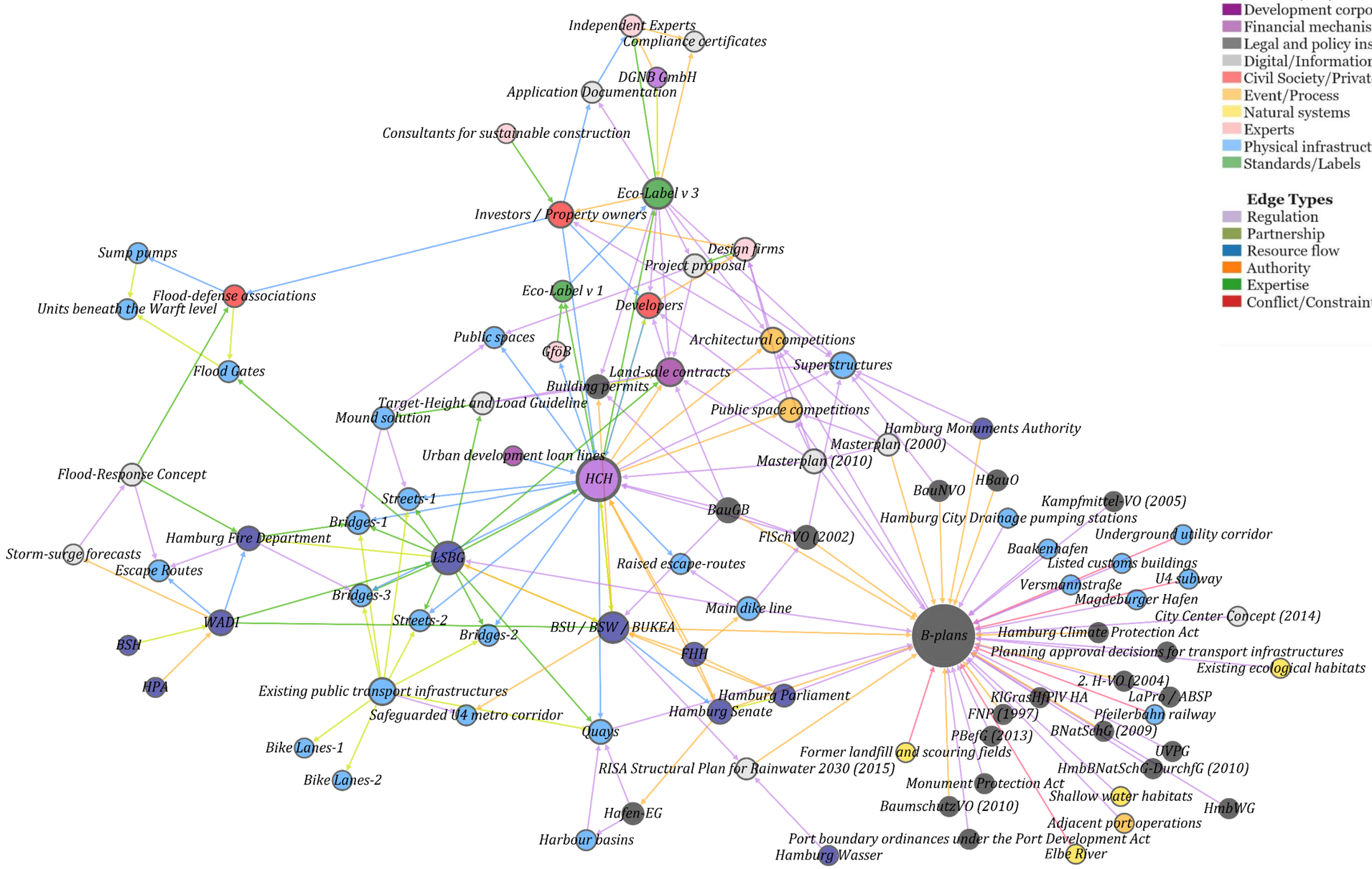


Figure 15: *ANT map of HafenCity's T6. Made by author.*

Evolution of Key Infrastructural Baselines Across T6

Across all B-plans (Table 11,Table **12**,Table **13**,Table **14**, Table **15**, Table 16), Fl-I dimension, and stormwater management are codified through the FlSchVO 2002, which still regulates the responsibilities of the developers towards raised plinths, watertight walls, escape emergency routes, and special edge details. The underground garages and drainage strategies are all regulated with the B-Plans. An early-established baseline was that all plots must be developed on warfts at a height of +7.5 meters NHN, with separate stormwater drainage to the Elbe basins. Later, B-Plans HC 11 and HC 14 required a minimum of +8.3 and +8.7 m, plus safety margins of +0.2 m, and systematically add an 80 cm expansion reserve and higher windward/peripheral benchmarks (up to 9.5 m in HC 14). Plans, HC 11 and HC 14, incorporated these requirements as construction progressed. The western part of HafenCity remained at +7.5 m NHN for promenades and plinths. The aim remained the same - to achieve storm-surge safety equivalent to areas behind the main dike. B-Plans specified additional quay wall reinforcements and the establishment of Baakenpark as a flood-resilient open space. The Eco-Labels further reinforced these requirements (Table 17, Table 18). The 2010 version mandated separate stormwater infrastructure and prevention of heavy metal discharges into water bodies. This was a gradual shift towards an integrated water management cycle.

The B-Plans regulate a dense, legally secured mesh of pedestrian and cyclist routes, quayside promenades, and passages, pedestrian and cycle rights-of-way and escape routes. HC 9 mandated arcades, passages, promenades, and bridges as rights-of-way for pedestrians and cyclists, enhancing permeability through the blocks. Plans for a pedestrian and cycle bridge over Baakenhafen and extensions of the Elbe Riverside Hiking Trail were codified as special-purpose road areas and green-path corridors that guarantee permanent public access (right of way) (HC 6, HC 9, HC 11, HC 14). Finally, along the water, lower quayside promenades (≈4.3-5.5 m NHN) were paired with higher warft-level squares or *city loggias* to better handle flooding. These broad promenades connect parks, the 1st Green Ring (HC9, HC13, and HC14). On the certification side, the 2010 Eco-Label framed HafenCity as a *walkable city* and required sufficient bicycle parking ratios and car-reduced housing in principle. Public accessibility at ground or warft levels. By 2017, this had become more quantified, with parking limited to specific numbers of spaces per dwelling in east HafenCity (and mandated underground), mandatory e-mobility charging infrastructure, and defined bicycle comfort standards. Public accessibility was still addressed qualitatively, linked to smart mobility strategies and car-sharing initiatives.

For the B-GI dimension, tree protection and roof greening requirements were codified in all plans, both as design quality and quantitative standards. The extension of Lohsepark as a green corridor and the shaping of Baakenhafen as an infrastructure with ecological and recreational value were required in HC14. HC 11 also required ecological connectivity across Baakenhafen. The 2010 Eco-Label also required roof greening and tree planting. Version 3.0 demanded at least 50% of roofs to be greened and green infrastructure remained mainly a qualitative design expectation.

> "When we started, they said they didn't want green because green is difficult to maintain. And now they say they want a lot of green because of the insects. This ideology in urban planning has changed a lot, also influenced by the politics of the European Union." (Interview 2, 2025)

The superstructures of HafenCity were codified in all B-Plans. Each plan prescribes a fine-grained mix of housing, offices, retail, and education that matches HafenCity's small-block model. All B-Plans set height limits, floor area ratios, requirements for raised ground or warft floors, and specify façade materials. HC9 prohibited the construction of large-scale retail or shopping centers to maintain mixed-use areas. The plans also address interior comfort by implementing stricter noise regulations. The building quality is addressed more through the Labels. In 2010, Eco-Label required energy efficiency to be 15-30-45 percent below the EnEV standard, depending on building type, as well as indoor air quality targets and acoustic and thermal comfort. Architectural quality, and family-friendliness were qualitative requirements that were dominant. By 2017, energy demand reductions were tied to 30-40 percent below the EnEV, depending on the building type. Energy monitoring was required for two years after completion. Comfort standards were also reinforced through simulations and stricter noise regulations. New qualitative obligations were also introduced, requiring flexibility, modularity, and reversibility in floor plans.

In this lengthy translation, HafenCity's B-Plans and Eco-Label certification regimes evolved in tandem with the district's physical development. The construction did not occur in a linear manner, but both B-Plans and certification rules were introduced during or after the infrastructure and building works were underway. The HafenCity Eco-Label evolved from a performance-driven, vision-oriented tool in 2010 to a more precise, codified, measurement-based certification regime by 2017. HafenCity was planned, built, and codified simultaneously, with each cycle of planning or Eco-Label retroactively legitimizing infrastructures already delivered, while regulating the next wave of buildings (Osiejak, 2023). This recursive pattern gives HafenCity its distinctive governance profile. In ANT terms, rules and material actants stabilize each other in an ongoing translation process.

Translation 7 (2005 - 2013): Renegotiations for the Elbphilharmonie

The seventh translation (T7) was problematized in 2005, when escalating construction costs forced City of Hamburg and Hochtief to renegotiate the contract for the Elbphilharmonie (Figure 16) four times (Nachträge 1-4) (Bürgerschaft der Freien und Hansestadt Hamburg and Dr. Peter Tschentscher, 2011). Finally, in 2013, points of agreement were legally inscribed in Nachtrag 5 (Freie und Hansestadt Hamburg and Hochtief Solutions AG, 2013). The official opening of the building in 2017 marked the end of the translation.

Figure 16: *Elbphilharmonie in Hamburg. Photo by author, 2023.*

The planning and building process of the philharmonic indicates a shift in the governance of iconic flagship projects, at least in Germany, and reveals new discourses and practices of a place-specific neoliberal governmentality. Uniquely, this project relied heavily on local civic commitment and patronage, as a new form of governance in urban development that blended public and private interests (Balke et al., 2018). Although the negotiations co-evolved with the evolution of the Eco-label, the label remained a parallel, district-wide instrument applied to new plots that came after 2007 and were not influenced by the contractual amendments of the concert hall. The renegotiations only influenced pedestrian circulation within the Elbphilharmonie public areas (Bürgerschaft der Freien und Hansestadt Hamburg, 2014) but did not revise HafenCity's existing cycle or footway network or the bridge corridors that had been decided by the 2010 *Masterplan*. Because of this, the translation was not investigated in greater depth.

Translation 8 (2011 - 2016): Affordable Housing Units (1/3 rule)

Hamburg raised the quota to one-third publicly subsidized housing in 2011. After that, every new HafenCity residential project, in principle, had to deliver the so-called *Drittelmix* (one third subsidized, one third market rent / private ownership, one third market-rate). The *1/3 rule* enrolled housing departments, cooperatives, and funding banks as new actors. Cooperatives and building groups gained more sites, and private developers had to integrate subsidized units and cross-subsidize within mixed blocks (HCH, n.d.-c). The outcomes from this are visible in the newer districts. Flagship projects like Moringa included subsidized apartments (HCH GmbH, 2024). Furthermore, the rule allowed a social mix of affordability requirements in all later plans and embedded them in plot tenders and development contracts. By 2016, every HafenCity plot tender routinely required the 1/3 mix rule, meaning the network had stabilized. This process did not initiate a change of other infrastructural baselines and engineering solutions and is not mapped and analyzed in greater depth.

Translation 9 (2013 - 2015): Post-Free-Port Consolidation

An important event for the redevelopment was the Freeport abolition in 2013. After this, the event planning authority was shifted fully to the city, and the constraints of customs and port laws were gone. Hamburg removed customs checkpoints and fences, and the entire area became a normal EU customs territory (Deutsche Welle, 2013). With the barriers gone, formerly restricted areas could receive new uses. The Oberhafen area was turned over to the creative industries, and the Spreehafen waterfront opened to the public (IBA Hamburg, 2013). With this, HafenCity redevelopment shifted into its *eastern phase,* and Baakenhafen and Elbbrücken quarters moved to implementation. The network stabilized around 2014-2015 when the issue dropped out of negotiations. Although this is an important translation for HafenCity redevelopment, the networks that form around it are not of interest to this dissertation.

Translation 10 (2023 - in progress): Stricter Sustainability Rules with DGNB Special Award Ecolabel Certificate

This translation focuses exclusively on the sub-network that follows the assemblages that form around the building plots tendering with the introduction of the new *DGNB Special Award Ecolabel*. The label was introduced in June 2023 by HCH and the German Sustainable

Building Council (DGNB)[4] as the successor to the local HafenCity Ecolabel v. 3.0. The certificate became mandatory for all new projects in HafenCity plus some other neighborhoods in Hamburg. The new label tailored the standard DGNB system to these districts, and the new certification was embedded in land-sale and permit processes. The label evaluates six groups of criteria: ecological, economic, technical, process, location, socio-cultural, and functional quality. The focus of the Label is on: contribution to climate protection and climate adaptation, avoidance of greenhouse gas emissions during the construction of the building and during operation, avoidance of substances that are harmful to the environment or health, circular construction, barrier-free usability, and socially and environmentally responsible mobility (HCH GmbH, 2024).

Analysis of the Network

The *DGNB Special Award Ecolabel* is placed at the network's very center as it is the focus of the sub-network analysis (Figure 17). In actor-network terms, the label functions as the OPP: every sustainability commitment like the *Paris Agreement*, *the UN SDGs*, the *European Green Deal*, the *EU Taxonomy Regulation*, the *Zero-Pollution Action Plan,* and the *EU Soil Strategy* reaches *HafenCity* only after being translated by *DGNB GmbH* into the EcoLabel's rulebook. Every *developer*, *investor*, *land-sale contract,* and ultimately every *building permit* must flow through that same label. *HCH* makes the passage unavoidable by embedding certification in the *agreement to start certification*, in *land-sale contracts,* and in the *building-permit checklist*. The DGNB hired independent experts who enforce compliance through the audit loop.

Around this OPP, several actor clusters gather. A peripheral normative cluster of grey nodes, new EU regulations, and strategies feed *DGNB GmbH*, which sits between global policy and the local projects. HCH, colored purple, forms a management core that couples the label to its own power: it issues agreements, allocates land, and accepts audit reports. Market actors, *developers*, and *investors* appear as red nodes, and their capital enters the network via resource-flow edges. The label is formally focused on the building plots; however, three criteria push obligations beyond the plot boundary. Stabilization happens once every plot contract and permit reference the label; sustainability goals become routine administrative facts.

[4] *The Deutsche Gesellschaft für Nachhaltiges Bauen* (DGNB) is an independent, non-profit association founded in 2007 that operates Germany's leading sustainability-certification system for buildings, interiors, and districts.

Evolution of Key Infrastructural Baselines Across T10

Projects in HafenCity, Billebogen, Grasbrook, and Science City Hamburg Bahrenfeld are designed, constructed, and certified according to the new DGNB Ecolabel regime (Table 19). In the DGNB Special Award Ecolabel, Fl-I dimension requirements were reframed through DGNB's rules, which require all projects to conduct climate risk analyses and demonstrate resilience to flooding and weather extremes. Use of nature-based solutions was encouraged as well. The AMI dimension was codified with numeric standards for bicycle-parking quotas and e-mobility charging points. Public accessibility of warft levels and walkability principles were retained as a qualitative commitment. B-GI was introduced to the DGNB catalogue through quantitative benchmarks for freshwater demand, suitable roof greening and biodiversity requirements. Superstructures are now strictly tied to DGNB performance indicators: life-cycle CO_2 balances must be disclosed, energy demand must be reduced by 25-40% below GEG/EnEV benchmarks, and two-year energy monitoring is compulsory.

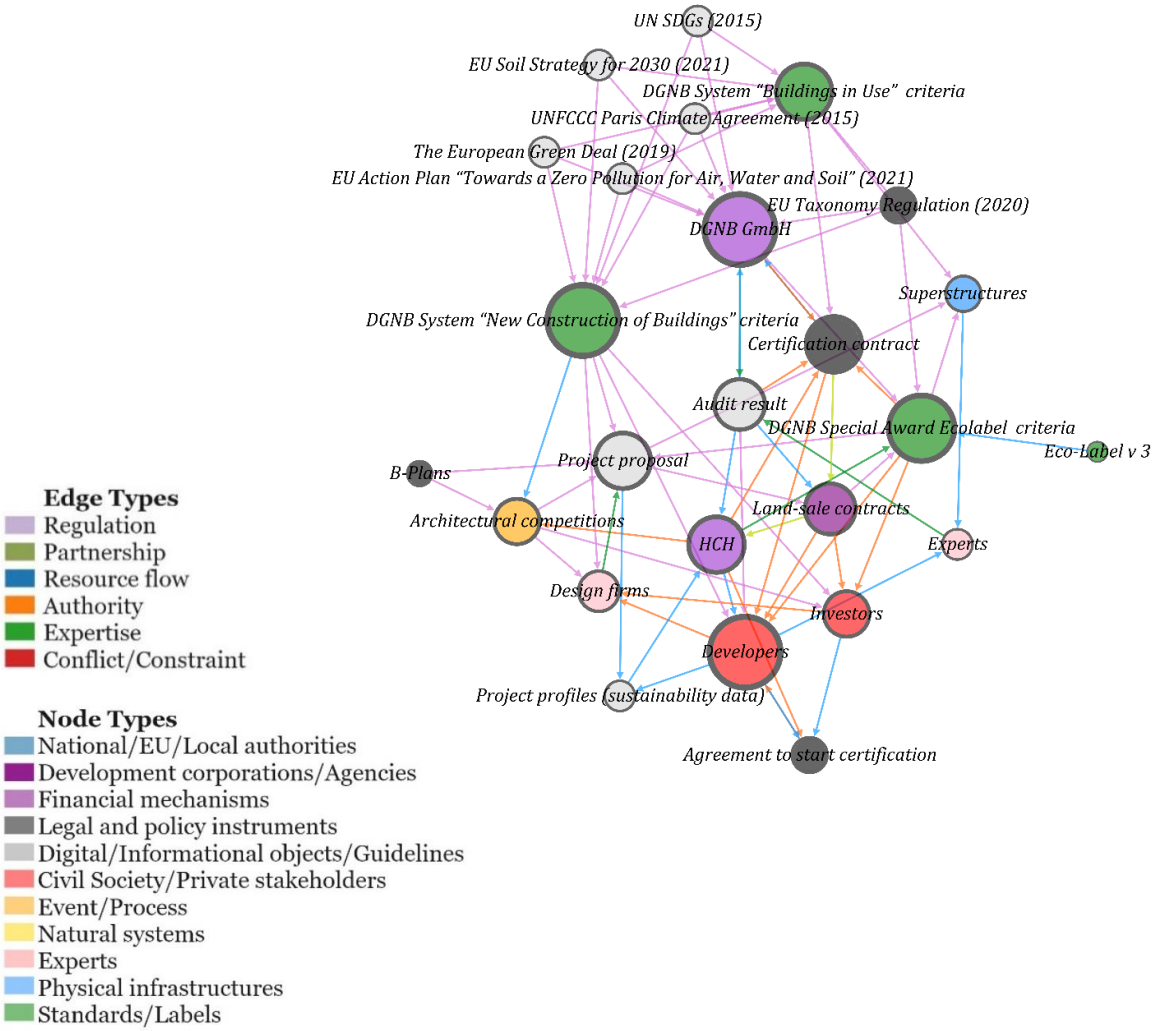


Figure 17: *ANT map of HafenCity's T10. Made by author.*

Chapter Summary

Chronological Overview and Key Turning Points

HafenCity's evolution has developed through ten key translations. The project was initiated in the early 1990s (T1) with the initial feasibility studies for the area that led to the vision of HafenCity. These studies later transitioned into the 2000 *Masterplan* (T2), which stabilized the concept and the mixed-use program of the area. Throughout the early 2000s, B-plans and flood ordinance operationalized these visions established and implemented rules for the infrastructural systems with the 7.5 m NHN plinth as a starting mean level height (T3). By 2007, sustainability ambitions were introduced through the voluntary Eco-Label (T4). This was followed by the 2008-2010 *Masterplan* revision process (T5), which re-negotiated housing and public space requirements for the eastern part of the redevelopment area. At the same time, the Eco-Label became mandatory (T6) and evolved into a codified certification regime. Parallelly, the flagship project - Elbphilharmonie triggered contractual renegotiations (T7), and the 2011 one-third affordable housing rule introduced social obligations for the investors (T8). The abolition of the Freeport in 2013 (T9) removed customs barriers and unlocked the development of the eastern region. Recently, the DGNB Special Award Eco-Label (T10) consolidated all prior sustainability standards into a systemic, certification-based regime.

Evolution of the Four Infrastructures in HafenCity (OPPs as baselines and OPP as nodes in networks)

Flood-protection Infrastructures

In T1, flood protection was problematized as an obstacle to redevelopment. The brownfield port land could not be made habitable without solving flood risk, and the warft model became the OPP requirement: only if plots were raised above flood levels could redevelopment proceed. Interessement happened with feasibility studies commissioned from 1991 onwards, which demonstrated the benefits of using warfts for the area. These studies aligned planners, engineers, and political actors around the same framework. Enrolment followed when the Senate adopted the vision HafenCity in 1997, which inscribed the baselines and at this point, the OPP existed as a requirement, not legally binding. The vision mobilized actors to produce more studies and to prepare the ground for a *Masterplan Concept*.

T2 reframed the issue - the warft was embedded as an operational rule for every project (problematization). Interessement occurred through the establishment of the GHS

and its further collaboration with BStadt in preparing the *Masterplan Concept* (which was a basis for the competition brief). This document inscribed flood-protection measures into the requirements for competitors. Furthermore, events such as the Real Estate Symposium and multiple planning studies refined the technical dimensions of the flood infrastructure. Enrolment was achieved when the Masterplan was approved, which inscribed the warft baseline into a binding framework. Thus, the OPP-nodes for this translation were the competition concept, and the Masterplan. Mobilization of a new network occurred with the Masterplan as a stabilizing baseline artefact.

With the Masterplan becoming an OPP in the previous translation, in T3, legal enforceability of the baseline across all developers was problematized. Interessement involved negotiations between HCH, LSBG, and legal authorities, which fixed the plinth height at +7.5 m NN. Enrolment occurred with the FlSchVO 2002, early B-Plans and land-sale contracts (OPP nodes), which legally codified the baseline and obliged developers to build on plinths. Mobilization followed: with the ordinance and B-Plans in force, the warft baseline was normalized as part of Hamburg's regulatory environment, and developers, architects, and engineers had to comply with it in every design and permitting process – thus, building permits became the OPP nodes.

After the stabilization of the baseline in T3, the problematization around Fl-I revolved around securing HafenCity against extreme water events, but beyond the plinth infrastructures (T5-T6). Interessment occurred through new studies being developed (like the *RISA Strategy*), and the Masterplan being revised for reinforcement of strategies and implementing different drainage rules (OPPs as requirements). Enrolment happened, again, through B-Plans and land-sale contracts (node OPPs) which tied developers to schemes for reinforced quay edges, new flood gates, and integrated drainage and pumping systems. Mobilization occurred as these infrastructures started to be implemented in HafenCity's fabric.

Active-Mobility Infrastructures

In T1, AMI appeared only as a background issue. The area at the time was cut off from Hamburg's city center, and its connectivity was problematized. However, there were no concrete active-mobility solutions defined, and the OPP baseline was absent during this translation. The vision (1997) aimed for improved accessibility and bridges, again without inscribing binding measures. At this stage, mobility baselines existed only as a concern.

T2 problematized mobility directly: redevelopment would not be successful without strong connections to the city center. The OPP as baseline became the extension of the U4

subway line and the creation of pedestrian bridges to connect. Interessement happened with the preparation of the brief baselines, which required competitors to propose corridors and connections. Enrolment followed with the 2000 Masterplan, which inscribed bridges as structural design elements. The Masterplan became an OPP node, which fixed AMI as part of HafenCity's planning logic. Mobilization of a new network followed the Masterplan introduction.

In T3, the problematization revolved around operationalizing the Masterplan's mobility vision which introduced a new modal split for the area. The OPP baseline became modal-split targets and design standards for bike and pedestrian infrastructure. Interessement involved planners, transport engineers, and HCH who negotiated with developers to secure corridors and early infrastructure funding. Enrolment and mobilization occurred through early B-Plans and land-sale contracts, which inscribed parking limits, bicycle parking quotas, and rights-of-way for bridges. B-Plans served as main OPP nodes, which turned AMI baselines into binding obligations.

Later translations (T5-T6) reframed active mobility as part of the new sustainability goals. The OPP requirement changed, and it focused on *eco-mobility*. Together with the B-Plans that served as OPP nodes, HafenCity EcoLabel obliged developers to implement lower car-park ratios and to improve bike and pedestrian facilities. Interessement this time also included private investors through the EcoLabel requirements. Enrollment and mobilization were achieved via B-plans and land-sale contracts. During these translations, active mobility targets were even more strictly inscribed to the real-estate market itself.

Blue-Green Infrastructures

During T1, B-GI was problematized in a minor way. The *Landscape Program of Hamburg* recognized the area as flood-prone but did not frame green space as an ecological requirement. No clear OPP emerged for B-GI. During T2, B-GI was problematized more clearly as a matter of urban amenity and branding. Making HafenCity attractive while the land was being redeveloped was the new objective. The OPP as baseline was the creation of public promenades and pocket parks, tied to the redevelopment's image. Interessement occurred through the competition briefs, and enrolment was secured with the development of the 2000 Masterplan, which inscribed continuous waterfront access. Again, the brief and the Masterplan became OPP nodes, which inscribed B-GI more as an amenity than an ecological function. Mobilization of a new network followed after the Masterplan was adopted.

T3 shifted B-GI into more measurable rules. Problematization revolved around ensuring that greenery obligations were realized in private plots, but also in public areas.

Interessement happened with the development of B-Plans and negotiations of HCH with developers. Enrolment and mobilization occurred when early B-Plans and land-sale contracts (critical OPP nodes) inscribed the baselines, which were implemented into the first plots. The OPP baseline was greening quotas for roofs, tree planting obligations, public courtyards, minimum greening percentages, and tree replacement. The implementation of the first neighborhood stabilized these baselines into physical artifacts.

T5 and T6 introduced stricter baselines for B-GI. The HafenCity EcoLabel in 2007 problematized the implementation of green roofs. The OPP as baseline was now a stricter integration of green infrastructure into building design. Interessement, enrollment, and mobilization followed the pattern of AMI.

Superstructures

In T1, buildings were framed aspirationally, and the OPP as baseline was the creation of high-quality, mixed-use urban quarters. Interessement occurred through Volkwin Marg's redevelopment study, and enrolment and mobilization occurred when actors gathered around architectural ambition through several studies that led to the vision which was adopted by the Senate in 1997 (the first OPP node). In T2, the problematization revolved around the question of how to guarantee that the redevelopment would deliver architectural quality and diversity. The OPP as baselines became *design excellence*. Interessement of actors occurred through the 1998 Real Estate Symposium, which mobilized investors and developers, and through the 1999 international competition, where OPP as a node was the Masterplan Concept itself. Enrolment and mobilization were achieved with the development of the *Masterplan* (the final OPP node), where design codes for block structure, building heights, and functional mix were inscribed.

In T3, operationalizing the Masterplan's ambitions in concrete terms was problematized. The OPP as a requirement, became binding architectural standards for façades, materials, density, and use-mix on individual plots. Interessement and enrollment involved preparing the B-Plans and HCH negotiating these standards with developers through land-sale contracts (OPPs as nodes). These documents specified and detailed building regulations that were key in turning architectural quality from a narrative into measurable obligations. Mobilization was achieved as the first buildings were realized in line with these baselines.

Later translations (T5, T6, T10) re-problematized the building baselines through the lens of sustainability. The OPPs as a baseline, turned toward energy efficiency, material quality, and construction-phase monitoring. The HafenCity EcoLabel (which became a

binding rulebook since 2010) problematized sustainability as an OPP to architectural quality. Interessement occurred through the certification process: developers, architects, and engineers were enrolled in a regime of audits, documentation, and verification managed by HCH and independent assessors, and enrolment of the actors was formalized through land-sale contracts. These contracts and certification systems became new OPP nodes for buildings that bind superstructure baselines to measurable indicators. Mobilization occurred with the construction of certified projects.

Influential Actants and OPPs in Network Dynamics

During T2, the dominant OPP was the *Masterplan Concept*. Almost every active actant: legal frameworks, hydrological studies, heritage constraints, and existing infrastructures were black boxed there as constraints or opportunities. Around it sits a governance/development agency triangle that acts as human OPPs: *GHS*, *BStadt*, and the *Hamburg Senate/Parliament.* In T3, OPPs shift from procedural to statutory. The B-Plans were black-boxed into a single super-node pulling in *BauGB*, *HBauO*, heritage and climate acts, emergency access corridors, and quay/utility constraints. Any actor, *HCH/GHS*, *AmtV*/*LSBG*, *developers*, *Hamburg Senate*, must pass through these plans to act. Coupled to them was the *FlSchVO 2002*, a hard OPP that fixed the warft baseline. The *Target-Height and Load Guideline* operate as a technical OPP. *Land-sale contracts* and *building permits* are the private/public-law OPPs that influenced each plot. Other important human OPPs were *HCH* (for contracts) and *LSBG* (for engineering rules).

T6 map shows a dual OPP system. First, *B-Plans* (this node represents HC6, HC9, HC11, HC13, HC14, HC16) stay the central regulatory gate through which every infrastructure, standard, and actor connects. Second, the *Eco-Label* becomes an operational certification OPP, embedded by HCH into *land-sale contracts* and the *permit checklist*. Finally, in T10, the operational certification OPP - *DGNB Special Award EcoLabel* is placed at the network's center, translating global norms (*UN SDGs*, *Paris Agreement*, *EU Green Deal*/*EU Taxonomy*, *Zero-Pollution*, *Soil Strategy*) into local, auditable criteria.

Across HafenCity, OPPs shift from procedural to statutory documents and finally to certification-based gates: the T2 it was the *Masterplan Concept*; in T3, OPP hardens around *B-Plans* coupled to the *FlSchVO 2002,* which legalize spatial rules; and from T6 to T10, a parallel, mandatory performance gate is layered - *Eco-Label/DGNB* system. Recurring *human* OPPs: *HCH/GHS, LSBG*, *BSU/Senate/Parliament*, and *DGNB GmbH*, while persistent *non-human* OPPs: *main dike/warft elevations*, *quay structures*, *B-Plans*, *building contracts* and *permits*.

4.2. Neckarbogen - Heilbronn

Historical Background and Context

Heilbronn was a key player in Württemberg's economic development in the last century. Since the 16th century, extensive river regulation measures have been applied to the river which reshaped the Neckar in Heilbronn to promote shipping, which also made flooding increasingly rare in the area (Stölzer & Stölzer, 2005). While the original harbor has vanished, the Port of Heilbronn currently ranks seventh among Germany's inland ports (Schmid, 2014). The *Fruchtschuppen* (fruit warehouses) area's spatial significance understandably came from its proximity to the river and railway lines. The Wilhelmskanal, which made the Neckar River navigable, was constructed in 1821 and the terminus station was established in 1848 - both remaining in this area to this day. The discovery of rock salt in the 1880s spurred the growth of the local chemical industry (Rösch, 2007). Over the years, in the late 19th century, the area saw the creation of harbors (Figure 18). The harbors Karlshafen and Floßhafen were filled in during the Neckar canalization in the 1930s (Figure 19). Since 1935, the Neckar has been blocked off by steep embankments and roads and was only visible as an element in the city only from a few spots. The Fruchtschuppen site was a freight center until the 1960s. Before

Figure 18: *Ports 1897 (Stadt Heilbronn, 2009).*

Figure 19: *Ports 1938 (Stadt Heilbronn, 2009).*

the Neckar Canal was built, the Port of Heilbronn occupied this location, which also functioned as a key site for handling rail-transported goods.

As transportation modes evolved and industries began to relocate or decline, the area along the Neckar faced spatial challenges. Deutsche Bahn AG (DB AG) was no longer utilizing the capacity of its railway tracks as much as in previous years (Stölzer and Stölzer, 2005), and the City of Heilbronn acquired the railway grounds from DB AG. This was an important step towards the development of the site and its concretization (Schmid, 2014). Large sections of the riverbanks were used for transportation, industry, and brownfield sites, while residential, recreation, and leisure activities were absent from the site. In the last decades of the 20th century, the area was occupied by fallow land, scrap merchants, recycling companies (paper and metals), and used car dealers (Schmid, 2014).

The aspirations of the city planners were to introduce living and working in the area and this concept was an important part of the application to host a Federal Garden Show in Heilbronn (Schmid, 2014). As explained in the BUGA Feasibility Study (BUGA FS) (Stölzer and Stölzer, 2005), the acquisition of that land for the city of Heilbronn meant that they could once again emphasize the Neckar River, which was the fundamental element that defined the cityscape. The goal of the City of Heilbronn was not just removing brownfields, connecting districts in the city center, but also achieving a totally new urbanity for Heilbronn with bold and innovative architecture. Along with the BUGA Park, the aim was to rebrand the city.

Tracing the Neckarbogen Redevelopment Process and Its Key Translations

Redeveloping Heilbronn's disused peninsula into the *Neckarbogen Modelquarter* has unfolded as a chain of five sequential translations (T1 - T5). Each translation marks the period in which a new idea, policy instrument, plan, or organization was still negotiated, adjusted, and enrolled until a decisive event black-boxed it into routine practice (Figure 22). The relevant infrastructures or districts mentioned on the timeline are referenced spatially on the maps below (Figure 20, Figure 21).

Figure 20: *Map of the planned state. For Neckarbogen Modelquartier. Made by author.*

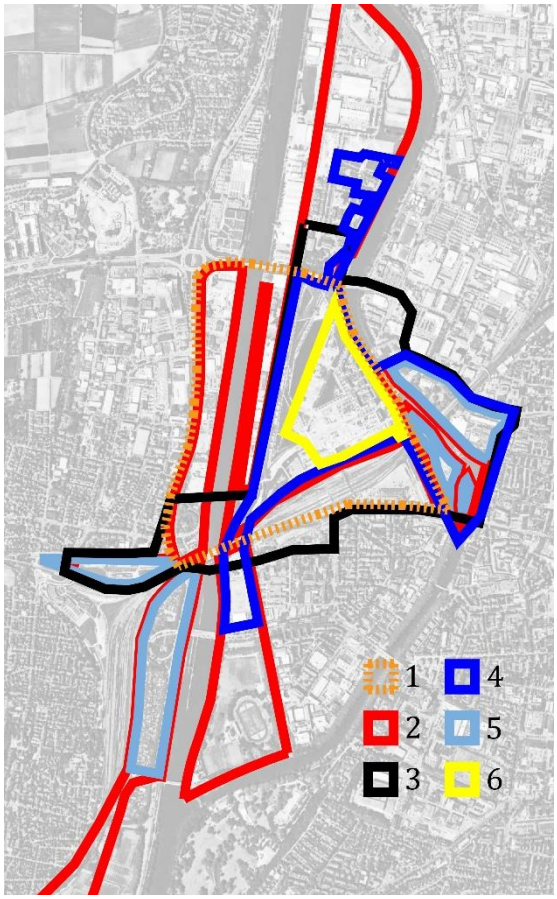


Figure 21: 1: *Fruchtshuppen area* ***2:*** *Redevelopment area in the BUGA feasibility study (2005);* ***3:*** *2008/09 "Masterplan Neckarvorstadt" ideas competition area;* ***4:*** *Temporary BUGA 2019 exhibition grounds;* ***5:*** *the SINAI open-space plan;* ***6:*** *"Neckarbogen" model quarter, Made by author.*

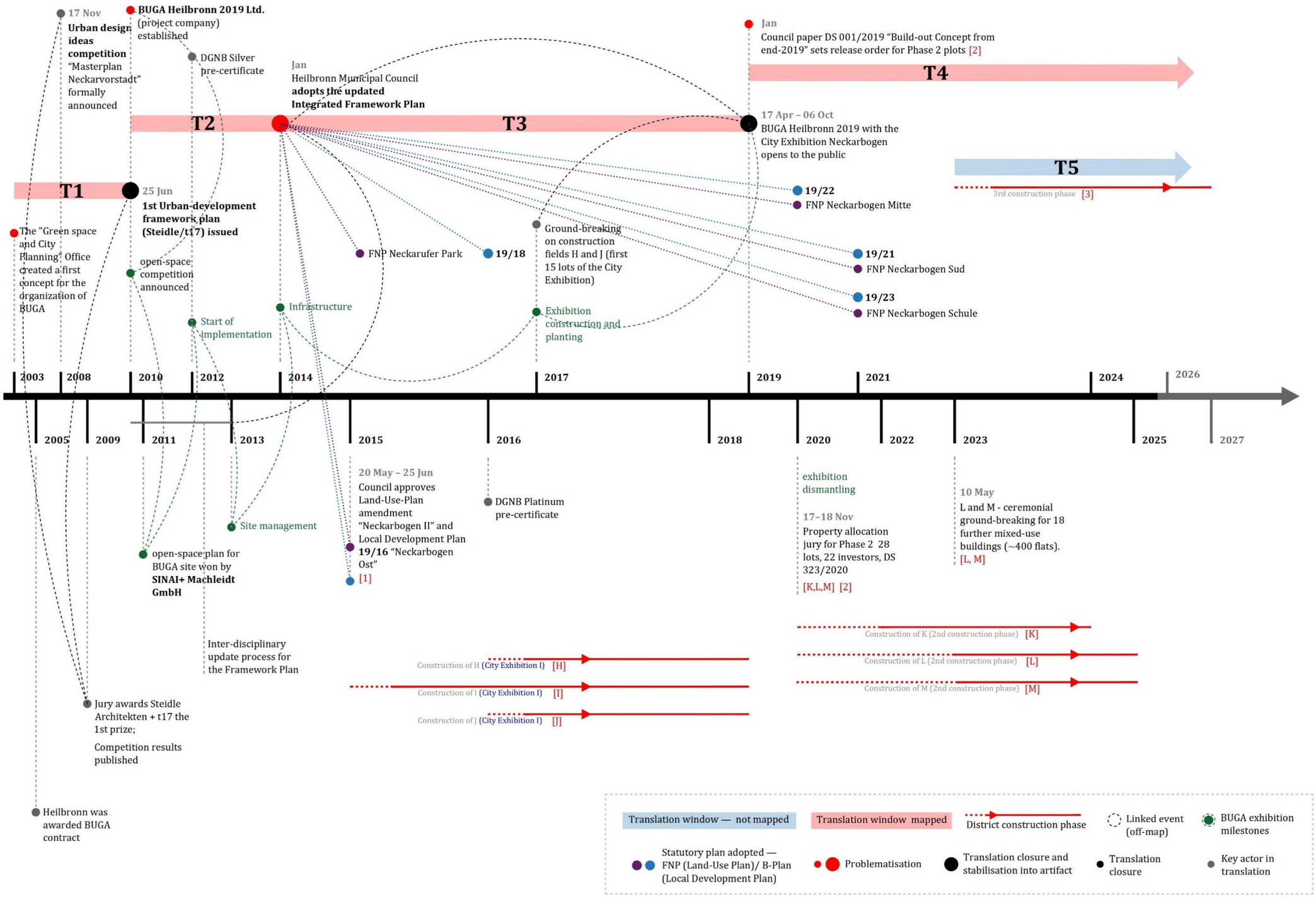


Figure 22: *timeline of Neckarbogen redevelopment. Made by author.*

Translation 1 (2003 - 2010): From Urban Void to Urban Development Framework Plan

In the early 2000s, Heilbronn began to look at the derelict 30-hectare Fruchtschuppen freight-yard peninsula, which is described in city documents as a *blank spot* of abandoned sheds and tracks in the very heart of the town. This blank spot was seen not as a liability but as a chance to create the *city on the river*. In 2003, the Green Space and City Planning Office in Heilbronn created the first concept for the organization of a Federal Garden Show (BUGA) in the city on the Neckar (Wikipedia, 2025), which represents the problematization of the redevelopment process and the start of the first translation (T1). On 17 November 2004, the Heilbronn City Council formally resolved to submit an application for BUGA 2019 (Stölzer & Stölzer, 2005), and in 2005, Heilbronn was awarded the contract by the German Federal Garden Show Company (Schmid, 2014).

In 2005, a feasibility study, *Insel im Fluss - Bundesgartenschau 2019 Heilbronn,* was published. The study re-framed the Neckarpark, Fruchtschuppenareal, Wohlgelegen, Bahnhofsvorstadt, and Böckingen zones (Figure 21) as a candidate for the BUGA 2019. The feasibility study was based on the *Green Guiding Vision* from 1992 (Barz & Schmid, 2011), which introduced the green rings, the blue-green Neckar band, and the goal of a continuous Neckarpark. The integration of riverbanks into an interconnected open space system framed the riverfront as a driver for later urban redevelopment.

The feasibility study was an interessement device that linked ecological ambitions from 1992 to a concrete event that could mobilize political support and set a fixed deadline for completion of the redevelopment. Although the council only took note of the vision, it became the silent criterion behind nearly every later decision. In 2008, the process of enrolment of new actors began - on 17 November, Heilbronn Planning and Building Law Office launched an international urban-design ideas competition for *Neckarvorstadt*[5]. The transformation was driven by the need to better integrate the Neckar River into the city's urban fabric and to reconnect the east and west districts that had been historically separated (Stadt Heilbronn, 2009b). The competition area covered approximately 100 hectares and included: Fruchtschuppen area, Heilbronn Innovationspark, planned Neckarpark, the southern edge of the station, Böckingen railway band, part of Wohlgelegen, station, and rail facilities and water areas (Figure 21) (Stadt Heilbronn, 2009b). The task was to create a framework plan that would serve as a guiding framework for development.

[5] *Neckarvorstadt* = the big initial vision, *Neckarbogen* = the deliverable model quarter.

Figure 23: *Winning entry (1st prize) in the 2009 "Masterplan Neckarvorstadt" urban design competition. Design by Steidle Architekten and t17 Landschaftsarchitekten. Retrieved from https://www.steidle-architekten.de/projekte?pid=27*

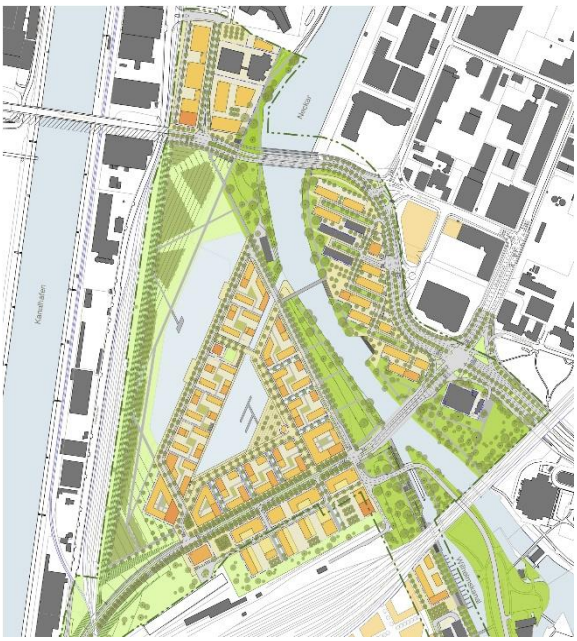


Figure 24: *Framework Plan 2011 (Dokumentation Modellquartier Neckarbogen, 2017).*

The jury decided the winner of the competition in June 2009: Steidle Architekten, in collaboration with the landscape architecture studio t17 (Figure 23). The winning team later translated the winning concept into a provisional framework plan (Figure 24) (Dokumentation Modellquartier Neckarbogen, 2017) which describes the basic features of the new district in the central Fruchtschuppen area. The plan integrated BUGA 2019 requirements, blue-green systems, transport links, and public space corridors into a spatial framework. In 2010, the framework plan was approved, which marked the closure of T1.

Network Analysis

In T1, the Neckarbogen project was converted from abstract visions toward concrete spatial and functional proposals. The *Neckarvorstadt competition brief* is the largest grey node in the network (Figure 25) and acts as the main OPP in the translation and almost every other actor is connected to it. The *competition brief* translated earlier visions, such as the *Green Guiding Vision* and the *BUGA Feasibility Study,* and their ambitions into site-specific requirements and criteria, and is surrounded by a dense cluster of local authorities (dark blue nodes) like the *Heilbronn City Council*, the *Planning and Building Law Office*, and the *Heilbronn Mayor*. These actors' institutional authority was reinforced by legal and procedural instruments like the *GRW 1995 Competition Rules* and by sectoral consultants such as the *Chamber of Architects Baden-Württemberg*. The *Heilbronn Planning and Building Law Office*

acted as the coordinating actor between the political leadership (*Heilbronn Mayor*, *City Council*), design consultants and experts, and landowners (Deutsche Bahn AG). The *Framework Plan* (2010) appears as a secondary central node, an artifact produced by this network, which served as a key stabilizer of baselines. Design and engineering firms, such as *Wick + Partner Architekten Stadtplaner* and *Steidle* and *t17*, entered the network through the competition and later became tied to the *Framework Plan*.

Throughout the whole process, natural systems - the *Neckar River* and *contaminated soils* - appear as peripheral actors that regulate or constrain the outcomes of the process, or they appear as assets that should be incorporated into planning. Light-blue nodes representing existing infrastructures are strong non-human actants which influence the brief and the winning concept as material constraints but also as enablers: *Peter-Bruckmann-Bridge*, *Wilhelm Canal*, *Neckar Canal*, *rail tracks*, *main station*, etc. These nodes are mainly placed peripherally in the network but directly influence the main OPPs. The BUGA Feasibility Study was a key actor in this translation because it advanced the idea of a riverside district and tied it to BUGA as a future event, and by these and contributed to enrolling actors into T1.

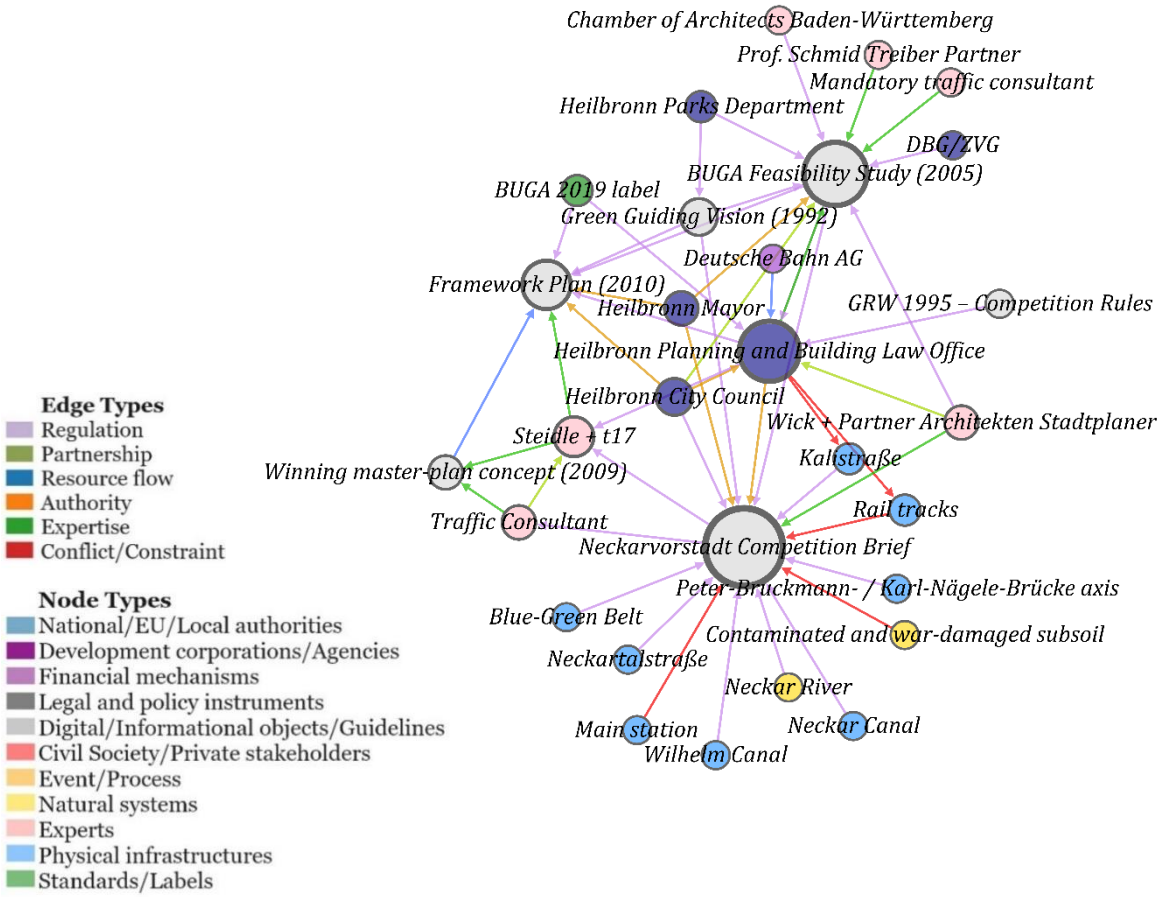


Figure 25: *ANT map of Neckarbogen's T1. Made by author.*

T1 network reveals a looser regulatory network where competitions, feasibility studies, and framework plans acted as the principal mediators of baselines. Constraints were visible only around actants that constrain or limit the design options, like contaminated soils and adjacent infrastructures. Civic society was absent at this stage as the translation was driven primarily by municipal authorities, design firms, and consultants.

Evolution of Key Infrastructural Baselines Across T1

The feasibility study problematized the brownfield as a barrier and hydrologically stable zone that should be revitalized by lakes and park rings and reconnect the city with the river. For the Fl-I dimension, measurable baselines were defined in terms of flood retention facilities in the wider system (Table 20) and became the first key OPP for this translation. The idea from the start was that the redevelopment area should complement flood-management structures through adaptive landscape design. Non-measurable goals were described as the creation of sustainable riverbank development and the re-naturalization of riparian landscapes. Key objectives of the 2008 competition (Table 21) included the development of riverbanks as defining open spaces. The problematization of flood infrastructure thus shifted from external hydraulic measures toward flood risk management within the urban plan. In the winning concept (Table 22), the Fl-I dimension is mostly visible in the riverbank, where parts of the Neckaruferpark lie within the HQ100 flood zone. Non-developed zones over the former harbor basins were reused to create new water landscapes that would also serve as retention spaces. In non-measurable terms, the water was framed as a defining character of the quarter. Neckar River, Wilhelm Canal, Karlshafen, and Floßhafen basins were fixed as structuring elements. With this, Fl-I evolved into a spatially integrated design principle that shaped landscape identity and adaptive open-space morphology.

The feasibility study, early in the process, problematized the relocation of Kalistraße and made the dimension of AMI the backbone of the concept. In measurable terms, the study proposed a continuous riverside promenade, a north-south greenway for pedestrians and cyclists, and new foot- and cycle-bridges. The competition brief demanded the restoration of fragmented links across the Neckar, inscribed requirements for north-south and east-west communication and green corridors, and integration of public waterfront spaces back into the urban fabric (Stadt Heilbronn, 2008). AMI is not directly addressed in the brief, but the winning masterplan concept and the framework plan address it on many levels. The winning proposal fixed the idea of a landmark pedestrian and cycle bridge linking the main station to the new district (Stadt Heilbronn, 2009a), a new east-west mobility axis (Europaplatz-

Fruchtschuppen Esplanade-Theresienstraße), and a southern parallel connection between Neckarpark and Neckarinsel.

B-GI is a key shaping factor in T1. This translation embedded a continuous ecological layer into the plan and is closely intertwined with public spaces and AMI dimensions that shape the concept. *BUGA Feasibility Study* identified the brownfield area as a degraded fluvial corridor with sealed surfaces and problematized the absence of continuity of open space between by proposing a system of parks and water bodies. Measurable baselines focus on the metropolitan scale and aim at improving the regional river-city connection. The initial objectives included the creation of 70-100 ha of BUGA parkland, integration into Heilbronn's three *green rings*, continuous Neckar promenade, and the non-measurable baselines framed the area as part of the *blue-green Neckar axis* (Stölzer and Stölzer, 2005). The competition brief demanded integration of the Neckarpark and the green belts along both river and canal, to reconnect citizens with the river and to treat the riverbanks as defining open spaces. Non-measurable baselines introduce re-establishing Neckarbogen as Heilbronn's identity element. Finally, the main points of the winning concept were the creation of two water basins - the designers proposed reopening of the filled-in historic Floßhafen and Karlshafen; a compact triangular block structure was proposed for the neighborhood placed in-between green corridors and water areas; The winning concept's B-GI baselines also included the potential for a bathing lake.

Finally, the formal superstructure's targets appear only in later translations, but proxies emerge in T1. The early feasibility study problematized the development district of residential and service buildings and the creation of a mix of living, working, leisure, and culture. The vision of living on the Neckar and creation of charismatic, sustainable buildings functioning in *symbiosis with the river* was presented as a qualitative baseline. Similar types of baselines were inscribed into the brief, where the non-measurable baselines conceptualize a new attractive urban district. The winning concept materialized those ambitions into urban morphology. The measurable baselines reference the block typologies and courtyards.

Translation 2 (2011 - 2014): From Provisional Framework Plan to Integrated Masterplan Adoption

The development of the Neckarbogen area has followed a clear, integrated planning process since the 2009 urban planning competition, which included early citizen participation (Dokumentation Modellquartier Neckarbogen, 2017; Stadt Heilbronn and BUGA Heilbronn 2019 GmbH, 2012). BUGA Heilbronn 2019 GmbH was founded by the City of Heilbronn and the German Federal Garden Show Society solely for the purpose of implementing this project. The joint company locked in the 2019 opening date and re-branded the peninsula as a national showpiece (Stimme, 2010). This is the point of a new problematization for the district that initiated the second translation (T2).

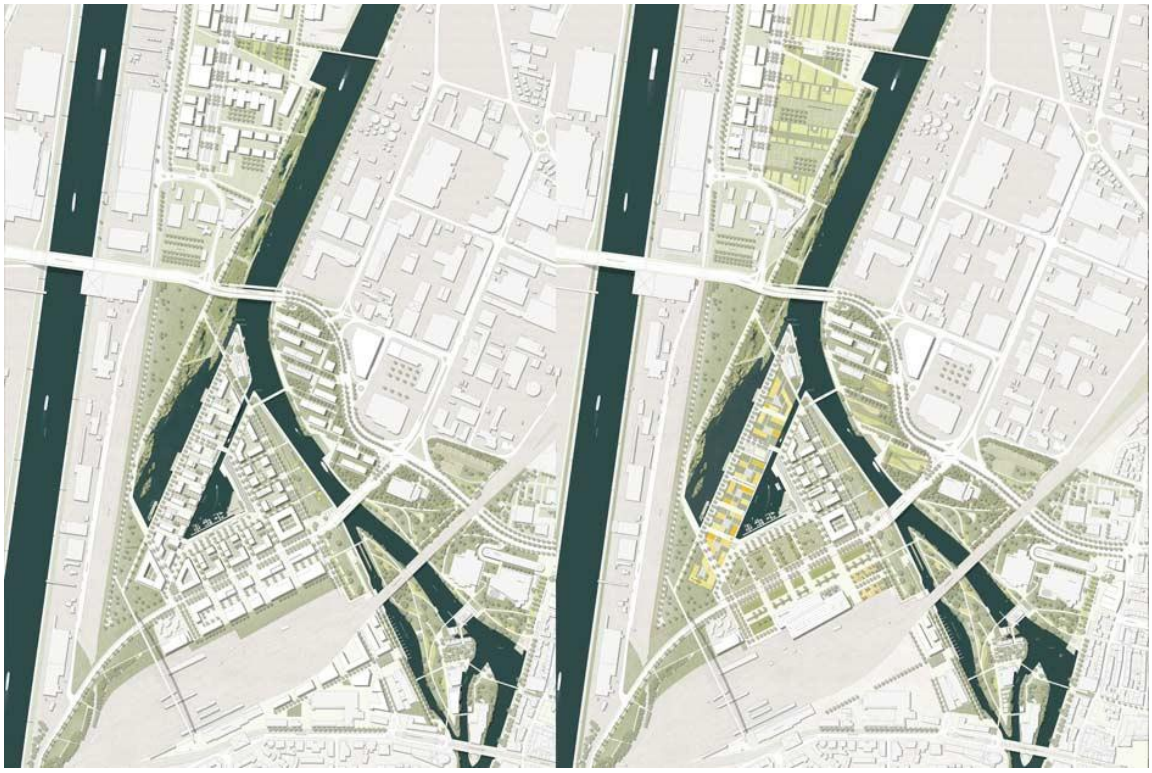


Figure 26: *Masterplan sequence for Neckarbogen's open-space competition (2011): left, the winning concept by SINAI GmbH with Machleidt GmbH interpreted as landscape-based urban structure around the Neckar and Neckar Canal; right, enhanced with highlighted building parcels resulting from that concept. Source: Neue Landschaften im Neckarbogen, Heilbronn (presentation of SINAI's 2011 competition entry), landscape.coac.net.*

T2 runs from the open-space competition in 2011 through the open-space winning concept, the *Urban Design Plan* from 2013, and culminates in the approval of the *Integrated Framework Plan* in 2014. The open-space competition was issued under the city's planning offices with BUGA Heilbronn 2019 GmbH as the development actor and was based on the 2010 *Framework Plan for Neckarbogen*. The competition was structured in two phases: Phase 1 - Generating diverse conceptual ideas and spatial strategies, and Phase 2: Refinement of selected proposals based on jury feedback, and the brief described the programmatic need to

align staging with BUGA 2019. The competition served as an interessement device that drew in design capacity, such as architectural and traffic planning experts (BUGA Heilbronn 2019 GmbH, 2010), and was won by Sinai Gesellschaft von Landschaftsarchitekten mbH in collaboration with Machleidt GmbH (Figure 26). The total area for the competition covered a total size of more than 70 hectares on both sides of the Neckar, but the final decision of the Municipal Council in 2012 on the concept of the BUGA reduced the area to around 50 hectares (Figure 20)(Schmid, 2014). In 2012, the Neckarbogen district won the early DGNB pre-certification, which, together with the BUGA 2019 label, raised performance targets for the district and tied urban redevelopment to sustainability themes and public participation. Heilbronn was one of the first German cities to have an entire neighborhood concept pre-certified by the DGNB (Anders, 2013).

Since the open-space competition, between 2012 and 2014, the winning concept was further elaborated. The city also launched an eight-month interdisciplinary update, which included working groups, expert boards, and seven citizen workshops in 2013. This update became another interessment device that enrolled new actors into the process. The update was led by Machleidt GmbH, SINAI GmbH, and specialist engineers. As a result of these workshops, a *Design Manual* was also introduced, which provided guidelines for coordinating different construction projects and served as a flexible guide for creating a unified and distinct identity for the area and for achieving a coherent overall picture, helping all involved in the planning process to coordinate with each other. Finally, the 2010 *Framework Plan* was updated to refine existing plans, to achieve a density that would allow for a critical mass to form in the district, and was closely aligned with the BUGA 2019 mission statement to maximize synergies between these complementary projects (Dokumentation Modellquartier Neckarbogen, 2017). In 2014, the *Integrated Framework Plan* was issued, and the Heilbronn Municipal Council formally adopted it on 23 January 2014. With this the masterplan was given statutory weight, and this translation phase was closed.

Parallel to the urban planning activities, Deutsche Bahn AG began with the dismantling of the tracks in the area, and strategies for contaminated site remediation were developed. Contamination was due less to railway operations than to wartime rubble and general refuse (Friedl, 2005). Therefore, site management included contaminated-soil remediation and unexploded-ordnance clearance (Bundesgartenschau Heilbronn 2019 GmbH, 2014). A landscaped earth berm up to nine meters high was built as a noise barrier, two water basins were re-excavated, and the steep banks along the Alter Neckar were regraded (Schmid, 2014).

Network Analysis

T2 is driven by the BUGA exhibition goals. The *Integrated Framework Plan (2014)* stands out as the central OPP and coupled with the *Design Manual* stabilizes the baselines which emerge from the network. These two artifacts effectively stabilized the *Framework Plan (2010),* the *Urban Design Plan (2013)*, and the *Open-space Competition results (2011)* into a single strategic plan where spatial principles and parcel structures were already defined. *Heilbronn City Council*, the *Planning and Building Law Office*, and *BUGA Heilbronn 2019 GmbH* appear in the network as authorities' / development agencies' nodes. The cluster is very closely linked and intertwined with actors such as the *citizens' workshops* and the *expert board,* forming the very core of the network that sets the frame, the participation, and authorizes the *Integrated Framework Plan*. Design and engineering firms gained stronger positions in this translation - *Machleidt GmbH* and *SINAI GmbH* acted as bridging nodes and key actors in the workshop process. The expertise cluster is intertwined with civil society and governance cluster. Sustainability frameworks also entered T2 with *DGNB Silver Pre-certificate* and marked the moment when ecological ambitions were no longer symbolic but operationalized through certification regimes.

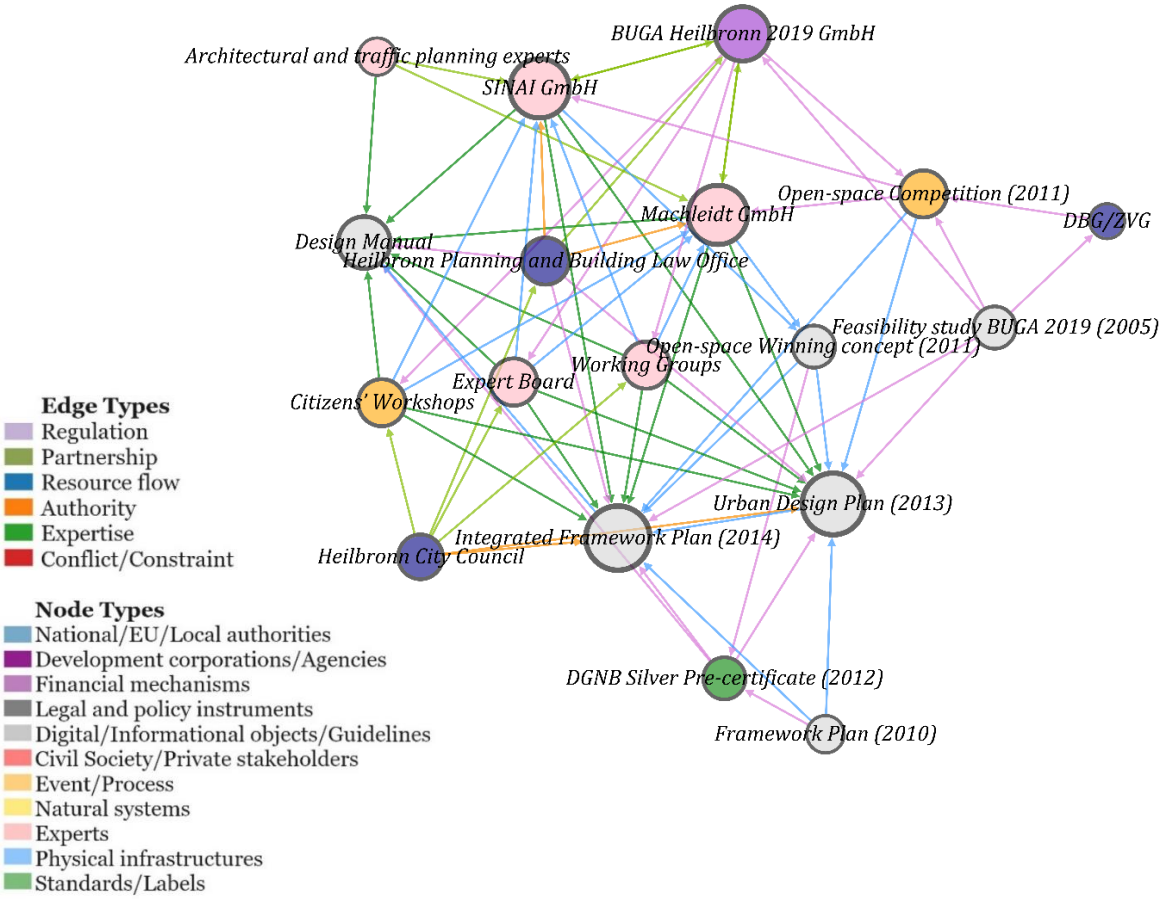


Figure 27: *ANT map of Neckarbogen's T2. Made by author.*

Compared to the first translation, which was dominated by feasibility studies and competitions, the T2 network shows a much tighter cooperation between government, expert actors, and civil society. Civic input is channeled in the redevelopment process through the *Framework Plan* and not directly on design outcomes. Constraints' edges are not prominent in T2 as the translation represents the moment when Neckarbogen redevelopment shifted from an idea with already defined constraints to a codified development strategy. This translation prepared the ground for the legal lock-in of baselines in T3.

Evolution of Key Infrastructural Baselines Across T2

In the *competition phase* of T2, flood safety in the Neckar and Neckar Canal areas was defined as a prerequisite for placing any permanent structures, but these baselines remained largely qualitative and not specified in numbers. With the Integrated Framework Plan (Table 23), measures like rainwater harvesting, greywater reuse, and decentralized water houses were explicitly listed. T2 is mobility-led and mostly tackles the AMI dimension and the new connections within the district and the neighboring districts. AMI baselines were still framed under the idea of *short distances* and accessibility on foot, bike, and public transport. In the framework plan, these baselines hardened into measurable targets: a modal split of 30% car versus 70% eco-mobility, obligatory bicycle parking integrated into public and residential buildings, and the design of Westrandstraße with segregated lanes for bikes and pedestrians. Additionally, a *low-car, but not car-free*, district was promoted. The Design Manual additionally required plot access and parking logic for the building plots (Table 28).

The framework plan introduced a clear set of baselines for B-GI: a continuous Stadtsee promenade, Seepark, and links to Neckarpark; a modular tree grid with defined spacing and tied to street hierarchy; and semi-public courtyard and roof garden typologies for the blocks. The non-measurable baselines included the identity of Neckarbogen as a *green quarter* with continuous landscape connections and as an example of water-sensitive urbanism. In the *Framework Plan,* architectural visions were converted into measurable standards: net building land, gross floor areas, and uniform eaves heights were defined. The non-measurable baselines listed the *Heilbronn block* as a permeable urban form, and buildings envisioned as sustainable and built with ecologically harmless materials and as demountable constructions.

Translation 3 (2014 - 2019): BUGA Exhibition as Implementation Catalyst

The third translation (T3) begins immediately after the T2 adoption of the *Integrated Framework Plan* in 2014 and runs to 2019 when the BUGA and City Exhibitions stabilize the network. BUGA was hosted by Heilbronn from April to October 2019 (Figure 28, Figure 29, Figure 30). This show was unique among BUGAs because it combined a classic horticultural exhibition with the creation of an entirely new urban district[6], an event that served as a catalyst for the urban development in the area. The exhibitions provided a platform for stakeholders as users or exhibitors and helped to promote the project (Machleidt Städtebau + Stadtplanung and Sinai Gesellschaft von Landschaftsarchitekten, 2015). The City Exhibition covered an area of approximately 3 hectares from the 40 hectares garden exhibition area (Figure 21) and was divided into 3 blocks consisting of 22 buildings. After the exhibition, the neighborhood construction was planned to be expanded into other districts. During this period, the open-space and urban design intent was converted into statutory instruments: B-Plans, contracts, selection decisions, and finally, it materialized into built infrastructures which were the stabilizing artefact for T3.

Figure 28: *Karlssee with view toward the climbing wall during BUGA 2019, Heilbronn. Photo taken 20 September 2019. Photo by Xocolatl, "AIMG 2194 HN Buga 2019 Karlssee mit Blick zur Kletterwand", via Wikimedia Commons, CC BY-SA 4.0.*

Figure 29: *Floßhafen at BUGA 2019, Heilbronn — timber pavilion on the waterfront at the former harbour basin (Floßhafen). Photo taken 14 April 2019. Photo by little_Monk, "Bundesgartenschau 2019 Heilbronn Floßhafen mit Holzpavillon," via Wikimedia Commons, CC BY 2.*

The whole translation apparatus rests on two moves. First, the city translates the Integrated Framework Plan into binding planning law via B-Plan 19/16 Neckarbogen Ost and B-Plan 19/18 Neckaruferpark (further referred to as BP19/16 and BP 19/18), which were accompanied by the FNP change Neckarbogen II and FNP change Neckaruferpark 7. These

[6] the first construction phase of Neckarbogen residential district was completed for the event.
[7] FNP change refers to a modification of the *Flächennutzungsplan* (FNP), Germany's legally required preparatory land-use plan, which is necessary before more detailed zoning plans (B-Plans) can be legally adopted and implemented.

instruments fixed the land-use, the massing of the district, public-space reservations, and riparian protections, and were the statutory basis for the City Exhibition lots.

Second, the City of Heilbronn implemented an innovative tendering process in which the city ran the investor selection procedure for the first building phase (2014-2015) under an investor selection jury, bringing developers, investors, and building and housing cooperatives into the network. Developers were selected based on quality criteria and plots were allocated individually, applicants were allowed to apply for up to two non-adjacent parcels with the same architect, and each construction site had to include at least one building cooperative or group (Dokumentation Modellquartier Neckarbogen, 2017). Furthermore, a special building commission - a city-appointed group of urban planners, landscape planners,

Figure 30: *a) Neckarpark waterfront green terraces. b) Multi-level Neckar promenade near Karlssee; c): Cycle-foot path with timber boardwalk next to Karlssee; d) SKAIO timber-hybrid residential tower (2019) and its adjoining public areas, e) public space between blocks, with seating/play elements; f) City Exhibition block with a green façade (climbing plants). Photos by author, 2023.*

and architects - reviewed construction projects based on the Design Manual, energy, mobility concepts, and the B-plan. Competitions where at least five architectural firms were participating were mandatory for key buildings and areas. The awarding authority was the plot owner or, in larger proceedings, the City of Heilbronn (Machleidt Städtebau + Stadtplanung and Sinai Gesellschaft von Landschaftsarchitekten, 2015). This kind of planning and implementation contributed to a collaborative design context, where investors and builders were given the greatest possible scope for their individual needs.

Third, the Design Manual became the day-to-day OPP for projects: the Building Commission applied it, and purchase and urban development contracts exported its rules into private obligations for the developers and investors. The Design Manual operated under a dual legal framework that reinforced its binding nature. Under public law, it was integrated into the B-Plans and the urban development contracts, so that specific structural and spatial elements were legally fixed. Under private law, it became a legally binding appendix to the purchase contract, while still allowing some flexibility in interpretation. This flexibility meant that although key parameters were predetermined, there was room for creative solutions and site-specific adaptations. From 2016, performance ambitions were raised as the district was DGNB Platinum pre-certified, which followed the DGNB Silver pre-certificate from 2012 (Anders, 2013). Ultimately, half of the buildings for the City Exhibition were realized in wooden structure, with *Skaio* being the flagship project - the first timber tower built in Germany (Figure 30-d).

Network Analysis

In T3, the problematization revolved around translating the *Framework Plan* into a binding artifact and a physical implementation of the district and the garden exhibition. The actor-network consolidated around a strong cluster of legal and policy instruments and informational artifacts (dark grey nodes), which dominate the map (Figure 31). The largest nodes are the B-Plans - *BP 19/16,* and *BP 19/18* which act as the principal OPPs of the translation that represent binding rules at plot level. Furthermore, the two *Environmental Reports* which were compiled for the respective B-plans list the legal bases, species constraints, and public-realm measures that the map clusters around. Surrounding the *B-Plans* and the *Environmental Reports* is a dense ring of higher-level frameworks and regulations. Infrastructural actants (blue nodes) such as the *road network*, *utilities*, *pipelines*, and *embankments* are peripheral actors, connected directly to *B-Plans* and *Environmental Reports*. Natural systems (yellow nodes): the *Neckar River*, *Floßhafen*, *rare butterflies*, *sand*

lizards, *bats*, and *bird habitats* appear semi-peripheral and are enrolled via *Environmental Reports* and *species assessments*. This is the first regulatory cluster of the network.

The second visible cluster is the *delivery and market cluster* which is a mix of *DGNB pre-certificates* which inscribe sustainability criteria for the *Design Manual*, *Building Commission* reviews, and *investor selection procedure* (2014-2015). The second visible group are the private actors (red nodes) where the key nodes are *investors*, *developers*, *building groups*, and *building cooperatives*. Procedural bodies such as *Building Commission* and *Investor selection jury* are also distributed through this cluster. The *urban development contracts*, *purchase contracts*, and *building permits* formed a regulatory cluster and act as OPPs for private developers.

The governance actors such as the *Heilbronn City Council*, the *Planning and Building Law Office*, and *BUGA Heilbronn 2019 GmbH* (blue and purple nodes) are tightly connected into the network. The governance bodies, the *BUGA Exhibition*, *City Exhibition* and the *building permits* are tying the regulatory cluster and the delivery and market cluster together acting as bridges T1 and T2 were driven by visions, competitions, and feasibility studies, while T3 crystallized into a dense legal framework. Therefore, the main OPPs of T3 are the *B-Plans*, the *Environmental Reports and the FNP change* actors which have the highest in-betweenness value. Together, they form the binding regulatory framework that must be passed through by every developer, infrastructure agency, or ecological measure. The main stabilizers of the network are the implemented infrastructures for the *BUGA 2019* and *City Exhibition* events, which fixed timelines and created urgency. *Protected species*, *contaminated soils*, and *existing infrastructures* act as constraining material actors. Then *building permits* as the final OPP of the process, which aggregates the project's compliance with *B-Plans*, *Design Manual*, and other environmental conditions. Finally, the *Investor selection procedure* and *Building Commission* are OPPs from the development cluster that designs mass pass in the process of ensuring design-quality.

Evolution of Key Infrastructural Baselines Across T3

T3 was a process where the focus was placed on landscaping, meaning that B-GI, public spaces, and AMI were the implementation priority tied to the BUGA 2019 exhibition deadline. The key actants in T3 where infrastructural baselines were inscribed were the Environmental Reports coupled with BP 19/18 (Table 25) and BP 19/16 (Table 26). These documents distributed ecological compensation and remediation responsibilities between the Neckarbogen's residential pilot plot and the area of Neckaruferpark. The environmental

reports fixed compensation measures, species protection, and soil remediation obligations into the B-Plans.

Fl-I dimension in T3 was addressed by fixing the HQ100 line of the Altneckar as a legal boundary in B-Plan 19/18 with a prohibition on building in the flood zone. Unsealing of surfaces related to a surplus of eco-points, with what the floodplain served as ecological but also as hydrological compensation. Qualitatively, the Neckaruferpark was reimagined as the *new face* of Neckarbogen toward the river. The riverbank park was to combine safety with accessibility, and its design should take into consideration the natural floodplain dynamics. Embankments were partially hardened or flattened and planted. In BP 19/16 permeable paths construction was required to manage runoff. AMI visions from before became concrete spatial provisions in T3. The closure of Kalistraße and its replacement was codified in BP 19/18, which removed the street as a barrier to the river. A continuous riverside promenade with foot and cycle paths was required along the Altneckar. BP 19/16 expanded the active-mobility requirements into building plots with measurable baselines: ≥1 weather-protected bicycle space per dwelling and communal bicycle facilities and banned above-ground parking. The Design Manual (Table 28) further prescribed a minimum of 2 m^2 bicycle storage per dwelling.

The baselines for B-GI are slightly intertwined with the Fl-I. The Neckaruferpark was designated as public green space with a detailed planting plan extending up to the HQ100 flood line. Numerous measurable baselines regulated this dimension: preservation of 25 existing trees and planting of 34 new, the obligation for using native species, and biotope typologies. Furthermore, green roof baselines and courtyard greening quotas were defined. Many baselines for habitat compensations were also defined which generated a compensation surplus eco-point for fauna/flora and eco-points for soil. Neckaruferpark was planned to be an ecological counterbalance to BP 19/16. BP 19/16 sets numerical baselines for greening of the building fabric for the first constructed plots: ≥2/3 roof greening, intensive greening of garage decks, and open plot planting quotas. Habitats for reptiles became obligatory. The Design Manual complemented the plan with species lists for plants, tree baselines per courtyard. Qualitative baselines refer to planting as both ecological compensation and identity-forming structural design element. BP 19/18 contained no buildings, but BP 19/16 and the Design Manual inscribed the baseline for superstructures. The B-plan fixed building plots, floor-space ratios and other volumetric parameters. Noise and ventilation standards were set, and materials were limited to the usage of bricks, concrete, glass, metal, excluding plastics and reflective surfaces. The Design Manual further elaborated on the superstructures: Heat loss values, renewable/recyclable construction

materials, and life cycle assessments were required. Qualitatively baselines for Second City Level of roof gardens and terraces, avoidance of dead walls, active ground floor was required.

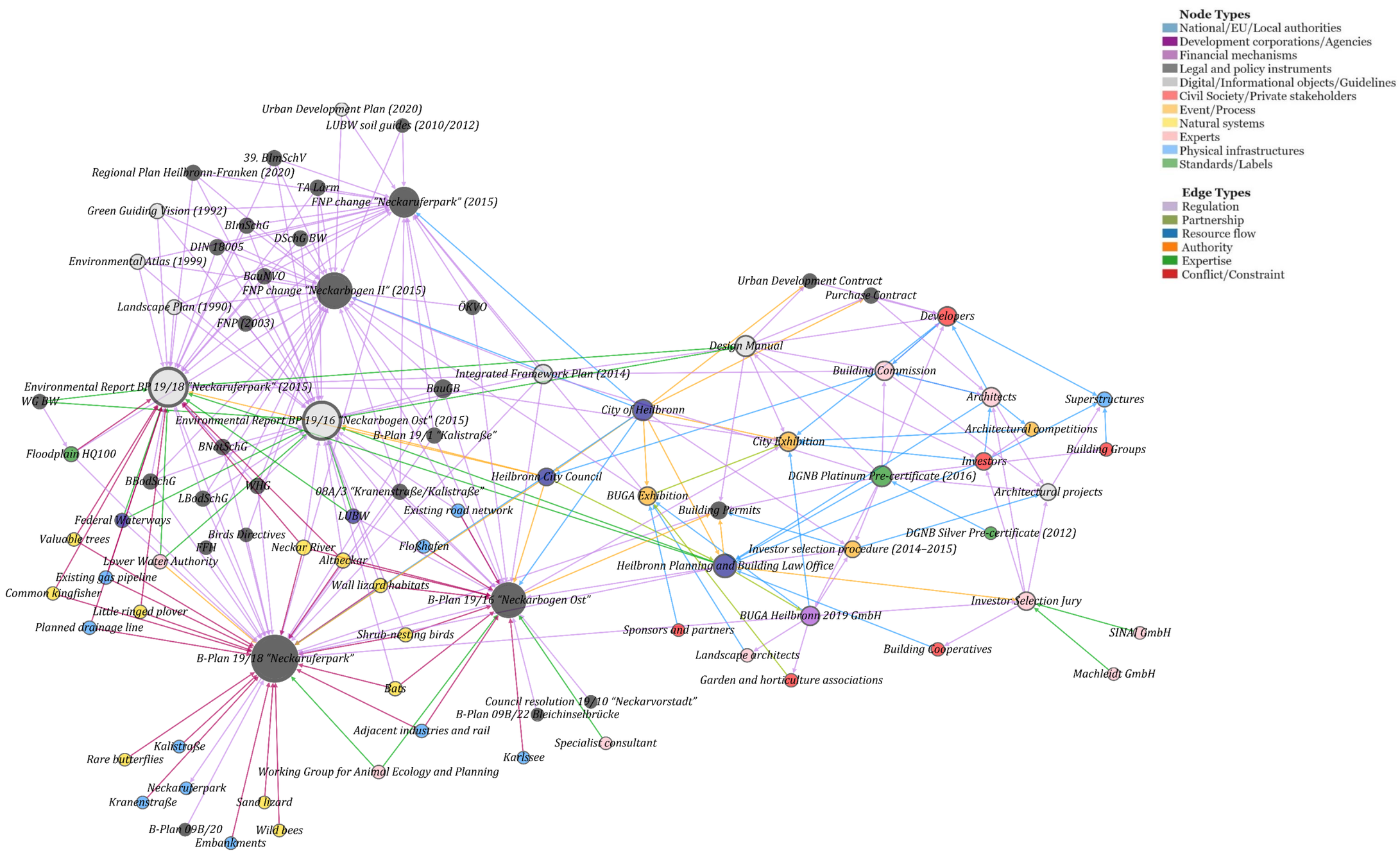


Figure 31: *ANT map of Neckarbogen's T3. Made by author.*

Translation 4 (2019 - 2025): Second Construction Phase Consolidation

After the first B-Plans were introduced in the east side of the district and along the riverbanks, attention shifted to the central areas of the district. Fourth translation (T4) (2019-2025) runs right after the end of T3 (BUGA 2019 exhibition) and problematizes the consolidation of the second construction phase of the Neckarbogen project which is covering plots K, L and M (Figure 20). The process began in January 2019, when council paper *DS 001/2019* (Stadt Heilbronn (Amt für Liegenschaften und Stadterneuerung; Planungs- und Baurechtsamt; Amt für Straßen), 2019) authorized the release of Phase 2 plots and paved the way for implementation of the block. In T4 The *Integrated Framework Plan* (2014) remains the reference, while new policy actants move in: the *Housing Action Program* (2015), *City Concept 2030*, the *Paula-Fuchs-Allee Development Plan* (2018) and the *Decision to remove Kalistraße*. In parallel, the city runs another investor selection procedure (2020) for plots in the Mitte area, and actors like investor selection jury, Building Commission, and the Heilbronn Planning and Building Law Office are at play again. The Office for Real Estate and Urban Renewal, Machleidt GmbH; and the Urban Design Advisory Board support project's coordination and give expert feed into the network. After *B-Plan 19/22 Neckarbogen – Mitte* (BP 19/22) was adopted, the city could make land-sales decisions. Building Commission and the Design Manual remain active actors in the network.

By 2020, new actors were involved in the translation with *FNP amendment Neckarbogen Mitte* (2020-2021) and *the B-Plan 19/22 Neckarbogen – Mitte.* In T4 the open-space and street logic from T2 and T3 is further translated into a legally binding deliverable. Between 2020 and 2021, the *Environmental Report on the FNP Amendment* and nature-conservation assessments introduce ecological constraints such as aquatic species in the Neckar, riparian vegetation, sand lizard, common pipistrelle, shrub birds and tree-nesting birds. These constraints and the Integrated Framework Plan are black boxed into BP 19/22, which fixes the land uses, the block depths, edges, and public areas. A major stabilization was reached in 2023 with the groundbreaking for 11 mixed-use blocks (Stadt Heilbronn, 2023). In 2020, the project's reputation was further strengthened when the German Urban Development Award recognized Neckarbogen as a model quarter, which reinforced its earlier DGNB Platinum certification from 2016. During this translation, innovative timber construction gained significant political backing and the building phase 2 would have 19 of the 28 lots built using wood-hybrid structures (Heilbornn, n.d.).

Network Analysis

The network's structure is built around two clusters – the *legal* and *marked and delivery* cluster (Figure 32). The legal cluster is formed by three sub clusters. At the middle of the network sits the *B-Plan 19/22 Neckarbogen - Mitte,* where most connections between governance, design and engineering, infrastructure, and ecological actors are concentrated. The B-Plan translates higher-level planning and legal documents into parcel-scale baselines and, finally, into building permits. The B-Plan is coupled with the *Land-Use Plan (FNP) amendment "Neckarbogen Mitte"* and the *Environmental Report on the FNP Amendment*, and, together, they form the legal and spatial foundation for the second phase redevelopment. Higher-level frameworks (grey nodes) such as *BauGB, BauNVO*, *the Regional Plan Heilbronn-Franken*, the *City Concept 2030*, etc., surround this core and are inscribed into the B-Plan. An ecological cluster (yellow nodes) is intertwined with the higher-level frameworks - *Neckar River*, the *Floßhafen*, *green corridors*, *riparian vegetation*, and *protected species*' nodes. These actants are inscribed in the *Environmental Report on the FNP amendment* for this area.

The delivery and market cluster is visible on the left side where the actors are more distributed. It consists of procedural instruments: the *investor selection procedure (2020)* and the *Design Manual* which determines who is allowed to build and under what conditions. Through these nodes, the main requirements for superstructures and some requirements for AMI, and B-GI were secured. A further regulatory group consists of the *DGNB Platinum Pre-certificate (2016),* the *Urban Development Contract*, and the *Purchase Contract*. This triad stabilizes the implementation process and codifies sustainability obligations and public responsibilities. The *Heilbronn City Council, Office for Real Estate and Urban Renewal* and the *Planning and Building Law Office* form the governance core. They approve the *B-plans*, convene the *Building Commission* and *Investor Selection Jury*, issue *building permits* and mediate land sales and contracts. The *Investor Selection Jury* links expert actors such as the *Urban Design Advisory Board* and *engineering firms* with *developers* and *housing cooperatives*. Civic actors such as advisory panels, citizen workshops, and participation processes are connected mainly through the *FNP amendment* - while participation is formally acknowledged, it remains mediated by planning instruments and does not directly determine design outcomes. The *City of Heilbronn*, the *Integrated Framework Plan* and the *Heilbronn City Council* sit at the middle of the network forming a bridge between the two main clusters.

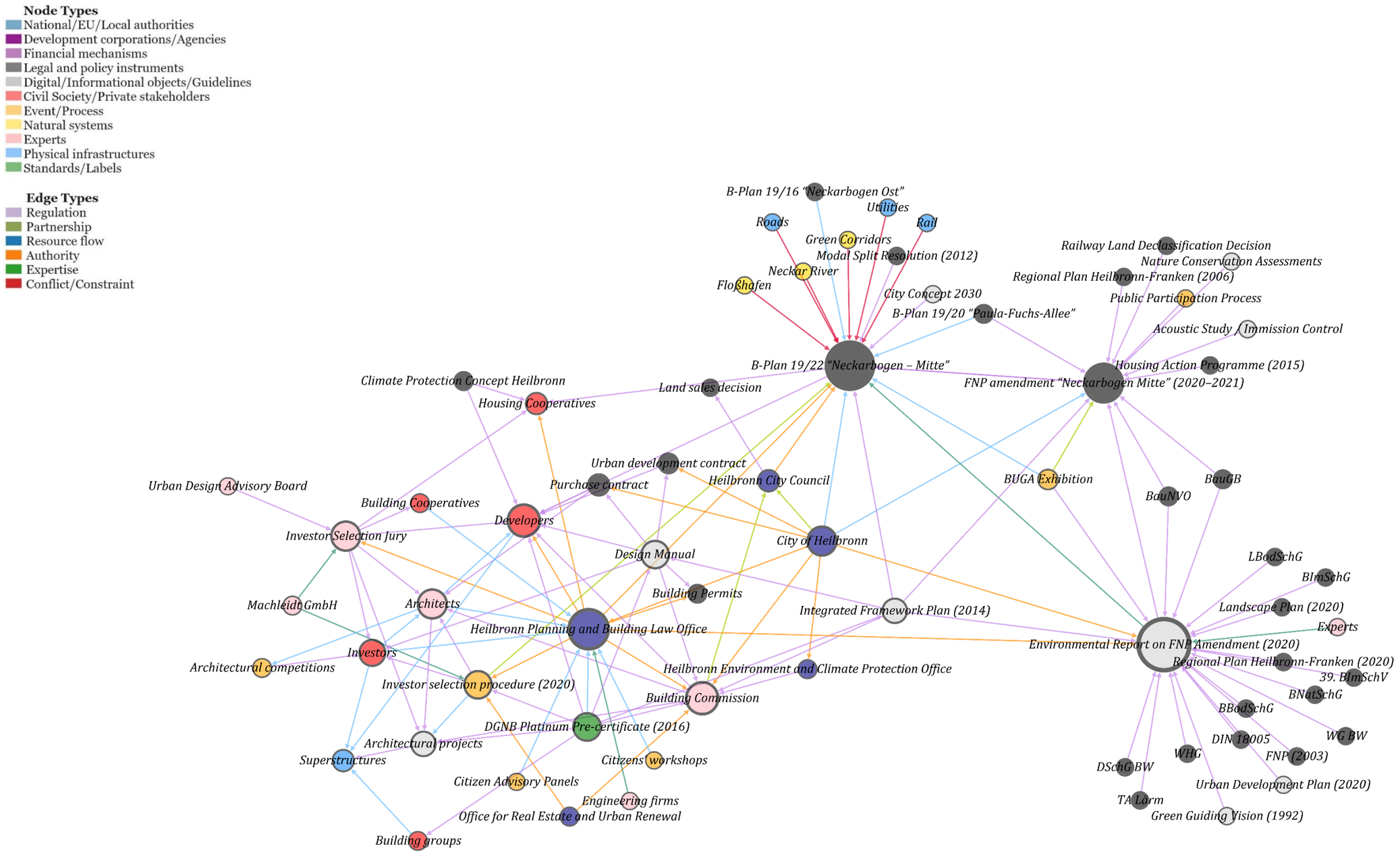


Figure 32: *ANT map of Neckarbogen's T4. Made by author.*

Evolution of Key Infrastructural Baselines Across T4

In T4, the decisive OPPs were the *BP 19/22* (Table 27), the *FNP Amendment* and the *Environmental Report on the FNP Amendment*. With their adoption, the second construction phase was effectively locked into law and enforceable design baselines. Fl-I was codified with high precision. A HQ200 design elevation (154.91-155.60 m NHN) and a district-wide planning height of 156.00 m were fixed for building and traffic areas to be raised above the design flood level. Any apartments below ground-floor level were prohibited and water permeability of public spaces' surfaces or suitable drainage is required. Alongside these technical baselines, the non-measurable framing cast the Floßhafen as more than a retention basin: it was reimagined as an identity-giving element.

AMI baselines hardened during T4: 70% eco-mobility vs. 30% private-car modal split, and streets designated as bicycle zones with 30 km/h speed limits. The Floßhafen edge and Paula-Fuchs-Allee were secured as pedestrian areas. Underground garages were supplemented by requirements for accessible bicycle storage. Non-measurable baselines focus on the vision of a *low-car, short-distance urban district* and designing *self-explanatory streets* which would enable multimodal mobility in the district.

B-GI were institutionalized through ambitious greening standards: at least 75% of roof surfaces had to be greened with a 13 cm phosphorus-free substrate, unbuilt areas were required to remain 60% unsealed garden soil, with one tree planted per 200 m^2. Furthermore, public green spaces were permanently secured, traffic areas and courtyards had to be planted with medium-large crowned deciduous trees and baselines for protecting natural habitats were defined. The Design Manual reinforced these baselines with detailed species lists, root-space standards, and bans on invasive plants. In non-measurable terms, the Floßhafen was envisioned as a *riverside square* and the B-GI baselines focused largely on creating the image of the district.

Superstructures were strictly defined by quantitative baselines: five to six stories were fixed together with density ranges of 0.7-0.75 (up to 0.9 with underground garages), and mandatory semi-open perimeter blocks known as the *Heilbronn Block*. Active *urban floor* at eye level around busy edges, noise and ventilation baselines and glazing protection rule for outdoor spaces were mandated. The Design Manual further extended the baseline into energy and material performance: transmission heat loss capped at HT' 0.3 W/m^2K (0.2 W/m^2K for innovative projects), ≥50% photovoltaic coverage of roof areas, fossil insulation prohibited, and recyclable or renewable materials prioritized. At the same time, facades were constrained by a coordinated color palette, use of calm and restricted structures, limited projection, and a

required 30-40% window ratio. In non-measurable terms mixture, diversity, density, and shaping a coherent, identity-building district was required.

Translation 5 (2021 - in progress): Third Construction-Phase Consolidation

Translation 5 (T5) is the part of the process that starts from the initiation and rollout of the third construction phase of the Neckarbogen development (Stadt Heilbronn, 2024). T5 involves the land use adjustments, the tenders for investor selection and the operational sequencing of implementation. It is a phase that overlaps partly with construction Phase 2 and the T4. The overlap comes from the fact that some core governance and design instruments like the Design Manual, City of Heilbronn Planning Office, DGNB sustainability framework are still active during T5, but are re-articulated around the needs of the new area rather than the Phase 2 blocks. Structurally, T4's network consists of construction and delivery of the Phase 2 area, while T5's network is planning, expansion and implementation oriented. This means that the last two translations are related but are distinct phases.

Chapter summary

Chronological Overview and Key Turning Points

Five translations have organized the trajectory of Neckarbogen evolution to date. The process began with the *Green Guiding Vision* from the early 90s and *BUGA Feasibility study* in the early 2000s (T1), when the basic requirements for the area were established as design requirements through the Neckarvorstadt ideas competition. These requirements were translated into the winning masterplan concept in 2009 and stabilized into the approved Framework Plan in 2010. The new framework plan was upgraded with the 2011 open space competition that help in delivering the project were also introduced, like the Urban Design Plan from 2013, which was further translated into the Integrated Framework Plan in 2014, and a Design Manual (T2). During T2, the mobility framework was established, riverside public spaces were fixed, and DGNB Silver Label (2012) introduced performance assessment for the built environment. After 2014 and until the opening of the BUGA 2019 (T3), B-Plans and changes of land-use plans were key actors for legalizing, contracting, and implementing the Framework Plan. Investor selection procedure (2014-15) helped in delivering purchase and urban development contracts. After the 2019 exhibition, the project delivery was expanded in the central area of the district (T4). During this translation, new B-Plans were introduced, and a new investor selection (2020) allocated plots and buildings. The implementation of the buildings and infrastructures for this area is a stabilization point for T4. The third construction phase started in 2023 and introduced new networks for the implementation of new parts of the district. This process is still ongoing (T5).

Evolution of the Four Infrastructures in Neckarbogen (OPPs as baselines and OPP as nodes in networks)

Flood-protection Infrastructures

In the earliest *feasibility study* and *idea-competition* phases (T1), flood risk and flood management were problematized as an opportunity for redevelopment. As the brownfields lay within flood-risk zones, redevelopment was only possible with a coordinated strategy. The OPP as baseline consisted of regional flood-retention measures which were already underway in the wider catchment (Leintal, Rotbachtal, Deinenbachtal, Böllinger Bachtal) and a dam improvement at the Am Neckar industrial area. The project relied heavily on this hydrological framework. Interessement of actors occurred through the city's feasibility studies when the riverbanks were framed as open space that should serve as a connector. Enrolment followed with the development of *Masterplan Neckarvorstadt*, when the baseline became inscribed in the competition brief (OPPas node) which required competitors to

design riverbanks as open spaces that integrate flood issues into landscape. Finally, mobilization happened when the winning proposal was developed into a framework plan. This plan transformed the HQ 100 floodplain into a landscaped parkland and stabilized the first measurable baseline, keeping the floodplain undeveloped and using it as public green space.

Throughout T2, the problematization revolved around the question: how the hydrological structures (Neckar River, Wilhelm Canal, Karlshafen, Floßhafen) could function as resilient open-space infrastructure. The OPP as requirement became the integration of flood safety into the landscape. The interessment device was the new open space competition with its competition brief becoming another node OPP that translated flood protection into a design requirement. The interessment involved alignment between the City of Heilbronn's Department for Urban Renewal, the Waterways and Shipping Authority (WSA), and landscape designers (Machleidt + SINAI). Enrolment and mobilization occurred with the production of the *Urban Development Framework Plan* (2014) - OPP node. The Framework Plan codified principles related to this dimension: flood-risk zones were formally mapped, non-developable corridors established, and ground-level heights and permeable surfaces were specified into it.

By the *implementation* phase (T3), the problematization focused on demonstrating flood-resilient urban living (OPP as baseline). The interessement process broadened the scope of actors and included BUGA Heilbronn 2019 GmbH. Enrolment and mobilization process included institutionalizing the baseline through B-Plans (19/18 and 19/16), a Design Manual (OPP nodes) and, finally, with the completion of the Neckaruferpark (with the riverbank) and Stadtsee.

Active-Mobility Infrastructures

The earliest feasibility study and OPP node problematized mobility as crucial to reconnecting the city with the river as the brownfield was cut off by the railway corridor and heavy road infrastructure (especially along Kalistraße) (T1). Later studies proposed relocating or reconfiguring Kalistraße and establishing a continuous north-south riverside promenade for pedestrians and cyclists as the main active-mobility baseline (OPP baseline). Interessement and enrolment followed the same trajectory as the Fl-I dimension (delivering a competition brief for a new framework plan). The new OPP nodes proposed restoration of fragmented east-west and north-south links and integrating the riverfront into the pedestrian and cycling network. Mobilization happened with the winning concept and the development of a new Framework Plan (OPP as a node), which introduced a pedestrian and cycle bridge

connecting the main station to the redevelopment area and laid out the first measurable spatial structure for AMI.

Problematization in T2, focused on operationalizing accessibility across the new urban quarter. The OPP as requirement became the realization of two key mobility axes: the east-west axis (Europaplatz - Fruchtschuppen Esplanade - Theresienstraße) and the southern axis (Südrand Bahnhof) that would connect Neckarpark and Neckarinsel. The 2011 open space competition acted as the new interessement device through which traffic engineers, the Department for Urban Renewal, Machleidt, SINAI, and BUGA Heilbronn 2019 GmbH aligned their interests. The competition brief became new OPP node. Enrolment and mobilization took place through implementation of the baselines into the Integrated Framework Plan (2014), which fixed the bridges and pedestrian permeability standards and became the new OPP node for T3.

During T3, the OPP baseline evolved into the *BUGA of short distances* vision, which problematized the goal of a compact, car-reduced, accessible by foot, bicycle, and public transport neighborhood. Interessement involved actors such as BUGA Heilbronn 2019 GmbH, Stadtsiedlung Heilbronn GmbH, and the City's Transport Office, that had to align around design, exhibition, and mobility goals. Enrolment and mobilization were achieved through delivery of the B-Plans (19/18 and 19/16) and the use of the Design Manual and the SINAI plan for BUGA exhibition to deliver the active-mobility infrastructures for the BUGA 2019 exhibition when visitors experienced the district via the new pedestrian and cycling network, the station bridge, and continuous riverside promenade. With T3 the AMI dimension finally stabilizes.

Blue-Green Infrastructures

In T1, the absence of B-GI was problematized as a constraint in transforming the port brownfield. The *Feasibility Study* (OPP as node) positioned the area within a regional blue-green system. At the site scale, the OPP baseline became the integration of the BUGA parkland and a continuous Neckar green axis. Enrolment and mobilization of actors followed with the production of Urban Development Framework Plan, which stabilized the first open and non-buildable corridors along the waters, reinterpreted the Karlshafen and Floßhafen basins as water landscapes. The plan became OPP node for T2.

During T2, problematization shifted to integration of ecology in the scale of the BUGA exhibition and the OPP baseline became the embedding of B-GI corridors and water surfaces as functional open-space infrastructure within the district. Interessment, enrollment and mobilization of new actors and inscription of baselines into artifacts followed the logic of T2

where competition brief and the framework plan acted as OPP nodes. The Integrated Framework Plan (2014) showed Neckaruferpark, Kraneninsel, and Stadtsee as the main landscape components and formalized measurable baselines such as green-space continuity, native planting, and minimum soil permeability. The adopted framework plan was the new node OPP for the following translations.

In T3, the *implementation* phase, the B-GI was problematized as the identity-defining feature of Neckarbogen and the OPP as baseline evolved into the realization of the Neckaruferpark, Stadtsee, and Leisure Lake. Interessement involved actors such as BUGA Heilbronn 2019 GmbH, Stadtsiedlung Heilbronn GmbH, and enrolment was achieved through the preparation of B-Plans (19/18 and 19/16). The plans functioned as OPP nodes and mobilized developers, engineers, landscape architects around implementation of parks and lakes for BUGA 2019. T4 did not focus as much on the B-GI dimensions, except for its implementation on private plots.

Superstructures

In T1, the transformation of brownfields into an urban quarter was problematized and the OPP baseline was the redevelopment for new residential and service buildings. Non-measurable OPPs included mixed use and architectural variety. Interessement occurred through 2008 Masterplan Neckarvorstadt competition and its brief (first OPP node) which confirmed the OPP baseline previously established. Enrolment and mobilization of actors followed with the development of *Urban Development Framework Plan* by Steidle + t17. This OPP node was inscribed with open block typologies oriented toward the Neckarpark, Esplanade, and City Harbor

During T2, translating the goals of architectural quality and social diversity into feasible development processes was problematized. The OPP as requirement became the curated allocation of parcels based on design quality rather than price. The 2011 competition served as the interessement device through which, the City of Heilbronn, Stadtsiedlung Heilbronn GmbH, Machleidt and SINAI were enrolled and finally mobilized. The network produced the Urban Development Framework Plan (2014) which became OPP node for T3.

In T3, superstructures were problematized as a demonstration of sustainable and community-oriented construction. The OPP baseline became the ecological design, architectural quality, and social mix for *Modelquartier* for the City Exhibition in 2019. Interessement happened the development of BP 19/16 and competitions for each of the plots. Actors such as BUGA Heilbronn 2019 GmbH, Stadtsiedlung Heilbronn, and the architectural teams were mobilized through the land-sale contracts and design guidelines from the *Design*

Manual (which became node OPPs) to follow the requirements for energy performance, façade articulation, and material durability. The network stabilized with the completion of the first construction phase for the City Exhibition in 2019.

In T4, implementation of the second district was problematized. The OPP baseline remains the sustainable construction, architectural quality and social mix. The interessment device is now the BP 19/22 and plot competitions. BUGA Heilbronn 2019 GmbH is no longer an active actant, but the network continued to mobilize developers and architects through land-sale contracts. Another node OPP is the Design Manual which was updated for this construction phase.

Influential Actants and OPPs in Network Dynamics

The OPPs across the Neckarbogen redevelopment evolved from conceptual studies and municipal authorities' actors toward formal regulatory and contractual instruments. In T1, the network was held by visionary OPPs. The *Neckarvorstadt* competition brief emerged as the OPP which connected the local authorities, design consultants, ecological constraints and existing infrastructures. The Heilbronn Planning and Building Law Office functioned as a key human OPP, which coordinated political decisions, land negotiations with, and expert advice from other human actants. The *BUGA Feasibility Study (2005)* acted as an informational OPP that linked the *Green Guiding Vision* with a BUGA 2019 event. The stabilization of T1 was reached with *the Framework Plan (2010).* The *Integrated Framework Plan* (2014) is the main OPP node in T2 - it translated the baselines from the 2011 open-space competition and the *Urban Design Plan* (2013). In T2, the network became denser and integrated civic, professional, and event-related actors. The Heilbronn Planning and Building Law Office remained the central human OPP. BUGA Heilbronn 2019 GmbH became a new institutional OPP in T2. Finally, the Design Manual became an emerging procedural OPP.

By T3, the OPPs shifted toward legal and operational artefacts - BP 19/16 and BP 19/18 became statutory OPPs through which every following action had to be passed. They were coupled with the environmental reports - regulatory OPPs which connected existing on-site natural systems with administrative and design actors. The Planning and Building Law Office and BUGA Heilbronn 2019 GmbH formed the administrative OPP cluster that transformed the Plan into implementation instruments. Finally, the BUGA and City Exhibition (2019) finally acted as stabilizers. During T4, the OPPs become mostly regulatory and procedural- the central OPP node was the *BP 19/22*, coupled with the *FNP Amendment* (2020-2021) and the Envir*onmental Report*. Together they were an OPP cluster that translated

higher-level frameworks into local binding design constraints. The *Heilbronn City Council* and *Heilbronn Planning and Building Law Office* were the main authority OPPs.

A review of all translations clearly reveals that the *Heilbronn Planning and Building Law Office* are a recurring human OPP that holds together and ensures coherence of the entire process and the *B-Plans*, represent the enduring non-human OPPs that enforce baselines.

4.3. 3Land - Basel, Weil am Rhein, Huningue

Historical Background and Context

The municipalities of Basel, Weil am Rhein, and Huningue form a historical border triangle on the river Rhine. The national borders have shifted over the centuries and today there are significant marks on the urban landscape. Over time, the cities have expanded towards these borders, resulting in a complex mix of urban areas and a closely connected cross-border region (Team LIN, 2015a) (Figure 33, Figure 34). From 1842 to 1876, the river Rhine was narrowed into a deeper, more controlled bed and became less navigable until 1962 when the Rhine Lateral Canal was built. During that time Basel was known internationally as a factory city with a high number of workers, a trend that continued until the 1980s (Team LIN, 2015a). The early 2000s saw the beginning of a new transformation phase with the development of the Novartis Campus, which was later extended to connect with the Rhine (ESPON, 2019). The region was characterized with a fragmented urban space while access to the Rhine was limited, with residential areas mostly located behind industrial zones.

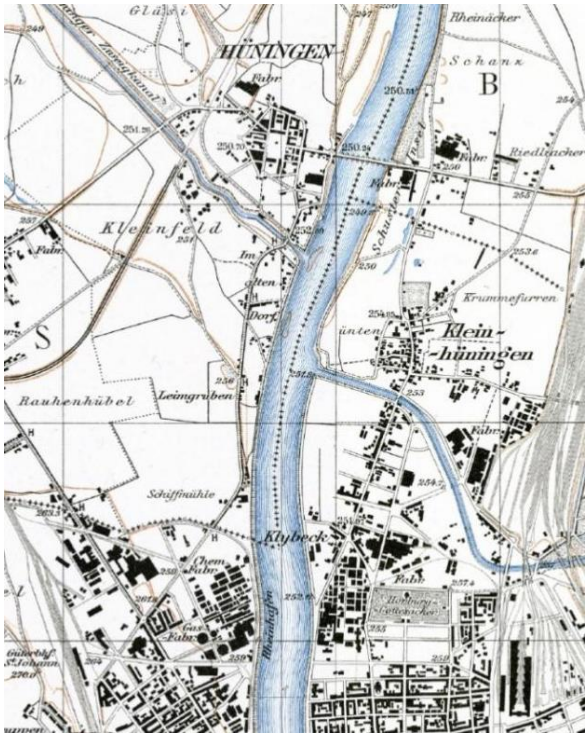


Figure 33: *3Land tri-border around Basel-Huningue-Weil am Rhein, ca. 1900. Extract from the Swiss historic topographic series Siegfriedkarte 1:25 000 (historic layer in swisstopo's "Journey through time"). Source: © swisstopo — Federal Office of Topography. map.geo.admin.ch.*

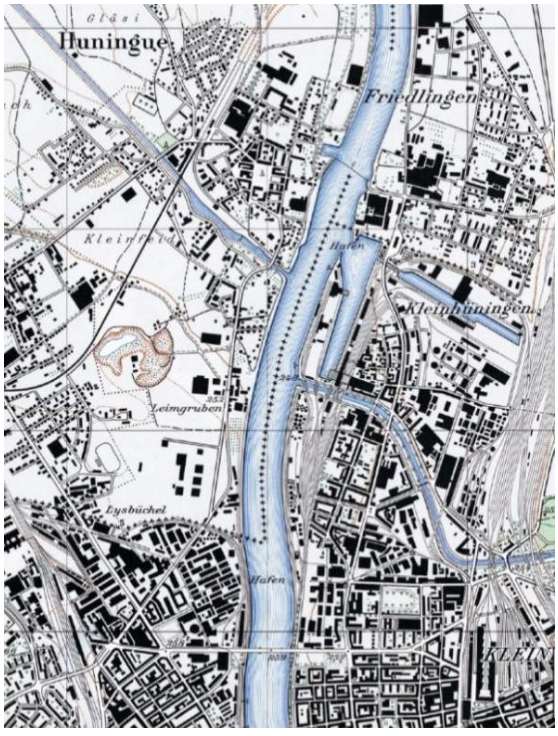


Figure 34: *Same area in the 1950s. Extract from Landeskarte der Schweiz 1:25 000 (first edition, ~1952; historic layer in "Journey through time"). Source: © swisstopo — Federal Office of Topography. map.geo.admin.ch.*

Despite its urban and industrial nature, the border triangle area also includes ecologically valuable habitats and biotope networks crucial for maintaining local, regional,

and supra-regional ecological networks (IBA Basel 2020, 2020a). Rhine today is considered a central figure in European cross-border identity, which offers opportunities for multifunctional, transnational urban development (Team LIN, 2015a).

> "… And the fact that the river Rhine is in the center of this area is also a specialty because the Rhine in the city of Basel is a very important open space for the people. In the summertime, everybody goes to the Rhine… But once you get to the border, over the border, it's different, you cannot get to the river at every point." (Interview 3, 2023)

Because of the economic structural change, the port and industrial area around the Dreiländereck were expected to be transformed and the three cities saw the opportunity to redevelop and repurpose the area, each with their own specific objectives (*3Land: A Cross-Border District Is Created in the 'Dreiländereck'*, n.d.). Basel's growth is limited by land availability, so there was a need for cooperation with nearby municipalities in the polycentric agglomeration. Huningue, though not the initiator, saw the project as a significant opportunity for its own development (Team LIN, 2015b). The well known idealized lifestyle - *working in Switzerland, shopping in Germany, and living in France* - was being reevaluated for sustainable development across the border region (Team LIN, 2015b). The cities of Basel, Huningue, and Weil am Rhein, the Saint-Louis Agglomération and the Conseil Général du Haut-Rhin, joined forces to develop this area into dense, sustainable urban districts through the *3Land* project. The reintegration of the port with the city and EU funding were catalysts for a redevelopment that would prioritizes regional economic development and cultural exchange (Le Den et al., 2019).

The 3Land project is situated in a 430-hectare cross-border area and aims to reconnect the cities with the Rhine River. The overall 3Land corridor runs along the Rhine between Basel's Dreirosen Bridge and the Palmrain Bridge (Figure 36). 3Land area, contrary to previous two cases, is a cross-border redevelopment field rather than a single brownfield: it is a patchwork of operational Rhine ports from each country, transitional industrial waterfronts, already redeveloped corporate estates, and existing residential neighborhoods. In the Swiss side (Basel) the redevelopment areas consist of the Basel-Nord riverfront with the neighborhoods Klybeck and Kleinhüningen. It includes the Klybeckplus former BASF and Novartis industrial lands and the Basel-Kleinhüningen port and rail area. On the German side (Weil am Rhein) the redevelopment includes the Friedlingen riverfront along the Rhine, including Rheinpark and its extension into the former southern Hafenareal, plus the quays around the Dreiländer Bridge (pedestrian and bike bridge to Huningue). On the French side (Huningue and Saint-Louis Agglomération) the redevelopment area consists of the Huningue Rhine banks from the Palmrain Bridge, up to the Dreiländerbrücke area that includes the Les

Jetées district and adjacent riverfront sectors, according to the French Land use plan. The City of Saint-Louis is also part of the project area in the broader planning perimeter. These areas are shown on a map compiled from multiple sources, aimed at representing the patchwork redevelopment area that takes place in 3Land (Figure 36).

Tracing the 3Land Redevelopment Process and Its Key Translations

Rivers are entities that cross multiple borders; thus, this case is a perfect example that illustrates the complexity of cross border planning for riverfronts. The process of redevelopment of 3Land area was traced as a series of 8 translations with other national-distributed sub-translation. The redevelopments in 3Land started almost a decade before an official agreement was signed between the countries that would steer the collaborative redevelopment process. In June 2001, the pharmaceutical company Novartis informed the public about its plan to transform its St. Johann site from a production site into a knowledge center that would house research, development and international corporate functions (Regierungsrat des Kantons Basel-Stadt, 2005). The Government Council approved the zone change and land exchange in that area in 2003, which would give the canton an opportunity to increase green areas in the quarter (Regierungsrat, 2003). Later, in 2003, there was a pressure towards the Basel Government to negotiate public access to the St. Johann Rhine bank and to make a route towards Huningue (Giovannone, 2003). As the project *Reuse of St. Johann Harbor - Campus Plus* aligned with canton's urban development goals for Basel-Nord, the government and Novartis established the key parameters of the project in a joined agreement in 2005. The same year, advisory opinion to the ground council proposed the relocation of St. Johann port and creation of Rhine promenade together with the campus (Regierungsrat des Kantons Basel-Stadt, 2005).

In 2006 the Grand Council approved *Campus Plus* project and ordered review of alternative port replacement sites instead of the port of Klybeck (Regierungsrat des Kantons Basel-Stadt, 2007) which lead to proposal of other replacement sites - Auhafen-Muttenz and Harbor Basin II (Kleinhüningen) (BRK, 2007). The alternative port sites were to be located not on the opposite Klybeckquai, (which was the initial plan), and this opened up the possibility of transforming the areas along the Rhine - Klybeckquai and Westquai - into urban districts in the long term (Eine Stadterweiterung Am Rhein - Städtebauliches Leitbild Klybeckquai & Westquai Basel, 2019).

The timeline (Figure 37) shows the process of redevelopment since the birth of the idea until 2025. Redevelopments that took place in the area since 1999 are multiple and sometimes unraveled at the same time. The 3Land area is a patchwork of existing

infrastructures, residential neighborhoods, factories, a campus etc. This dissertation will follow the processes that directly led to signing a mutual agreement and the development of an urban concept for the area. Therefore, the initial steps of development of the idea will be represented through actor-network maps. The process takes place in three countries, and several development projects, including different programs (from bridge construction-to river promenades-to residential blocks) take place parallelly, in a distributed manner, or at very different time and include a different partner country. Looking into all the possible redevelopments in the 3Land area is not in the scope of this research. To be able to compare with other case studies where the implementation of the first plots was analyzed in-depth, the research focused on the riverfront redevelopments that included pilot plots in each country: Les Jetées (France), Klybeckquai/Westquai (Switzerland), and Friedlingen (Germany).

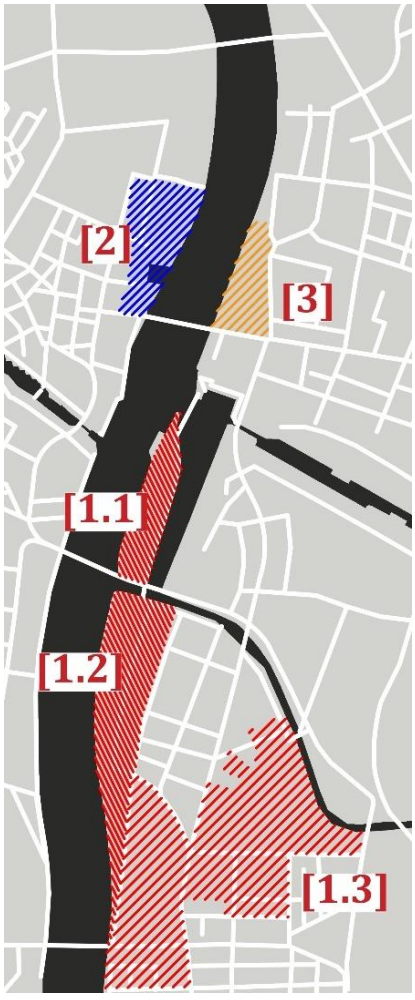


Figure 35: *Mapped timelines for areas: [1.1] Klybeckquai, [1.2] Westquai, [1.3] Klybeckplus [2] Les Jetées, [3] Rheinpark. Made by author.*

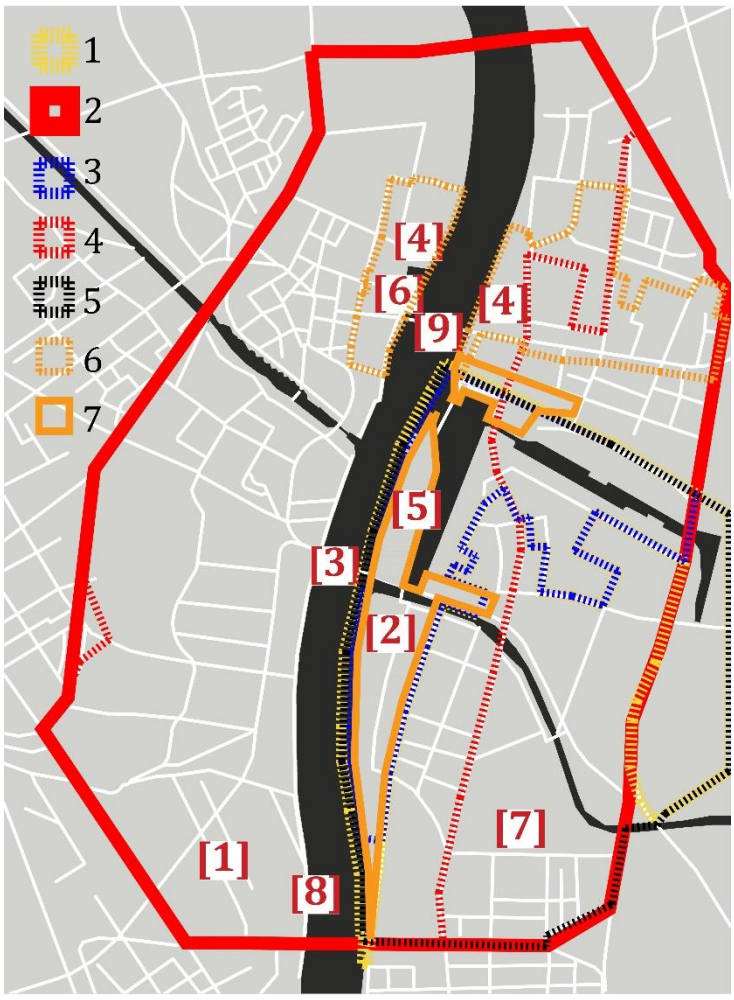


Figure 36: *3Land cross-border context and early planning footprints: [1] Basel Nord first test-planning area; [2] 3Land project area today (referenced in the Third Planning Agreement;[3] Klybeck-Kleinhüningen first urban development study area, second planning agreement area; [4] Development Vision 3Land (2011), area referenced in the First and Second Planning Agreement. Made by author.; [6] Huningue and Friedlingen Redevelopment areas; [7] Programming Port Area Klybeck/Kleinhüningen (2017). Made by author.*

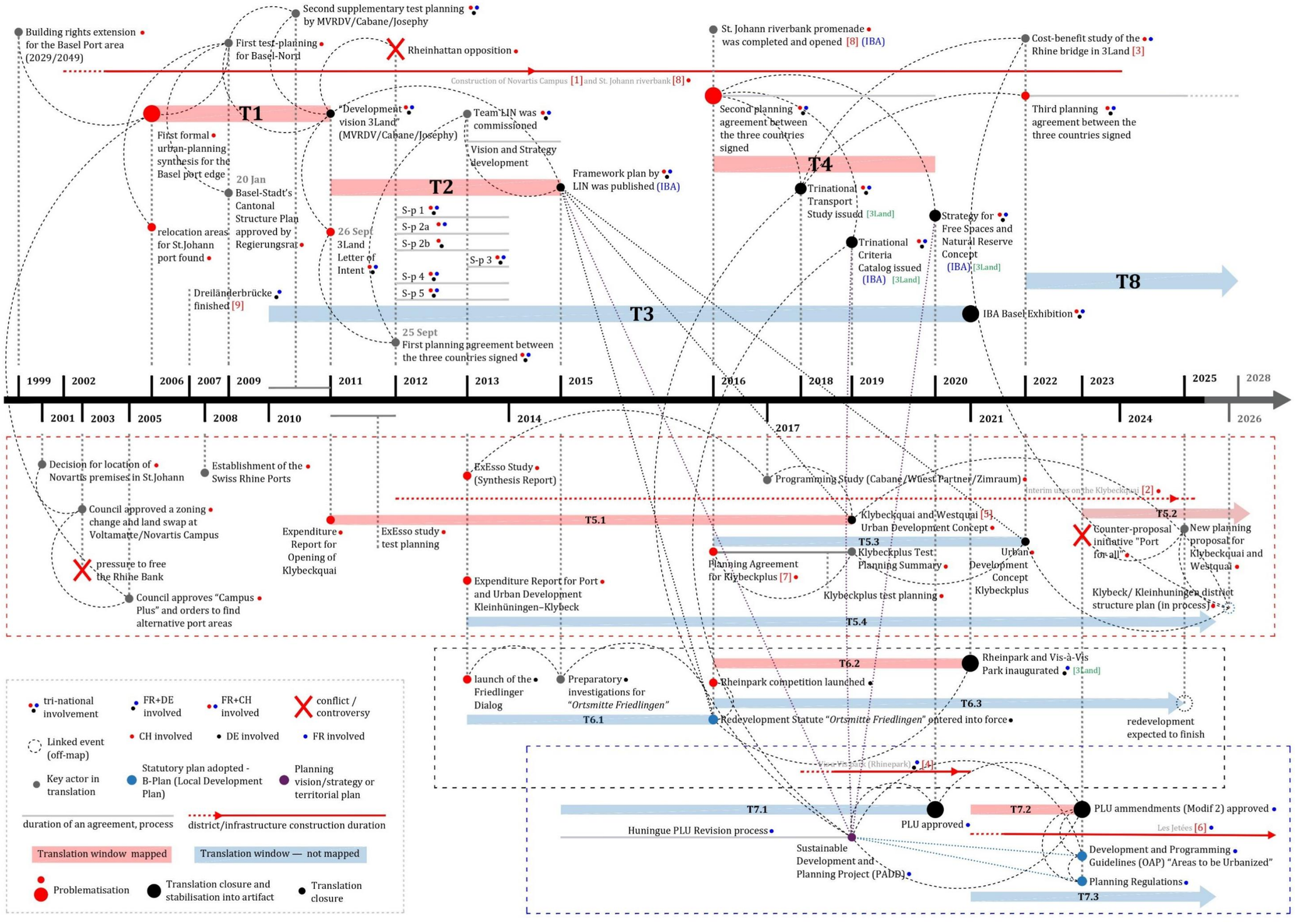


Figure 37: *timeline of 3Land redevelopment. Made by author.*

Translation 1 (2006 - 2011): From Joined Vision to Commitment

Although interviewed stakeholders situate the project's start in 2010-2011 (Interview 4, 2023), the *Urban Development Report – Rhine Port Klybeck-Kleinhüningen* (Feddersen et al., 2006) and the decision not to use Klybeck as a new port area were the first events to problematize a development for the Klybeck-Kleinhüningen districts (Figure 37). Ideas about transforming the port areas in Switzerland start with the Government Council decision to extend building rights for the port, but to exclude Klybeck and Westquai port edge as they recognized the possibility to turn the area into a mixed-use riverside district after the ports lease expires in 2029 (Regierungsrat, 1999). In 2006, an initial urban development concept for Klybeck-Kleinhüningen areas was introduced. This concept was a result of a workshop process for the Planning Office of the Canton of Basel Stadt and is the first formal urban-planning synthesis for the port edge. The concept proposed development in steps which were tied to the port lease timelines (2016/2029/2049).

In 2009, a *Resolution of the Basel City Development Plan* was introduced and with it, the city of Basel - the largest city of the trinational agglomeration - agreed to contribute to preventing further urban sprawl at the edges of the agglomeration and to start its densification inward. The previous events started mobilizing new actors into the network. Key moment was the initial urban development test planning that was launched on the back of the 2009 *Cantonal Structure Plan* and the concept developed in 2006. To maximize urban quality, the Rhine riverbank between the Dreirosen Bridge and the border triangle was planned as a mixed-use area (BVD et al., 2010).

Three teams participated in the test planning - HHF/AWP, ASTOC/LOST, and MVRDV/Cabane/Josephy, and, respectively, produced distinct planning results: a strongly landscape-oriented design, a site-specific, differentiated approach and a novel variant

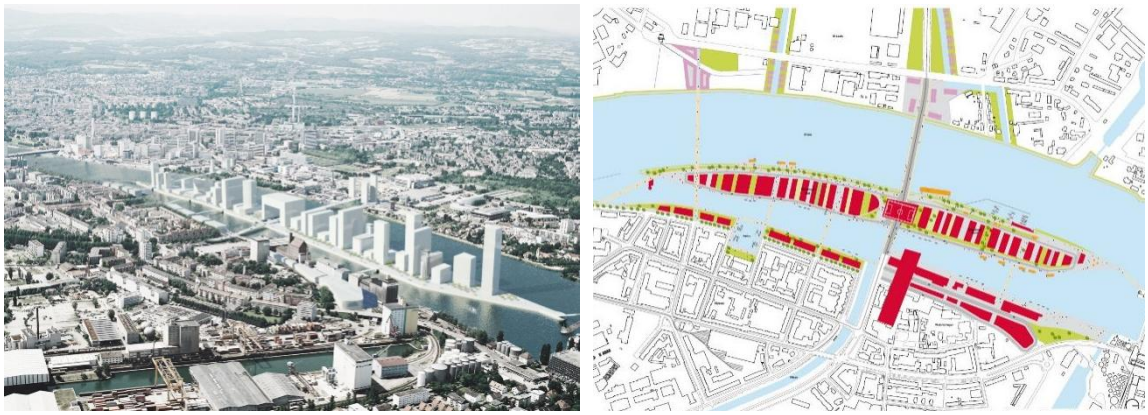


Figure 38: *Rheincity, Basel — aerial visualization along the Rhine showing proposed river-island development and waterfront skyline and situation plan of the new island with adjoining areas. Credit: © MVRDV. Used with permission.*

detached from the context. The MVRDV/Cabane/Josephy proposal won over the evaluation committee - their idea was separating Klybeckquai and Westquai from the existing district by a canal, creating a densely built-up Rhine Island (Figure 38). Their design proposal also featured new bridge connections to France and Germany, with the aim to stimulate cross-border development.

The planning team MVRDV/Cabane/Josephy was commissioned again to identify the cross-border development opportunities of the three municipalities of Basel, Huningue, and Weil am Rhein and to integrate them into a comprehensive concept. Based on the preferred idea from previous test plan, a second trinational test planning took place from 2010-2011 which enrolled actors from two partner cities and the port authorities *(Eine Stadterweiterung Am Rhein - Städtebauliches Leitbild Klybeckquai & Westquai Basel*, 2019). The planning was done in cooperation with IBA which provided institutional umbrella for the process (IBA Basel 2020, 2011). The planning resulted in an urban development vision - a composition of neighborhoods of varying character and shape: in addition to the Rhine Island in Basel, the Quartier du Diamant in Huningue and the patchwork town of Friedlingen in Weil am Rhein. Ultimately, the tri-national development vision (MVRDV et al., 2011) resulted in fixing the results of those studies into an urban concept. The visualizations provided by the design team resembled an American high-rise metropolis (Figure 38), so the phrase *Rheinhattan* became known in the Basel daily press - a term coined by the opponents of the project in 2012 on their blog *Sinking the Rheinhattan* (Bürgin et al., 2015).

Network Analysis

T1 is organized around the test-planning cycles and their outputs (Figure 39). The *First test-planning for Basel-Nord (2009)* sits at the center of the network, represented by the largest and most connected node. Almost every legal instrument, authority, design team, and subsequent planning documents thread through it which makes it the key OPP of this translation. The 2009 test-planning translates regulatory framework, mainly from the Swiss side and ecological restrictions into programmatic requirements. Connected to this core node are the *Test plans 1-3 (2010)*. These events act as successive stabilizers that refine the earlier resolutions and constraints (the *1999 Government resolution*, the *Freight Traffic Shift Act*, and the *building-lease time horizons)*. The test plans also serve as mediators that carry forward the inputs unto spatial models. Digital and informational objects like the *Urban Development Synthesis (2006) and Port and Urban Development Synthesis (2010)* are distributed through the network and act as stabilizers. That consolidated the outputs of test planning.

The Swiss authorities, *Kanton Basel-Stadt, SRH Hafenbahn*, and the *Political Steering Committee*, are institutional nodes that delegate responsibilities to design offices (*ASTOC/LOST, HHF/AWP, MVRDV/Cabane/Josephy*) in the first test planning process. Design and engineering firms also form a small cluster in the middle of the network. For the second test planning they collaborate with German (*Stadt Weil am Rhein*) and French (*Ville de Huningue*) counterparts. In such trinational constellation authority is more distributed. Additionally, *IBA Basel* 2020 functioned as a mediator that set new standards during the second planning phase. Legal and policy instruments cluster at the network's periphery and provide statutory baselines. Finally, civil society and the private sector appears only marginally, which indicates that the translation is still a technocratic and expert-driven process that did not rely much on wider opinions.

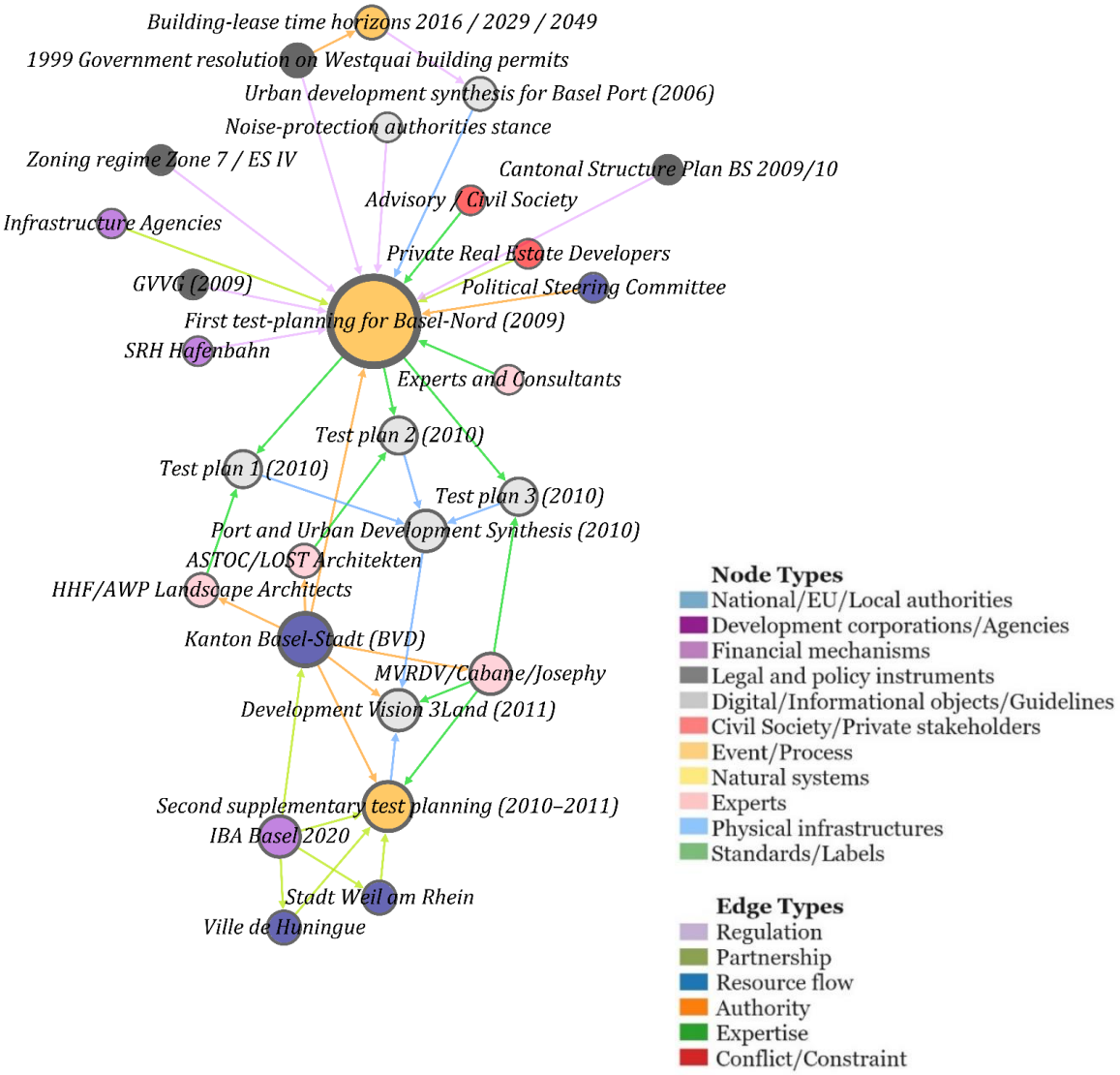


Figure 39: *ANT map of 3Land's T1. Made by author.*

Evolution of Key Infrastructural Baselines Across T1

During T1, the sequence of planning frameworks, the *2006 Urban Planning Synthesis* (Table 29), the *2010 Synthesis Report for the First Test Planning* (Table 30), and *the 2011 3Land Development Vision* (Table 31), functioned as successive OPPs that provided the infrastructural baselines for Klybeck-Kleinhüningen district on the Swiss side, and finally for the whole 3Land area. Each document was built on the previous test-planning stages or expert workshops. This succession shows that Basel's riverfront requirements were negotiated through overlapping visions and test plans that steadily stabilized AMI and B-GI as core elements of the redevelopment vision.

Fl-I baselines were not explicitly inscribed into the planning documents relevant in T1. The 2006 Synthesis inscribed a physical restructuring of the port edge through the removal of sidings at the Rhine bank during the 2006-2016 period and clearing land for new public functions. However, this did not translate into fixed technical standards. The AMI dimension was defined clearly - the 2006 synthesis already mentions banning trucks on the Klybeck shore and dedicating the Rhine bank to slow traffic. The *2010 Synthesis Report* advanced this baseline into a continuous Rhine promenade from Dreirosen Bridge to Weil am Rhein - Friedlingen. Mandatory extension axes from Klybeck to the river and to new bridges (at the Wiese estuary and at the trinational border) were listed as goals. Finally, in 2011, the *3Land Vision* stabilized these discussions into plans that show continuous foot and cycle paths along the river and includes the banks on the French and German side. The new bridges connecting the three countries are also stabilized as necessary infrastructures and are framed in 2011 *Vision* as the most important development measure. In measurable terms, non-motorized traffic became the baseline requirement, while in non-measurable terms it carried trinational symbolism.

The B-GI dimension also evolved into trinational landscape visions. In 2006, new water basins between the Rhine and Altrheinweg and integration of the Wiese riverbanks were proposed. Altrhein basin remained relevant in 2010 planning goals, while compensation measures for lost ecological functions and a possible were added- with what ecological remediation of legacy waste was added as a baseline. The 2011 vision reframed the B-GI into a wider trinational context: the Rhine, Wiese, and Huningue Canal were consolidated into a continuous ecological corridor, and the continuous landscape was envisioned from Basel-Nord into the Sundgau and Rhine floodplains. With this the early acupunctural baselines were now a part of a wider landscape system that served as an infrastructural anchor of the vision.

The superstructure's baselines progression is equally clear. The *2006 Synthesis* opened the Rhinefront to urban uses, introduced first waterfront housing at Novartis and

Wiesendamm and set the timeline span for the release of Klybeckinsel. The 2010 synthesis report fixed typologies (high-density tall buildings at Westquaiinsel, medium-density fabric at Klybeckquai) and required preservation or adaptive reuse of silos, cranes, and the Brasilea building. By 2011, the vision went tri-national and focused more on the symbolic ambition. It defined eight functional zones with distinct identities and envisioned a trinational skyline with new landmarks such as bridges and high-rise silhouettes. The measurable baselines were mostly spatial - defined on maps while the non-measurable baselines emphasized living on the Rhine, cultural identity, and a trinational image.

T1 is a translation in which the vision for redevelopment expanded from Switzerland to encompass all three neighboring countries. Trinational collaboration was articulated in both preliminary planning syntheses, but it crystallized into a consolidated vision in 2011. Stabilization of baselines in T1 emerged through the layering of successive test-planning documents that normalized active mobility and landscape integration as the defining baselines of Basel's riverfront redevelopment.

Translation 2 (2011 - 2015): From Vision to 3Land Urban Concept

The development vision formed the ground for the first planning agreement which can be considered as the problematization of the second translation (T2). T2 enrolled actors to collaborate on developing a new spatial concept. On 26 September 2011, the *3Land Letter of Intent* was signed, which was the first step toward the establishment of the tri-national collaboration (Kanton Basel-Stadt et al., 2011). On September 25, 2012, a planning agreement (Kanton Basel-Stadt et al., 2012) was signed by political representatives from the three countries and the three sides agreed to develop five jointly financed sub-projects: 1. Concept

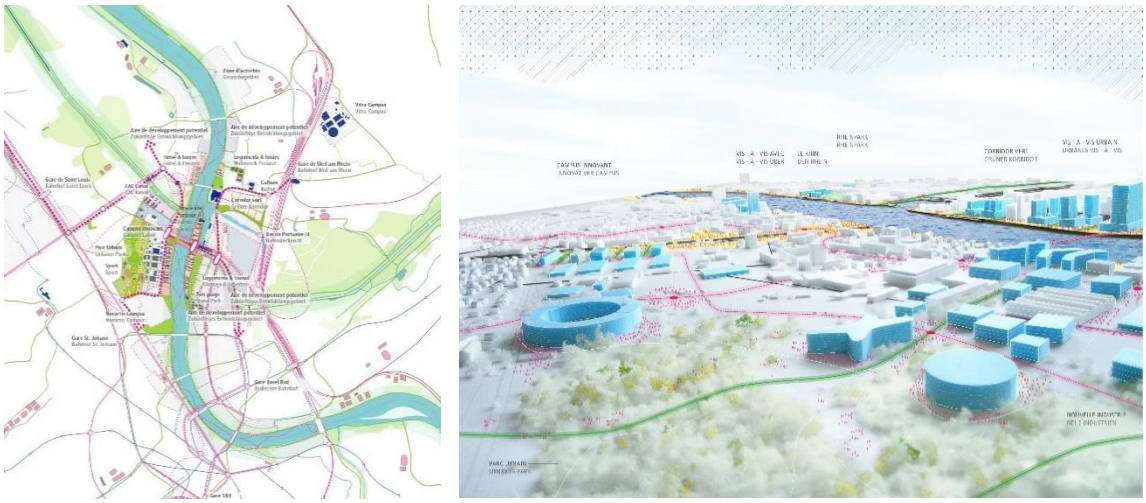


Figure 40: *Territorial development vision for the trinational area and perspective model visualization of the 3Land project. Source: LIN ARCHITECTURE + URBANISM. Used with permission.*

for traffic and land use planning; 2. Central bridges and connections; 3. Trinational economics; 4. Trinational masterplan and 5. Trinational communication (Planungsvereinbarung 3Land - Convention de Planification Trinationale, 2012). The sub-projects were expected to last around 2 years and each of them enrolled and mobilized different actors.

In 2013, the LIN team was commissioned to develop a spatial concept for the 3Land area. The task was to further develop the *3Land Vision* from 2011, taking into consideration the results from the sub-projects 1, 2 and 3. After consulting with politicians, planners, and experts from Germany, Switzerland, and France (Team LIN, 2015b), an urban concept was proposed for possible spatial development, instead of a final master plan (Figure 40). The concept was later refined based on feedback (Team LIN, 2015c) and was published as a collective set of four volumes that included a *Territorial Development Vision* (Team LIN, 2015d) and a *Transformation Strategy* (Team LIN, 2015e). The proposed 3Land concept aimed for a mixed-use approach - approximately 900,000 m^2 of area was planned to be developed.

Network Analysis

The *sub-project 4*, which gathers all the previous projects' inputs; is one of the nodes where collaboration between the three sides takes shape and finally it produces the output - the *3Land Urban Concept*. The node is the largest OPP of the network and around it clusters the rest of the sub-projects *(S-p.1-5)*, which act as mediators - they translate the agreements into specific design and planning exercises. The three municipal authorities are the largest human actor nodes that connect directly to the sub-projects which transform the trinational collaboration into tangible planning outputs. *Basel-Stadt*, *Weil am Rhein*, and *Ville de Huningue* represent part of the institutional actors that cluster around the *Planning Agreement* and its sub-projects. The Planning agreement is one of the interessment devices of the network but remains peripheral to the development of the urban concept.

Digital and informational objects like the *Development Vision 3Land* (2011), *3Land Urban Concept* (2015), and related visualizations consolidate the vision into communicable formats which acted as reference points for exhibitions, conflicts, debates, and the IBA Basel exhibition and they also appear peripherally in the network. The vision's visualizations, and the *Sinking the Rheinhattan* media reaction mobilize attention to the project, affecting the later development of the masterplan (Sub-project 4). The *IBA Basel 2020* is positioned

between *S-p. 4* and the *3Land Urban Concept*, and is influential in embedding new standards of participation and design quality (Team LIN, 2015c).

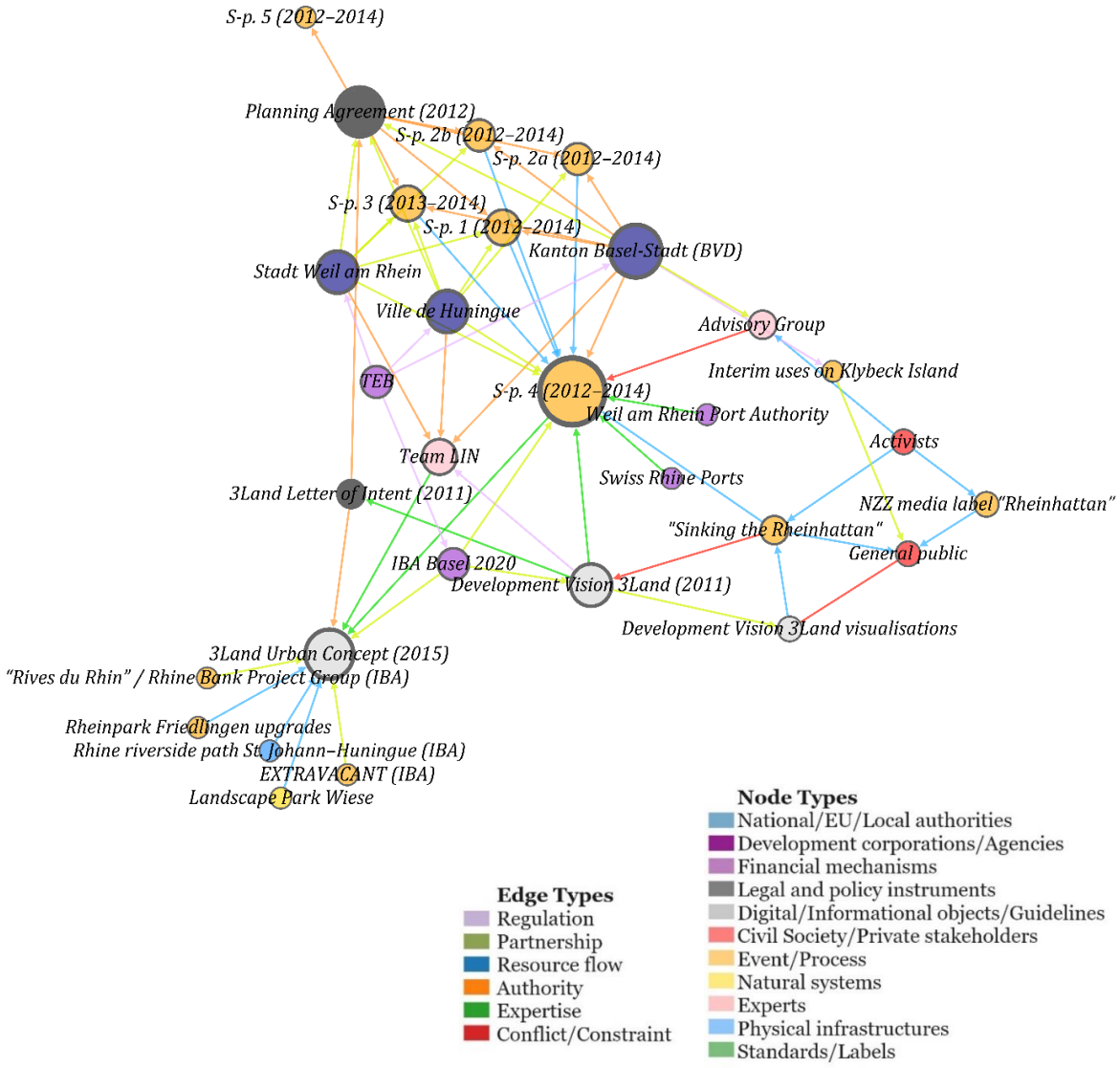


Figure 41: *ANT map of 3Land's T2. Made by author.*

Evolution of Key Infrastructural Baselines Across T2

Fl-I was generally absent from the document's baselines in this translation. Even in the 2015 *3Land Urban Concept*, no explicit flood-protection measures were introduced. Instead, this layer focused toward symbolically reframing the *Rhine in the middle*, as the backbone of the development and was mostly codified by baselines that refer to B-GI and AMI.

The early baselines were dominated by the AMI dimension. The 2012 *Planning Agreement* (Table 32) already fixed the idea of a Rhine pedestrian and cycle bridge and harbor bridge and framed them as part of a sub-project. AMI, improved cross-border accessibility

and the continuity of the Rhine banks were a structuring principle of the riverfront. By 2015, the *Development Vision* (Table 33) expanded AMI dimension: new bridges were scheduled across all three borders, multimodal corridors were mapped, the Rhine banks were reserved for non-motorized traffic, and a detailed parking strategy was introduced to support the AMI. Bridges were envisioned as connectors of trinational daily life. In the 2015 *Transformation Strategy* (Table 34) these baselines were consolidated into timelines: CH-FR bridge by 2020, CH-DE by 2025, and CH-CH bridge by 2030 and mobility itself was framed as the backbone of centrality.

Creation of high-quality open spaces and the preservation of natural areas was the only implicit mention of B-GI in 2012 *Agreement*. The 2015 *Vision for Territorial Development and the Transformation Strategy*, on the contrary, placed this dimension at the center. Three major parks: Huningue Quarry Park, Central Port Park, and the Green Corridor in Weil Am Rhein, were defined, as well as their surface areas and compensatory habitat requirements. In the *Transformation Strategy* of 2015, this vision was translated into phased implementation and the reconnection of the Rhine, Wiese, and Huningue Canal into continuous ecological corridors was fixed.

Superstructures were not explicitly addressed in the 2012 *Planning Agreement*. By 2015, vision introduced numerical programming for offices, housing, industry, culture, and retail, while the non-measurable baselines required innovative typologies and the reuse of industrial heritage as tools for image-building. *Transformation Strategy* again translated these ambitions into phased development programs. Finally, non-measurable baselines required flexibility of the superstructure's development and implementation of hybrid *architecture-as-infrastructure*.

Translation 3 (2010 - 2020): IBA 2020 as Curatorial Gate

Another process was running parallel to the 3Land *masterplanning* - the IBA Exhibition which was launched by the TEB[8] to publicize cross-border cooperation. IBA is treated as a parallel process, a layer that qualified and supported the 3Land process - its own network intertwined with the network of delivery of the 3Land, and projects in the perimeter of the 3Land. This translation stabilized when the exhibition was finalized in 2021.

> "IBA provided a lot of manpower and communication know-how, but at the same time their role was not always clearly defined. It was helpful but also a bit messy, because it was a project within a project." … "It was a win-win situation: both projects became

[8] TEB (Trinational Eurodistrict Basel) is a cross-border association of ~83 municipalities and regional bodies from Switzerland, France, and Germany, that are covering the entire trinational Basel agglomeration. TEB was formally created in 2007 (as successor to the ATB/TAB) to coordinate planning and projects across the border (*Das Gebiet Des Trinationalen Eurodistrict Basel | TEB*, n.d.).

more visible and gained value from being part of each other." … "They helped build a platform for cross-border projects, and this platform was really useful for the dialogue process." (Interview 5, 2025)

IBA ran a multi-stage qualification process for projects that took place in the TEB region. There are several OPPs that anchor the IBA process network such as the committee gate and an *IBA Convention of Quality Standards*. However, the tight schedule of 10 years, the common budget, and the trinational workgroups and steering groups that were introduced by the exhibition process (IBA Basel 2020, 2013, 2020c, 2020b) influenced the translation that ran parallel to the IBA Exhibition.

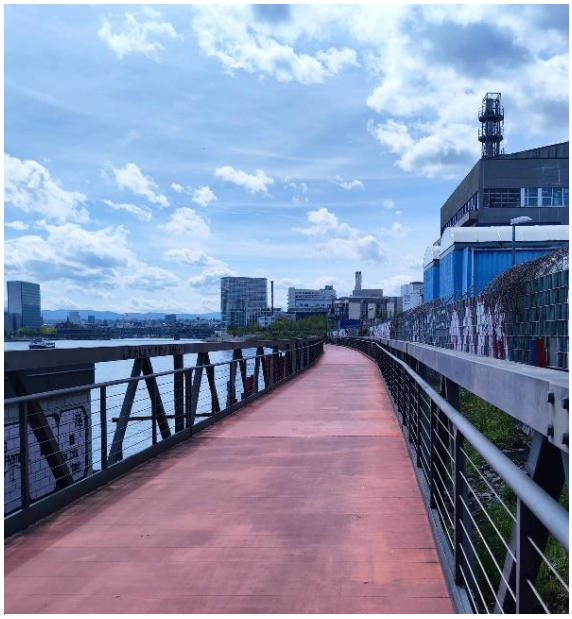


Figure 42: *Riverside path on the Huningue bank looking toward Basel - part of the cross-border Rheinuferweg corridor. Photo by author, 2023*

Figure 43: *St. Johann riverside promenade (Basel), the walk/cycle path runs along the floodwall as a section of the Rheinuferweg St. Johann-Huningue. Photo by author, 2023*

"For us, the IBA phase was mainly about networking and showing that cross-border planning could work." (Interview 6, 2025)

Moreover, deliveries of the exhibition (projects that were IBA labelled), are located in the 3Land perimeter and became infrastructural actors influential to the 3Land process. Three projects were directly affected by this and two of them got the IBA label. First it was the core cross-border district project itself *3Land - Three Cities, One Future* (as a self-standing IBA project). IBA influenced it by setting the tempo (goals had to be achieved in one decade), provided a cross-border project management together with TEB and produced the key 3Land framework publications (T4). Participation formats were also run, such as the IBA KIT which was used to gather requirements for subprojects like the Rheinpark redesign.

The 3Land was also linked to other IBA initiatives through project groups, for example the *Rheinliebe* project. Through its public communication platforms - the IBA Forum, Project Shows, and IBA Expo 2016/2021 - 3Land's progress was regularly presented to the wider public. The riverside promenade Rheinuferweg St. Johann (Basel - Huningue) was the first project awarded the IBA Label in 2016. It is a cross-border riverside promenade from St. Johanns-Park to Dreiländer Bridge (Figure 42, Figure 43) and was part of the project group *Rheinliebe*.

Translation 4 (2016 - 2020): Second Planning Agreement to Design Guidelines

The 2016 *Planning Agreement* signed between the three countries problematized a new, fourth translation (T4) and interessed new actors through the political steering committee (PS), global project steering group (GPS), overall project management (GPL), working group 1 for bridges, mobility and economic feasibility (WG1), working group 2 for spatial planning, urban design and initial uses (WG2), communications and lobbying working group (Comms WG), and the TEB and the network stabilized into several artefacts which became a node OPP, where plenty infrastructural baselines were inscribed (Kanton Basel-Stadt et al., 2016).

The first stabilization happened with the *Trinational Transport Study* (Ledergerber et al., 2017). The study was prepared on behalf of the overall organization 3Land under WG1. It fixed transport measures, phasing of the mobility transformation and an action plan. With this stabilization the new bridge was positioned as the core element of the 3Land redevelopment.

> "The bridge is probably the most important project in the whole 3Land process, because it is the only one that is really physical and directly connects the three countries… Whenever we speak about 3Land, we show the bridge. It's the image everyone understands." (Interview 5, 2025)

The second stabilization was in 2020 with the *Strategy for Free Spaces and Natural Reserve Concept*. The strategy was later validated by the political committee as a manual that each of the countries should adopt in future. The goal of the strategy was to guide future planning in each city, and to serve as a regulatory tool. The document includes specific tasks for each city, categorized into short-term, medium-term, and long-term goals. The third sub-network stabilized in 2019 with the *Trinational Criteria Catalog*. The catalogue builds on the goals of the 2016 planning agreement, sets 13 criteria with 31 indicators and creates a trinational support group with milestone reviews that projects would have to pass to be awarded. The catalogue was intended to guide private and non-profit investors, developers, and landowners across the three participating countries with the aim - the new projects to

exceed current standards. The *Sustainable 3Land Durable* certificate would be awarded to those who meet the requirements set in the catalogue (Ville de Huningue et al., 2020). Thus, the catalogue becomes a project-scale OPP node for projects that were planned to be implemented. However, these documents never achieved the status of binding OPPs.

> "The *Trinational Criteria Catalog* was a good idea for IBA 2020, but in practice it has not yet been applied. The *Open Space and Nature Conservation Concept* is a good planning basis for more in-depth planning..." (Interview 6, 2025)

> "It was meant as a checklist for the municipalities and investors, to see if a project fulfils the trinational goals. But to be honest, it has not been used very much since then." "The idea was good, but it was too abstract and not really binding. Everyone agreed with the principles, but when it came to implementation, each side has its own procedures." "Still, the discussions around the *Criteria Catalog* were useful because they created a common understanding, what we mean by *sustainable* and *trinational*. Even if the document itself is not applied, the mindset stayed." (Interview 5, 2025)

The documents remained conceptual, so this translation does not represent a decision gate. However, the stabilization of the network remains as artifacts that reflect the shared goals of the three countries at that given moment and were simultaneously shaped by ongoing projects and local planning dynamics.

> "But I don't think that is really harmful, because many of the criteria in the catalogue already came from Basel. We managed to put many of Basel-Stadt's goals into the catalogue. In the meantime, much has changed. For example, Basel now has a policy that the city must be carbon neutral by 2037, and other laws and regulations have also changed. So, the criteria in the catalogue would not meet the goals we have now. The buildings in Klybeck will probably be built without this catalogue, but I think they will not be worse than if the catalogue had been used." (Interview 5, 2025)

Network Analysis

The network in T4 (Figure 44) revolves around on OPP - the *Planning Agreement* (2016-2020), the problematizing actant. The networks produced three artifacts: *the Strategy for Free Spaces and Natural Reserve Concept* (2020); the *Certification Process Manual* (2019) and *Trinational Transport Study* (2017). The three municipal authorities, Kanton Basel-Stadt, Stadt Weil am Rhein, and Ville de Huningue appear in the core of the network. They operate under the coordination of the TEB and are supported by the IBA Basel 2020.

Evolution of Key Infrastructural Baselines Across T4

Fl-I baselines were absent in the early stages of T4. In the 2016 *Planning Agreement* (Table 35), the Rhine was only symbolically mentioned as the *central free space* without

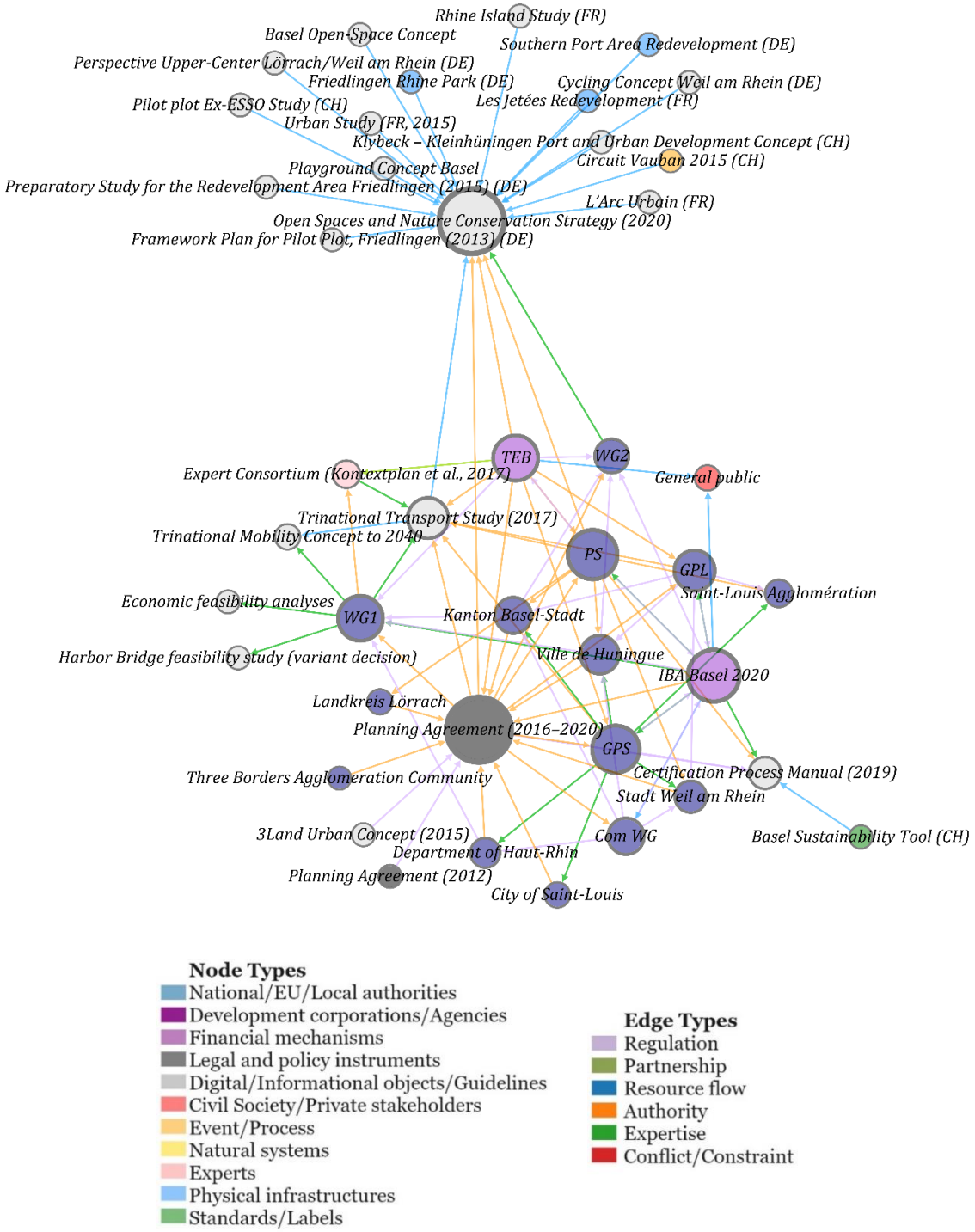


Figure 44: *ANT map of 3Land's T4. Made by author.*

defined technical targets. Similar case is the *Trinational Transport Study* (2017) (Table 36). Significant shift happens in the 2020 *Strategy for Free Spaces and Natural Reserve Concept* (Table 38), where explicit, water management baselines are inscribed: integration of water elements in public and green spaces, unsealed and vegetation-capable edge areas, permeable surfaces, demolition of hard embankments, and restoration of natural river profiles. In this way the flood infrastructure dimension-baselines evolved to measurable prescriptions that

intertwine requirements for habitat continuity, regulation of microclimate and flood resilience, but they were still not binding.

The AMI baselines developed into the most codified system. First, the *Planning Convention* defined the mobility hierarchy of the area which established walking, cycling, and public transport as priorities. Cross-border accessibility through soft mobility was set as one of the priorities. The *Trinational Transport Study* further elaborated these goals into concrete baselines: a dense, direct pedestrian and cycling grid with short paths, new Rhine bridges, Park and Ride facilities and collective parking in support of the modal shift. AMI was also tackled in *Certification Process Manual* (2019) (Table 37), which required projects to ensure continuous, safe pedestrian connections, user-friendly bicycle parking, and efficient parking management with reduced ratios and collective garages. Finally, the *Strategy for Free Spaces and Natural Reserve Concept*, specified car-free zones along the Rhine, generous and shaded pedestrian and cycle corridors, bridgeheads as social and visual nodes, and barrier-free access throughout neighborhoods. Thus, AMI baselines evolved from ambition (2016) to codified performance criteria (2019), and context-specific open-space typologies (2020).

Similarly to AMI, the B-GI dimension shifted from vision to structured ecological system. In the *Planning Convention*, the Rhine and surrounding open spaces were defined as valuable natural assets for urban identity and quality, but as visionary goals. Next, the *Certification Manual* established concrete ecological performance baselines: climate-adapted planting, de-sealing of surfaces, and safeguarding habitats through roof and facade greening and biotope connections which were required for a project to gain certification. Finally, in 2020 *Strategy for Free Spaces and Natural Reserve Concept* expanded these standards into detailed ecological design requirements. The strategy recommended native, dry-warm vegetation; structurally and species-rich meadows and ruderal strips; woody plantings that avoids overshading; permeable and vegetated perimeters functioning as ecological relays; and continuous biotope networks connecting Rhine, Wiese, and Canal de Huningue.

Superstructural baselines also progressed to quantified sustainability standards during T4. The certification manual introduced some measurable indicators for energy and material performance: reduction of grey and operational energy, use of cooperative infrastructures, and circular-economy indicators such as reuse of demolition materials, recycling, and long-life, low-maintenance materials. The *Strategy for Free Spaces and Natural Reserve Concept* required green facades on buildings along corridors and material specifications (high-albedo, reflective surfaces in the neighborhood). Architecture was to be envisioned in a site-specific manner and designed to integrate industrial heritage and maintain harmony with surrounding ecological and recreational landscapes without

disturbing the biotope network. Buildings were explicitly linked to the linear open-space and mobility structure, ensuring permeability, shading, and cross-border identity.

Distributed Implementation and Statutory Embedding of Tri-national Vision

Each of the three countries initiated independent redevelopment initiatives on their respective sides of the Rhine after the *3Land Vision* by MVRDV/Cabane/Josephy was published. These processes were initially driven by specific needs and priorities of each country, rather than by the common trinational goals. Right after the vision was published the first processes began in Basel. Although, redevelopments occurred parallelly to the preparation of the joint *3Land Urban Concept* and in a distributed manner, the baselines of the plan were being integrated into the countries' redevelopment concepts, statutory instruments and projects after 2015. Thus, the shared vision unfolded through multiple, parallel processes in the three countries. TEB and IBA Basel acted as trinational mediators, but the stabilizations occurred within networks that were based in each of three sides. Each of the countries had their pilot projects connected to the redevelopment – the Ex-Esso planning plot in Switzerland, Les Jetées in France, the Rhinepark in Germany, and the Vis-à-vis project between France and Germany.

In the following sections, the processes for every involved side will be analyzed as a set of translations, however, only the development steps of pilot plots will be deconstructed into actor-network maps, as extension of this approach would be beyond the feasible steps for this research.

Basel - *Translation 5.1 (2011 - 2019) and 5.2 (2023 - in progress): From Preliminary Studies to Urban Development Concepts for Klybeckquai and Westquai*

The *Expenditure Report Concerning the Opening of Klybeckquai* (Regierungsrat des Kantons Basel-Stadt, 2011) is one of the earliest official documents that mark the problematization of the first, tangible step towards the industrial Rhine riverbank transformation. The document was formally approved by the Grand Council soon after that (Der Grosse Rat des Kantons Basel-Stadt, 2012). The expenditure report and the parliamentary approval are the first OPPs through which the idea becomes materially anchored process. This led to the start of spatial experimentation on the banks, a temporary urbanism which preceded the urban planning steps. Interim uses such as sports, art, culture and gastronomy gave visibility to redevelopment and shaped the image of the place for the residents of the three cities (Figure 45). The interim uses were an interessment device for

citizens mainly - as Rinderknecht (2025) reflects, the interim uses *put the area on the mental map of the people*.

The enrollment phase came with assigning different roles through subsequent test planning studies. First study was the Ex-Esso in 2013, which inscribed new baselines with the 2013 *Ex-Esso Synthesis Report*. This study served as a test-planning ground to explore Rhinebank redevelopment. The name refers to the former Esso petroleum depot site on Klybeckquai which was a central pilot parcel for the Swiss side of the redevelopment. It was a typical port-industrial morphology and became an accessible ground thanks to the measures from 2011-2012 (Departement für Wirtschaft, Soziales und Umwelt des Kantons Basel-Stadt & Bau- und Verkehrsdepartement des Kantons Basel-Stadt, 2013). Next, the *Programming Hafenareal Study* (2017) transformed the previously established design ideals into procedural guidelines and quantified baselines. Finally, the *Urban Development Concept* (2019) codified the previous two studies within a spatial and regulatory framework which was recognized by the Canton.

This translation managed to achieve a high degree of mobilization around one shared goal, and that mobilization finally occurs when the *Urban Development Concept* and the *3Land Framework* started to act as mediators for common narrative. The project spoke as a single entity for the redevelopment of Klybeckquai and Westquai. This translation can be described as one of material and symbolical interessment of actors. Its products were the temporary use of the promenade, pilot studies and the development concept.

Figure 45: *Interim use at Klybeckquai (Holzpark Klybeck), Basel, Switzerland - riverside bar and lounge. Photos by author, 2023.*

A turn of events happened in 2023, with the *Hafen für alle* counterproposal which led to revisions on land-use ratios (Stadtentwicklung Klybeck-Kleinhüningen, 2023). In ANT terms, the network took a detour. This is a result of the remaining of the previous translation as performative but not institutionalized, so the vision became contested again (T5.2). The discussion shifted toward questions of ownership, affordability, and the proportion of public versus private land use (Department of Construction and Transport of the Canton of Basel-Stadt, 2023). Although the Canton initially rejected the popular initiative, the authorities reintroduced a new proposal, which will be a subject to public participation processes in 2025. Consequently, the question about redevelopment of Klybeckquai and Westquai remains unanswered. The previous translations mobilized actors around shared goals, but the alignments never fully stabilized, so the infrastructural and planning baselines for Klybeckquai and Westquai remain open for negotiation.

Network Analysis

This actor-network map (Figure 46) shows the Basel's Klybeckquai-Westquai district's planning evolution as a translation process, that moves from technical studies and design frameworks to a shared urban development vision. In the network stand three main OPPs: the *Ex-Esso Study* (2013), the *Programming Hafenareal Study* (2017), and the *Urban Development Concept* (2019). Each of these marks a key moment in this translation. First, the *Ex-Esso Study* represents the early phase which mobilized design and technical experts such as Herzog and de Meuron, MVRDV, and Josephy. Next, the *Programming Hafenareal Study* (2017) which is an informational artifact - a result from previous research and *Round Table Workshops*. It became the principal coordination instrument, where port relocation and the strategies for further urban planning are discussed. Around this OPP cluster various advisory groups, workshops, and technical offices. Many perspectives, from flood protection to heritage and B-GI, were aligned through this study. By 2019, the *Urban Development Concept* consolidated these earlier translations into a coherent framework.

Several *civil society* clusters appear on the periphery of the network and represent the influence of general public on the process of redevelopment in Basel. These private actors participate in the process mainly through round table workshops, advisory groups, and the interim uses on the Klybeckquai. These clusters are linked to the network by red (contestation) edges, directly engaging with the *Development Klybeck–Kleinhüningen* process of establishing a new District Structure Plan[9]. Two important clusters contest the process

[9] district structure plan (*Stadtteilrichtplan*) is a binding district level strategic guiding plan that defines objectives and measures for a specific quarter in the canton of Basel-Stadt.

against the 3Land Vision. One is the *Rheinhattan* controversy from 2011 and second is the *Hafen für Alle* initiative. Several years into the translation, *Hafen für Alle* represents a detour that reopens the stabilized network to public critique and alternative visions for the area. The *Urban Development Concept*, thus, served as a mobilization point, but also became a new point of contestation.

Expert offices (pink nodes) appear peripherally in the power dynamics as they input technical and ecological knowledge into the planning concepts. Public authorities (*WSU BS*, *BVD*, *SRH*, *Regierungsrat BS*) functioned as central nodes which form an *authority's* cluster which represents a bridge between the three largest nodes - they anchor the network and mediate between the OPPs.

Evolution of Key Infrastructural Baselines Across T5.1 and T5.2

Fl-I was not the dominant baseline in these translations. Flood resilience was embedded mostly in spatial design as the quay edges and public promenades were maintained as elevated, continuous flood barriers. The baselines focused on preserving hydrological continuity of the Rhine. AMI was the most concretely defined layer during T5.1. The 2013 *Ex-Esso Study* (Table 39) already framed the Rhine promenade and the bridge to Huningue as the key infrastructures for achieving connectivity. Next the 2017 *Programming Report* (Table 40) framed continuous cycle paths, pedestrian links between the districts and the Rhine, and dedicated bridge corridors. By 2019 the *Development Concept* (Table 41) proposed car-free Rhine promenades, cross-district bicycle routes along the Rhine, Wiese, and Altrheinweg, and pedestrian-only cross-streets within the Gleispark. Street-width standards were quantitatively defined (15 m for residential, 5–8 m for commercial cross-streets). Non-measurable baselines mainly referred to prioritizing walking, cycling, and public transport over private cars, and short distance living. The B-GI baselines were equally consolidated. The early goals of improving biodiversity along the Rhine and Wiese evolved into measurable design baselines: a 30 m-wide Rhine promenade as a continuous ecological corridor, the 900 m-long Gleispark on the former port railway (40–90 m wide). Non-measurable baselines promoted the Rhine and Wiese as supra-regional ecological axes.

The baselines on superstructures evolved to the greatest extent during this translation - from experimental and flexible in 2013 to codified architectural and material baselines in 2019. Quantitative parameters were established: 20 m eaves height on secondary streets, 30 m along the waterfront, and 65 m for flagship towers, with 900 m^2 footprint limits for high-rise buildings. In 2019 *Development Concept* qualitative design rules were focused on roof greening, restrained façade articulation, and a coherent color and material palette

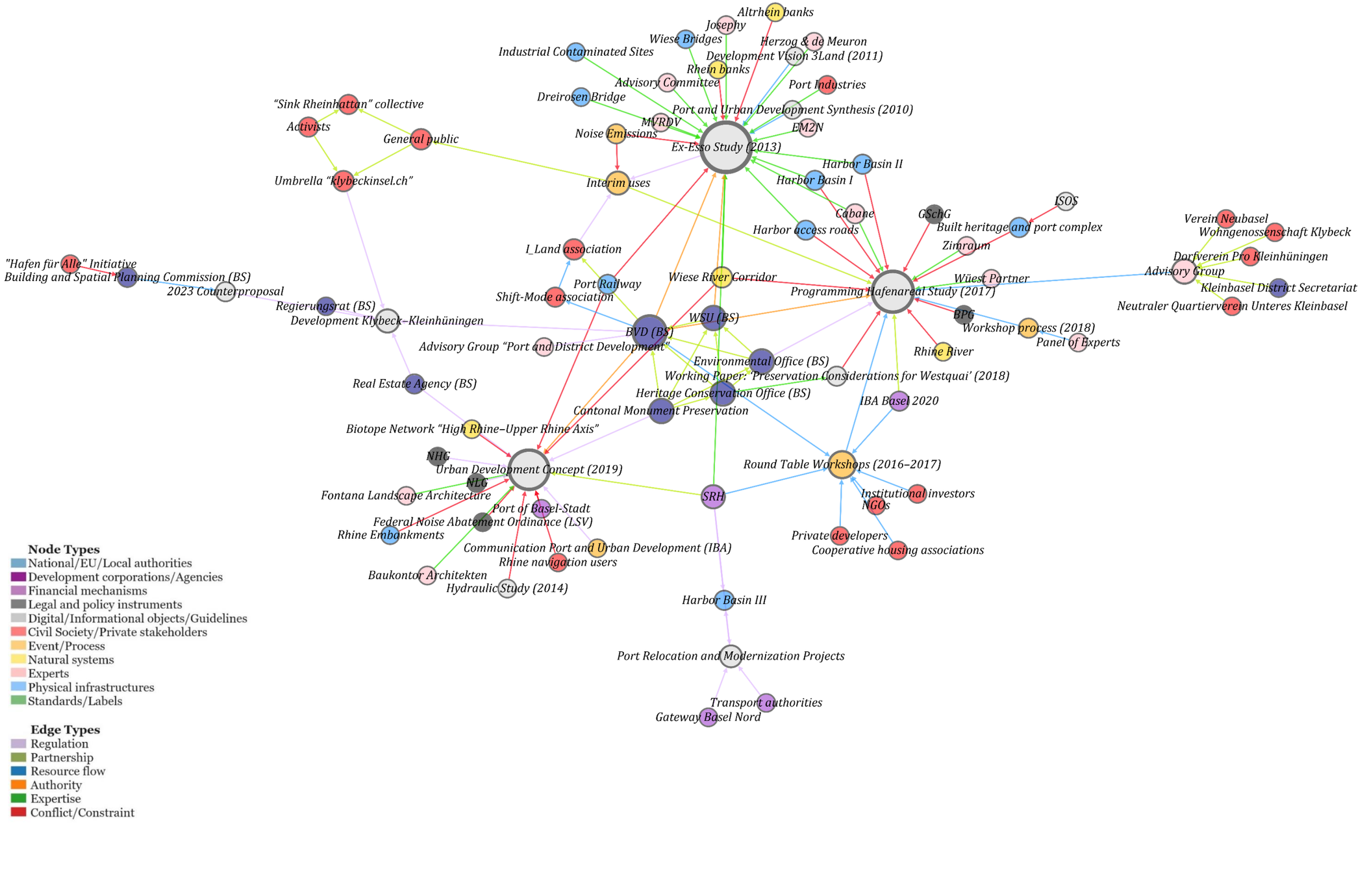


Figure 46: *ANT map of 3Land T5.1. Made by author.*

derived from the port's industrial heritage. Principle of reuse and transformation of important heritage buildings was also established. Finally, cranes, silos, and warehouses were retained as artifacts important for the identity of the district.

Basel - *Translation 5.3 (2016 - 2022): From Preliminary Studies to Urban Development Concept for Klybeckplus*

Parallelly to the Klybeckquai-Westquai processes, the redevelopment of another industrial area in Basel was problematized - the Klybeck industrial site - Klybeckplus. In 2016, Basel-Stadt signed a planning agreement with Novartis and BASF for joint site redevelopment. After the land sale in 2019, the new owners (Swiss Life AG and Rhystadt AG) continued towards redevelopment under the same framework (Swiss Life AG & Rhystadt AG, 2025). The mobilization unfolded with the *Urban Development Concept* for *Klybeckplus* (2022) which fixed spatial, mobility, and ecological baselines (Canton of Basel-Stadt et al., 2022). Similarly, this translation mobilized actors around one shared goal, but did not fully stabilize into a binding artefact, which left it open for renegotiations.

Basel - *Translation 5.4 (2014 - in progress): Statutory Embedding of Klybeck/ Kleinhüningen Redevelopment into the District Structure Plan*

A stabilization of baselines is expected to occur with the *Kleinhüningen-Klybeck District Development Plan (Stadtteilrichtplan)* (Regierungsrat des Kantons Basel-Stadt, 2022). The Klybeckquai–Westquai port redevelopment and Klybeckplus projects have evolved as separate translations, each with its own actors and temporalities, they overlap spatially and institutionally with the *District Development Plan* unfolding process. The problematization of this translation began in 2013 with an *Expenditure Report and Government Council decision of* titled *Port and Urban Development Kleinhüningen–Klybeck* (2013). The Canton of Basel-Stadt launched the *Stadtentwicklung Klybeck-Kleinhüningen* process to coordinate all port, industrial, and urban developments in Basel North. The plan, is expected to be adopted in 2026, and will be the binding coordination tool for future zoning, mobility, and landscape measures (BVD, 2024; StA BVD BS, 2024).

Weil am Rhein - *Translation 6.1 (2013 - 2016): Formalizing the Ortsmitte Friedlingen Redevelopment*

The redevelopment of Friedlingen can be described as a translation sequence whose problematization started between 2013 and 2015 with the launch of the Friedlinger Dialog - a participative process where the need to redefine Friedlingen's identity, address spatial and social deficiencies, and reconnect the district to the Rhine was problematized (Stadt Weil am

Rhein, Stadtplanungsamt, 2015). A pilot plot was defined and a preliminary framework plan by Pesch Partner, was produced in 2013.

This phase interessed and enrolled new actors, such as citizens and planning offices, through public workshops and studies. Institutionally, there was a stabilization of this phase with the adoption of *Redevelopment Statute Ortsmitte Friedlingen* (2016). This document fixed the redevelopment boundaries and formally enabled the use of federal and state urban renewal funds. The redevelopment goals combined the four infrastructural layers by implementing soft riverbank design for Rheinpark, adding new pedestrian and cycle connections and encouraging energy-efficient renovations for private buildings. Although Weil am Rhein has fewer financial and administrative resources compared to Basel-Stadt, it leveraged other funding instruments such as EU Interreg (for Vis-à-vis park) or KfW programs (for superstructures modernization).

Weil am Rhein - *Translation 6.2 (2016 - 2021): From Rheinpark Competition to Development*

Following the adoption of the statute, the mobilization phase began with competition for the Rheinpark redesign (won by Faktorgrün Landschaftsarchitekten). The competition operationalized the Statute's goals and this process is an instance of a trinational cooperation through the competition jury which included IBA Basel and the TEB. They embedded the project within the broader 3Land cooperation (Stadt Weil am Rhein et al., 2016). The *Strategy for Free Spaces and Natural Reserve Concept*, which was parallelly developed, came later, in 2020, so it did not guide the Rheinpark project, but the park's outcomes informed its goals, which already indicates the reciprocal relationship between the local implementations and the setting of the tri-national goals. Mobilization unfolded through the implementation of the Rheinpark expansion and the construction of the JUNO II youth facility. Finally, since 2021, closure of the network has been achieved with the inauguration of the Rheinpark as part of the Vis-à-vis project.

Network Analysis

The actor-network for the Rheinpark implementation in Friedlingen shows the steps of planning and implementation between 2013 and 2021 (Figure 47). At the center stands the *City of Weil am Rhein* and the node for *Rheinpark implementation*. The expert–design group of actants, formed by *Pesch Partner*, *faktorgruen Freiburg*, and the *Landscape Architects*, is distributed throughout the whole network. Similarly, the institutional/governance cluster - *Rheinhafengesellschaft*, *WSA Freiburg*, *BMWBSB*, and *EU Interreg V*, provide the regulatory and financial input for the project, distributed throughout the network and feed into the

implementation node. There is also a cross-border group of actants - *Ville de Huningue*, *TEB*, *IBA Basel* and the *3Land Urban Concept* (2015) which illustrates the tri-national significance of the Rheinpark. Finally, the *Rheinpark*, as an infrastructural node, represents the physical stabilization of this network. The map shows the significance of *City of Weil am Rhein* as an institution that aligns citizens and expert inputs with tri-national goals.

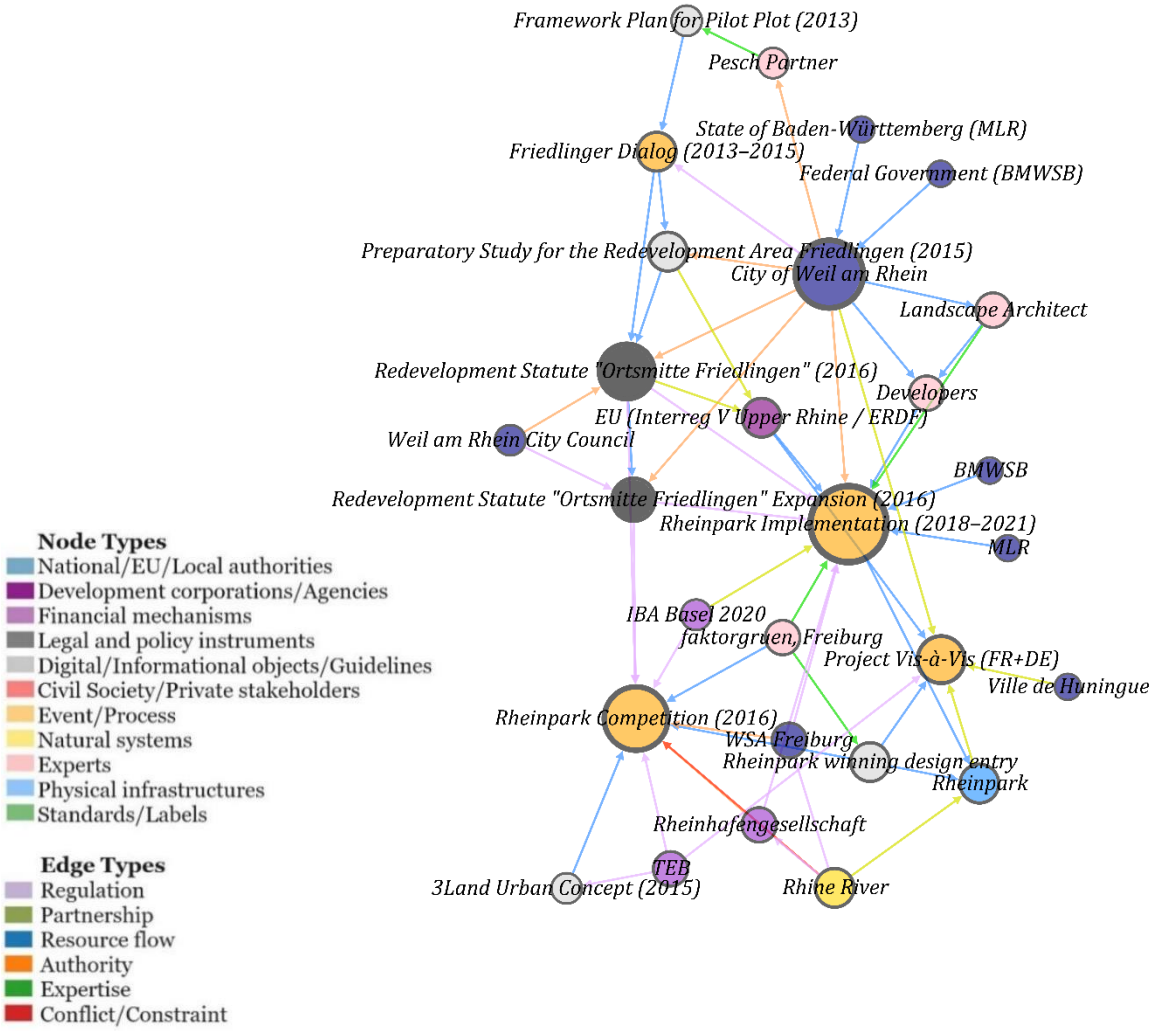


Figure 47: *ANT map of 3Land T6.2. Made by author.*

Evolution of Key Infrastructural Baselines Across T6.2

This translation mainly elaborates the implementation of an open space – a park (Table 47, Table 48). Fl-I baselines were addressed primarily through landscape design - the winning design proposed lowering the promenade by approximately 50 cm relative to the park height. The goal was to improve both visual and physical access to the Rhine while maintaining hydraulic safety. AMI were stabilized into a north–south cycle path within the promenade. A direct connection beneath the Rhine Bridge to link the Friedlingen district with

Huningue and Basel was established. B-GI were the backbone of this transformation. The *Redevelopment Statute* framed an improvement of green and open spaces as part of the district's rehabilitation objectives. Thus, the park design converts the area into a bathing bay. Tree population was mostly preserved and new plantings introduced. Biodiversity continuity and climate adaptation were some of the goals as well as creating a resilient, accessible interface between water and land. Superstructures remained peripheral in this translation.

Weil am Rhein - *Translation 6.3 (2016 - expected to stabilize in 2025): From Redevelopment Statute to Complete Local Implementation*

Besides the development of Rhinepark, statute's goals such as energy-efficient modernization, renewal of street spaces, and improvement of social infrastructure proceeded through multiple micro-translations. After the adoption of the *Redevelopment Statute*, the stabilization of the Ortsmitte Friedlingen network thus unfolded continuously - property owners were mobilized through KfW programs, local incentives, and design consultations. The area of redevelopment was expanded with a new statute in 2016, and full closure of the translation was foreseen by 2025.

Huningue - *Translation 7.1 (2015 - 2020), Translation 7.2 (2021 - 2023) and Translation 7.3 (2021 - expected to stabilize in 2027): PLU Revision, Second Modification and Les Jetées Implementation*

Huningue entered an implementation phase after 2015 when the revision process for Huningue *Local Urban Development Plan* (PLU) was problematized (T7.1). During this phase the 3Land baselines were inscribed into binding urban instruments and projects. The PLU Revision (2019) approved in 2020, replaced the old 2008 PLU. The approval of the plan formally stabilized and aligned Huningue's urban policies with the *3Land Urban Concept*. The Revision encompasses a set of interrelated documents that together define the planning baselines for the municipality. In the network analyzed all these documents are represented through a single node, as they are synchronized to frame the development objectives. In the baseline tables they are reconstructed as single documents. The *Sustainable Development Project* (PADD) is one of those documents (Table 42). The PADD spatially defined development sectors along the Rhine corridor which fix the Les Jetées (Figure 48 – c, d), Vis-à-vis (Figure 48 – a, b, e) redevelopment projects as some of the priorities.

The second amendment of the PLU was problematized in 2021 (T7.2) and stabilized in 2023 (PLU Modification n°2). The second modification was a key step which incorporated the 3Land principles into French statutory planning framework. The PLU Modification is

likewise represented as one node in the network, pointilizing a set of interrelated documents that are, however, analyzed individually to trace specific baselines (Table 43, Table 44).

Three specific redevelopment zones were formally defined and one of those zones was the plot for the Les Jetées development (1-AUa) (ADAUHR & Ville de Huningue, 2022, 2023). These amendments provide tangible evidence that the baselines from *3Land Vision*, *Trinational Criteria Catalogue*, and *Strategy for Free Spaces and Natural Reserve Concept* were formally integrated and aligned into binding statutory instruments on the French side of the redevelopment area. In this sense, the 2019-2023 modifications constitute the first legal codification of the shared baselines into a binding artefact, which demonstrates that the project was not only conceptual but also institutionally operationalized.

Figure 48: *(a, e) Vis-à-vis Park, Huningue, France. (b) Rheinpark, Friedlingen (Weil am Rhein, Germany), (c, d) Les Jetées, Huningue, France. Photos by author, 2023, 2024.*

The third translation in Huningue (7.3) follows the problematization of Les Jetées implementation which was the first major waterfront redevelopment on the 3Land area. The realization of the project re-opens the network. The alignment of the project with Durable 3Land objectives is mentioned in several sources (ADAUHR & Ville de Huningue, 2022; Brugger et al., 2019; IBA Basel 2020, 2020a), however it has not been officially certified. In ANT terms, the possible implementation and certification of the project could mean the first stabilization of the 3Land Durable infrastructural baselines. For the purpose of this research T7.2 will be deconstructed to map the power relations for stabilizing baselines.

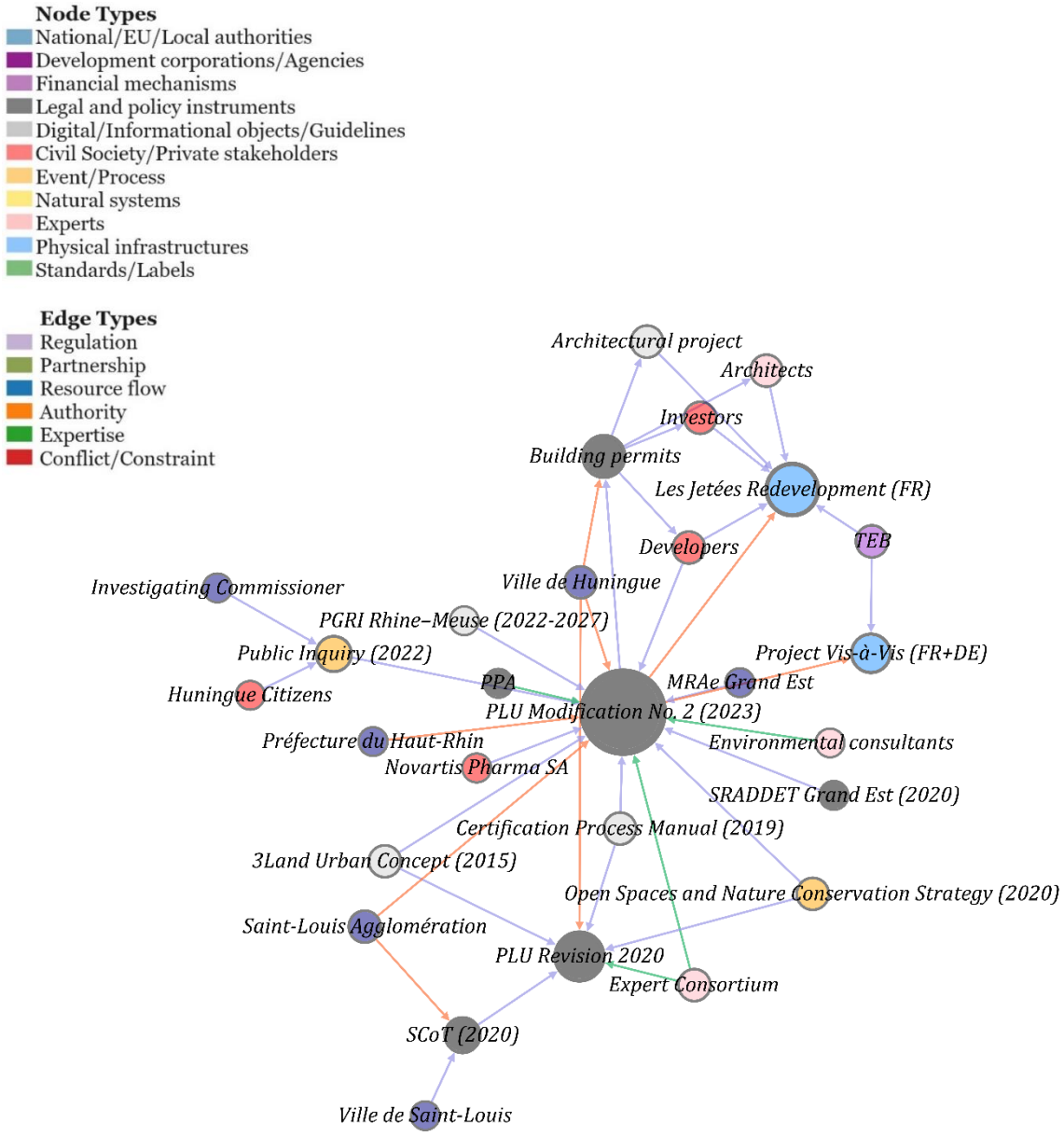


Figure 49: *ANT map of 3Land T7.2. Made by author.*

Network Analysis

The network (Figure 49) revolves around one main node that functions as the main OPP - the *PLU Modification No. 2* (2023). This node translates the wider vision to implementation and regulates in detail new OAPs [10] for the Les Jetées and other redevelopment sectors. *PLU Revision* acts as a problematization node in the network, and it is the second largest legal OPP node. This node consolidates previous orientations (PADD 2019) into binding zoning and regulatory baselines.

Ville de Huningue operates as the central local authority node. There is a small cluster consisting of digital and informational nodes: the *3Land Urban Concept*, the *Certification Process Manual* and the *Strategy for Free Spaces and Natural Reserve Concept* which are inscribing baselines into both OPPs. *Les Jetées* and *Vis-à-vis* are the stabilizators of the network.

Evolution of Key Infrastructural Baselines Across T7.2

On the French side of the development, there was an integration of Rhine flood risk into project design trough explicit measurable requirements in the *PADD Orientations from PLU Revision* (Table 42), that included a qualitative requirement for urban design to internalize risk awareness. By 2023, the *PLU Modification No. 2* and its accompanying *Regulations* (Table 43) and *OAP* (Table 44) documents introduced stricter baselines like sub-soil levels adjusted to water-table dynamics, rainwater infiltration at the plot level, and a two-level limit for underground parking due to groundwater conditions.

AMI dimension evolved from strategic to operational: the 2019 PADD introduced a north-south multimodal corridor, soft-mobility network that would link Rhine and Huningue Canal. Targets for park-and-ride facilities were also defined. Non-measurable baselines referenced the *3Land Transport Study* (2017), prioritized walking, cycling, and public transport, and encouraged short-distance daily travel within the trinational area. Finally in the 2023 modification these goals were stabilized by the Les Jetées project. Quantitative rules limited motorized access and defined minimum road widths. In the OAP, the principal Rhine promenade became a pedestrian-cyclist path with cycle-parking areas and a 15 m-wide Allée des Marronniers as the primary landscaped axis. Qualitative baselines reinforced the priority of soft mobility and the avoidance of transit traffic near the riverfront and Weil-am-Rhein square.

[10] *The Orientation d'Aménagement et de Programmation* (OAP) is a planning guideline within French Local Urban Plans (PLU)

B-GI's early baselines demanded a balance between built and green areas, compliance with the *Schéma Régional de Cohérence Écologique* (SRCE), and defined tree-alignments. By 2023, these ambitions translated into precise ratios: ≥ 50 % permeable surfaces in 1-AUb and 1-AUa, and more than 20 % green space per lot in 1-AUe. The OAP secured an ecological corridor within 1-Aue. Non-measurable baselines required, green buffer zones toward Rue de France, and the continuity of the Rhine's ecological system.

Finally, the 2019 PADD, for the superstructures' dimension, introduced measurable targets for energy reduction and use of low-impact materials while the non-measurable baselines required adaptive reuse, and heritage preservation within redevelopment areas. Next, the 2023 PLU and its OAP introduced detailed numeric constraints for the buildings such as maximum heights ranging from 15 m to 58 m; maximum footprints of 25 % per land unit; and density caps. Additionally, architectural alignment along Quai de la République was required. Non-measurable baselines list harmonious façades, coherent architectural language, and achieving an effect of a gate that would mark the entrance from Rue de France.

Translation 8 (2022 - in progress): Third Planning Agreement

T8 problematized the concretization of baselines connected to implementation of new bridges in the 3Land perimeter. These bridges existed as baselines to optimally connect the 3 cities. Those were the foot-cycle Harbor Bridge between Basel and Weil am Rhein, the foot-cycle and public transport Rhine Bridge between Basel and Huningue and a third foot-cycle bridge on the Swiss side. The first two were set as priorities at these stage (Regierungsrat des Kantons Basel-Stadt, 2022). The tri-national partners signed the third *3Land Planning Agreement* in 2022(Canton Basel-Stadt et al., 2022) which was the interessment device for several workstreams. Some actors were re-mobilized, and new ones were enrolled: PS, GPS, GPL, TEB Secretariat, Basel-Stadt (BVD), Stadt Weil am Rhein, Ville de Huningue, Saint-Louis Agglo/CEA, and transport and ecology consultants. The agreement widened the governance circle and the funding of the works and aims to move the process forward to the pre-implementation phase. As mentioned in the agreement, the actors were enrolled for the development of a *Trinational Mobility Concept* by 2025 which would be a basis for state-specific developments.

A cross-border *Cost-Benefit Analysis for the new Rhine Bridge* (2022) confirmed the bridge as a priority infrastructure within the 3Land perimeter. Creating a design competition for the Rhine Bridge as a new 3Land sub-project was one of the goals of the agreement, so one of the workstreams enrolled actors around its implementation. Although the initial plan was to fix the bridge implementation in the 2022-2025 timeline, the current trinational agreement

was extended to 2028. As Rinderknecht (2025) noted, these plans were overly optimistic, and the parties learned that the process is way more complicated as there was no precedent for building a bridge between France and Switzerland. Therefore, the process was forced into extending the negotiation loop, project's actors were re-defined, and the Rhine bridge process entered a detour phase. This detour did not obstruct the project but redefined the actor-network necessary for its realization. Moreover, another sub-project problematized the variant for the harbor foot and cycle bridge, but the decision was established very soon after, as a result of a feasibility study, so the baselines around this bridge were partially stabilized (Bau- und Verkehrsdepartement, 2023). T8 is a translation that mainly revolves around active-mobility dimension, and even though decisions around bridges have progressively stabilized, the translation and baselines are still open for negotiation.

Chapter Summary

Chronological Overview and Key Turning Points

3Land's redevelopment until 2025 unfolded through eight translations with several sub-translations and many of them have not been fully closed or stabilized. The area's redevelopment was problematized in 2006, and actors were mobilized actors several test-planning steps that produced the *Development Vision 3Land* in 2011 (T1). The *First Letter of Intent* problematized another translation that stabilized with the *First Planning Agreement* in 2012 and the 2015 *3Land Urban Concept* (T2). The *Second Planning Agreement* (T4) problematized the goal of producing tri-national development strategies that would inscribe shared quality benchmarks and positioned the Rhine Bridge as the central 3Land project. Furthermore, T2 and T4 were influenced by another parallel process - the preparation of IBA Exhibition (T3). T5.1-T5.4, T6.1-T6.3, and T7.1-T7.3 illustrate the distributed redevelopment processes in the 3Land parameter that are sometimes aligned with the trinational vision. Pilot redevelopments such as Rheinpark / Vis-à-vis and Les Jetées were analyzed in the study. Finally, T8 occurred when the *Third Planning Agreement* opened new OPPs: launching the Rhine Bridge design competition, deciding the harbor footbridge variant, and preparing a trinational mobility concept.

Evolution of the Four Infrastructures in 3Land (OPPs as baselines and OPP as nodes in networks)

Flood-protection infrastructures

During T1, flood risk was not explicitly considered as much as other baselines, but, nevertheless, baselines connected to re-shaping the river corridor were negotiated. The 2006 *Synthesis Report* problematized making the Rhine an open-space corridor that should remain undeveloped. Thus, the baseline OPP was reserving the riverbanks as non-buildable zones. The first and second test-planning were interessment devices that invited new actors into the network - planners and port authorities. Enrollment and mobilization happened when the actors aligned around the logic of flood safety through spatial reservation of the banks instead of using structural flood protection and produced new planning ideas. MVRDV/Cabane/Josephy team further elaborated the idea of maximizing waterfront exposure by creating the Rhine Island, which was a baseline inscribed in both the 2010 *Test Planning Report* and in the 2011 *Trinational Vision*.

In T2, the open space corridor along the Rhine remained the OPP baseline. Interessment occurred with the signing of the *Trinational Agreement* when new actors were enrolled around the production of a new trinational *3Land Urban Concept* - the new OPP node.

The plan did not introduce new measurable flood-protection criteria, and it left the Rhine Island concept open for negotiation. The OPP nodes of this phase only translated the implicit flood baseline from T1 into a shared planning principle.

During T4, *the Second Planning Agreement* problematized the setting of more technical tri-national baselines in general. Interessment occurred when the agreement set new working groups to develop these baselines. Actors enrolled and mobilized through Working Group 2 and the *Strategy for Free Spaces and Natural Reserve Concept* development process. The strategy consolidated the shared vision, but it still did not lead to binding implementation measures and the baselines connected to hydraulic design were still not inscribed in a stabilizing artifact.

In the distributed implementation process (2011- in progress), some of the advisory documents became embedded into differentiated national frameworks. The problematizations in each of the elaborated translations revolved around embedding their baselines into a new development concept or a statutory document. In Huningue, interessment occurred during the process of the 2019 *PLU Revision* and 2023 *PLU Modification No. 2* (T7.1 and T7.2) which legally codified flood and groundwater management through rules on infiltration, and limited underground parking. The approval of the documents marked the first binding stabilization of the flood-related baselines. In Weil am Rhein, the 2016 *Redevelopment Statute* problematized redevelopment next to the river (T6.2) and the Rheinpark competition became an interessment device that tackled hydraulic safety through the design of the landscape. The opening of Vis-à-vis project was another stabilizing moment for the flood related dimension. Finally, in Basel (T5.1, T5.2 and T5.3) the flood-related baselines remained spatial, procedural, and not yet supported by binding ordinances.

Active-Mobility Infrastructures

During T1, the AMI was problematized in the first OPP node - the 2006 *Synthesis Report* which dedicated the Klybeckquai and Westquai banks to non-motorized traffic. Interessement and enrolment occurred through the coordination of Basel-Stadt's planning department, the port authority, and through the test-plannings where all actors aligned on this baseline and mobilized to do the test planning where the OPP-baseline was confirmed. A second problematization occurred during the test planning by the MVRDV/Cabane/Josephy team with the proposal of new bridges that would accommodate active mobility. New actors enrolled and mobilized around this problem through the second test planning, which produced the 2011 *Trinational Vision*. The vision expanded the idea of non motorized traffic

along the banks of the three countries, which would also be connected to each other with new bridges. This baseline became a defining infrastructural concept of the 3Land area.

In T2, the *Letter of Intent* and the *Planning Agreement* formalized AMI goals, and the creation of a cross-border network of bridges and multimodal corridors became the OPP baseline. Interessment occurred within the sub-projects of the *Planning Agreement*, the second and fourth sub-projects - *Central Bridges and Connections* and *Trinational Masterplan* that aimed to translate those goals into planning concepts. Enrollment and mobilization occurred through the alignment of mobility engineers, planners, and local governments, and the commission of Team LIN for the *3Land Urban Concept*. The concept mapped three bridge crossings (CH–FR, CH–DE, and CH–CH) and a hierarchy of mobility corridors. Finally, the *3Land Urban Concept* was published and the active mobility baselines were partly stabilized and scheduled for realization in phases (2020, 2025, 2030).

During T4, the *Second Planning Agreement* (OPP node) problematized the creation of shared, tri-national mobility standards as technical and quantifiable baselines. Interessement broadened the network and included actors like TEB, IBA Basel, transport consultants, and city authorities. Actors were enrolled and mobilized to create the *Trinational Transport Study*, *3Land Durable Certification Manual*, and the *Strategy for Free Spaces and Natural Reserve Concept*. These documents introduced more precise baselines: a continuous pedestrian and cycling grid, collective parking systems, park-and-ride facilities, and a modal-shift strategy toward soft mobility. However, stabilization of baselines remained partial as the proposed measures were not yet institutionalized or translated into statutory planning system.

In the course of the distributed implementation phase, implementation of active mobility corridors as a priority to the development were problematized in all three countries. On the French side interessment-to-mobilization process occurred through the *PLU Revision* (2019) and *PLU Modification No. 2* (2023) (T7.1 and T7.2). Stabilization of the baselines came with the key node OPPs - the *PADD* and the *OAP* and *Planning Regulations*. These documents legally fixed a north–south multimodal corridor, a pedestrian–cyclist promenade along the Rhine, restricted motorized access, and minimum road widths. First physical stabilization happened with the construction of Vis-à-vis park and the river promenade. In Weil am Rhein, the active mobility dimension followed the same unfolding process as the green infrastructure dimension, following the trajectory of Rhine Park development and its stabilization (T6.2). In both countries, France and Germany, OPP baselines were establishing active mobility connections across the border.

In Basel, the Ex-Esso study brought the first problematization for opening the Rhine riverbank with the goal to establish non-motorized connections to the neighboring countries

through bridges (Development steps 4 and 5) (T5.1). The *Programming Hafenareal Study* (2017) was the first interessment device around this OPP baselines and second OPP node in T5.1. A second interessment device was the *Urban Development Concept* from 2019 (Second OPP node) and the workshops that preceded it. Actors mobilized and created the *Urban Development Concept* - the product from this network. The principles stabilized in the spatial design concepts – a promenade that links Klybeckquai and Westquai and two new bridges prioritizing walking and cycling. The citizen initiative *Hafen für alle* and the 2023 counter-proposal did not debate on mobility baselines, so the discussion on continuous, car free Rhine promenade and new bridge connections ended with T5.1.

T8 was a translation that unfolded parallelly to the distributed implementation phase and exclusively tackled the AMI dimension. Two bridges were problematized; actors were interessed and enrolled through working groups delegated by the third agreement. Baselines were partially fixed (for the CH-DE footbridge), but the translation is still open, and the network has not fully mobilized.

Blue-Green Infrastructures

2006 *Synthesis Report* (first OPP node) (T1) problematized the need for continuous ecological landscapes along the Rhine and positioned the Klybeck–Kleinhüningen area within the regional network of ecological corridors. Maintaining the riverbanks as vegetated zones became OPP baseline. Actors were interessed, enrolled and mobilized around this goal through the successive test-planning studies (2009–2011) – two new OPP nodes. The 2011 *Trinational Vision* which linked the Rhine, Wiese, and Canal de Huningue into a shared spatial system partially stabilized this baseline.

In T2 the sub-projects defined within the *Planning Agreement* further problematized the ecological compensation in the 3Land perimeter. The OPP baseline was achieving a balance between development intensity with environmental protection. The OPP nodes were the *Planning Agreement* itself, serving as an interessment device, and the *3Land Urban Concept*. Interessement to mobilization process occurred as representatives from the three countries, coordinated through IBA Basel, translated local environmental goals and contributed to inscribing them into a joint landscape vision in 2015. The *3Land Urban Concept* spatially defined major green spaces such as the Central Port Park in Basel, the Huningue Quarry Park, and the Green Corridor in Weil am Rhein. Nevertheless, the stabilization of the baselines remained partial as the *3Land Urban Concept* left three spatial options open for negotiation, namely, the Park, Peninsula, and Island scenarios. Each of the scenarios proposed

a different concept for ecological restoration. Therefore, the question remained open, particularly regarding the realization of Central Port Park in Basel.

The *Second Planning Agreement* (T4) explicitly problematized the creation of a shared landscape strategy with specified goals for B-GI for the three countries. The agreement was an OPP node for this translation and acted as an interessment device for a wide actor network that consisted of environmental consultants, municipal green-space offices, and cross-border experts working under the TEB and IBA Basel coordination. The actors enrolled and mobilized around creating the *3Land Durable Certification Manual* (2019) and the *Strategy for Free Spaces and Natural Reserve Concept* (2020) - a new node OPPs where B-GI baselines were inscribed. The manual itself does not define any baselines that would constitute an OPP. However, the strategy reaffirms the objective of establishing ecological corridors along the Rhine, Wiese, and Huningue Canal. These can be considered the OPP baselines for T4.

Similarly, as for the AMI dimension, the statutory stabilization of baselines for B-GI was problematized within three different translations on each side of the border. On the French side (T7.1 and T7.2) and German side (T6.1 and T6.2) the statutory fixing of free Rhine banks and implementation of Vis-à-vis (OPP baseline) was problematized and stabilized by the end of the traced translation. The unfolding of this baseline followed the same trajectory as the AMI baseline. For Basel, the generous renaturation of the Rhine banks was problematized as an OPP (T5.1), and the actors mobilized around this goal through the same trajectory as for the other infrastructural baselines. In 2019, with the *Urban Development Concept*, another OPP baseline emerged: the creation of the Gleispark, which was selected from three earlier options. In this sense, the baseline became stabilized in 2019. Later, the question of B-GI was re-problematized (T5.2); actors were newly enrolled around the objectives of expanding B-GI, so the debate is still left open.

Superstructures

The transformation of the port-industrial riverfront into a livable urban district was first problematized in T1. The baseline OPP in that time was still symbolic: introducing new mixed-use housing and service buildings and establishing relationship with the river. The test planning process interessed, enrolled and mobilized actors, so the baseline was re-framed through each iterative design. The OPP node - the *Trinational Vision* (2011) introduced high-density mixed-use building clusters along the Rhine, and the image of *Living on the Rhine.* The superstructures baselines of T1 were partially mobilized as the vision met public resistance due to its ambitions.

In T2 the re-framing of superstructures as tri-national development mechanism was problematized. Hard baselines were still not established, instead the floor areas and building density were quantified and non-measurable requirements like innovation, heritage preservation and mixed typology dominated. Interessment device in T2 was the *Planning Agreement* and actors were enrolled and mobilized through the sub-projects' working groups, particularly S-p 4, and the work within the team LIN. They acted as mediators that translated these baselines into new artifact – the *3Land Urban Concept* which acted as a new OPP node. In T4 establishing architectural quality across the three countries was problematized. Superstructure baselines shifted towards sustainability standards and IBA, TEB, and representatives from each city were enrolled through the *Second Planning Agreement* (interessment device) to create *3Land Durable* – the OPP node. However, the handbook never fully mobilized actors around its baselines and remained only as advisory tool.

Throughout the distributed implementation phases, in France and Germany (T6.1, T6.2, T63, T7.1, T7.2, and T7.3), making binding regulations for superstructures in the redevelopment zones was problematized. In France, the OPP as a node was the OAP *Secteurs à urbaniser*, which made binding rules for building height, density, and façade design, which were the OPP baselines for the French side. The Les Jetées redevelopment was the interessment device around which actants enrolled and mobilized. Stabilization of this process is slowly unfolding as the first buildings on the French side, and first superstructures in the 3Land area, are being finished one by one. In Germany, the interessment was made around renovating existing buildings in the redevelopment zone (the OPP baseline for Germany), enrollment and mobilization of private homeowners, engineers, and subsidy funds was done, and with the renovation of buildings, the stabilization of the redevelopment is expected to end in 2025.

The process of stabilizing superstructures in Basel seems to unfold at the slowest rate. During T5.1, the *Ex-Esso Study* (2013) problematized a dense urban form and its co-existence with port identity. The OPP baseline was maintaining visual links to the river and the industrial image. The *Programming Hafenareal Study* reframed this through interessement in *acupuncture planning*. Enrolment and mobilization of actors occurred through coordination between the canton, SRH, and local stakeholders. Partial stabilization occurred in 2019 when the *Urban Development Concept* was introduced, in which these parameters stabilized as design rules. Later, the network was re-problematized with the initiative *Hafen für Alle*. This detour did not allow the network to fully stabilize; it tackled the density baseline for the superstructure dimension, so it remains open for negotiations.

Influential Actants and OPPs in Network Dynamics

The network during T1 was consisted mostly of actors from the Swiss side. The *first test planning* - first OPP, and *second test planning* as *process* actants are the anchors of the network which was fed by nodes such as local authorities, legal instruments, earlier studies and the private sector. Another powerful human actor for the network was the *Kanton Basel Stadt* which authorized most other actors. The test plan designs, the design teams and the *Port and Urban Development Synthesis* from 2010 serve as mediators that help mobilize the ideas into the *Development Vision 3Land* in 2011. T2 and T4 merged actors from all three countries in order to formalize the joint planning. During T2, the network became more distributed. It was anchored by the *Letter of Intent* (2011) and the *First Planning Agreement* (2012), as OPP nodes. These documents led to formalizing planning ambitions between countries. The *Planning* Agreement also activated working groups that worked on different sub-projects. *Sub Project 4* - the working group focusing on masterplan development, was a second OPP, positioned in the center of the network. The network stabilized in the production of the *3Land Urban Concept* (2015). By T4, a new OPP emerged through the second *Planning Agreement* (2016-2020), which expanded the network to include actors like *Saint-Louis Agglomeration*. The *Trinational Transport Study* (2017) and *Strategy for Free Spaces and Natural Reserve Concept* (2020) acted as informational OPPs that stabilized the intentions of the network created.

In the distributed implementation process, the actors from each country worked on their side of the border. For Switzerland, the network for the redevelopment of Klybeckquai and Westquai was analyzed (T5.1 and T5.2). The OPPs for that network were informational objects such as the *Ex-Esso Study* (2013), the *Programming Hafenareal Study* (2017), and the *Urban Development Concept* (2019). In France (T6.2), the OPPs hardened into statutory and regulatory gates. The *PLU Revision* and the *PLU Modification No. 2* in Huningue became the central OPP nodes. *PLU Modification No. 2* was the most significant as it incorporated results from *Environmental Assessments* (2023) and black boxed the *OAP 2*-Aue. In Germany, the *Rheinpark implementation process* (T7.2) was the largest OPP node that anchored the stabilization of the network. *City of Weil am Rhein* also acted as one of the central OPPs. Across 3Land, OPPs evolved from visions to procedural agreements, technical and ecological guiding instruments, and finally statutory frameworks. Nevertheless, as the networks take shape in parallel, there is not one established timeline for how the OPPs develop. Stabilizations occurred earlier for Huningue and Weil am Rhein, but for Basel, the OPPs still remain symbolic and conceptual. Recurring human OPPs are *Basel-Stadt*, *Stadt Weil am Rhein*, and *Ville de Huningue*, which obviously sustain the coordination across national systems.

5. COMPARATIVE ANALYSIS OF CASE STUDIES

5.1. General Comparison of the Cities

Hamburg is one of Germany's three city-states with a population of around 1.9 million, known through history as a global port city. The Elbe River plays a central role to this identity. Elbe is a tidal river that is directly connected to the North Sea, which provided Hamburg to rise as a Hanseatic trading center and later as one of Europe's largest container ports. Although the river provided the economic position to the city it is also its vulnerability - representing both an opportunity and a risk. The urban area positioned outside the dike line is almost permanently threatened by storm surges and tidal flooding. Most dramatical was the 1962 flood disaster. The river drove the expansion of port infrastructure which later created extensive zones of industrial areas with warehouses to become brownfields. The unpredictability of Elbe at the same time forced Hamburg to seek innovative solutions in flood engineering and risk governance, and to embed structural resilience measures into its urban planning framework. Today, the riverbank is a stage where Hamburg builds its image as a resilient and innovative *city on water*.

Heilbronn is a mid-sized city with a population of 125,000. It is located in Baden-Württemberg, along the banks of the Neckar River. Compared to Hamburg, Heilbronn has a distinct historical trajectory. Instead of global maritime trade, Heilbronn's economic growth was tied to integration with the surrounding region's productive landscape and small-scale industry. The Neckar river's hydrological dynamics are less extreme than those of the Elbe and the river posed less of a threat to the city. Neckar was regulated in a canal-like waterway and for much of the twentieth century, the river served primarily as a channel and transport corridor. During that period the city has turned its back to the river and the industry occupied the main riverfront areas. By the end of twentieth century, Heilbronn sought to reclaim the Neckar as an asset, opening its banks to the river as public spaces and by integrating them into broader green networks. The river for Heilbronn also became a means of restructuring the city's identity and providing amenities that can attract new residents and visitors.

Basel as the largest city in the trinational agglomeration presents a distinctive model from the other two cases. With around 200,000 inhabitants, it is smaller than Hamburg. However, its pharmaceutical and chemical industries, and strategic position on the Rhine makes it more globally connected than Heilbronn. The Rhine River secured Basel's position as an inland trade center throughout history. It connected Basel to the North Sea and in the nineteenth and twentieth centuries industrialization enforced Rhines's role as a corridor of

production and industry. Unlike Heilbronn, Basel built a strong tradition of urban life along the river with its banks shaped by promenades and bridges and integrated the river into everyday urban life, to the point where swimming in Rhine's waters became a part of the city's culture. As the agglomeration spread across three countries, the river became a dividing line as much as it was a shared resource.

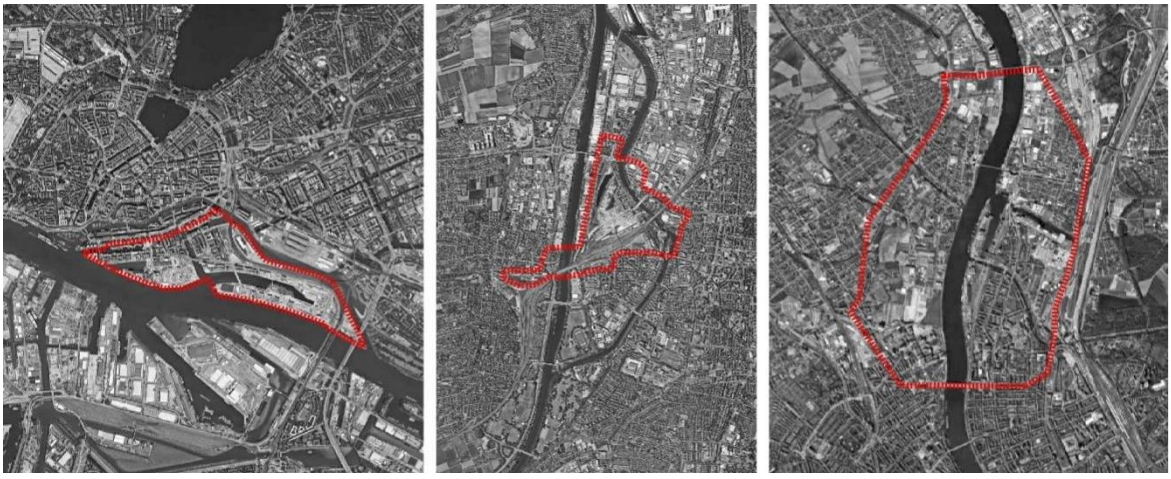
Weil am Rhein is a much smaller city of around 30,000 inhabitants located on the German side of the Rhine, directly across from Basel. Historically, the city's identity was less tied to river trade than Basel. However, the city has not maintained a relationship with the river until 2007 when the construction of the Dreiländer Bridge symbolically reconnected the city to the river and to the other side - Huningue. Huningue, is a city on the Rhine, on the French side, with a population of about 7,000. The city, historically, oriented itself inland rather than to the Rhine. In the past two decades, redevelopments of brownfields have transformed parts of the waterfront. For Huningue, the Rhine today serves as a symbolical and physical connection to Basel and Weil am Rhein.

When compared side by side, these three cities illustrate how the river can shape urban trajectories in distinct ways. In the case of Hamburg, Elbe linked the city to global maritime networks, but at the same time it exposed the city to flood risks. In the case of Neckar in Heilbronn, regional industry was tied by the river which was neglected for a long time and recently rediscovered. In the tri-national Basel agglomeration, the Rhine has always been an economic artery, but also a boundary - connecting but separating the three cities. While Basel strongly built its connection to the river, Weil am Rhein and Huningue turned away from it.

5.2. Comparison Between the Case Studies

Hamburg's HafenCity is one of the largest inner-city redevelopment projects in Europe. The redevelopment area covers 157 hectares which encompasses former port and warehouse land directly next to the historic Speicherstadt and in proximity to the city centre (Figure 50-a). The site is characterized by its exposure to tides as it lies outside the main Hamburg dike line which makes it directly vulnerable to storm surges from the Elbe. This risk shaped the concept of redevelopment and led to the adoption of the warft solution and adoption of a special Flood Protection Ordinance. The specific location of the site made the transformation a technical challenge, but also a symbolic project and a laboratory for innovation that played a significant role in the branding of Hamburg.

Neckarbogen redevelopment area in Heilbronn, is comparatively much smaller in scale - about 40 hectares (Figure 50-b). The site along the Neckar was formerly industrial land, long separated from the urban core by rail infrastructures and warehouses. Flooding is not a dominant risk in the area, and the focus of the project was reconnecting the city to the river and integrating green and blue infrastructural systems as ecological amenities. The 2019 BUGA played a crucial role in the process because it framed the site as a temporary exhibition ground and as a permanent urban district. This gave Neckarbogen a chance to position itself as a model for sustainable living which is shaped by, cooperative housing, and innovative public space design.



a) **b)** **c)**

Figure 50: *Case study sites of riverfront redevelopment projects. a) HafenCity, Hamburg; b) Neckarbogen, Heilbronn; c) 3Land, Basel-Weil am Rhein-Huningue. Satellite imagery, edited by author*

The 3Land project is larger in area than both HafenCity and Neckarbogen, covering approximately 430 hectares, yet its scale is fragmented instead of a single compact brownfield. The area of the project stretches across the trinational border and encompasses disused port areas in Basel, industrial zones in Weil am Rhein, and residential districts in Huningue (Figure 50-c). The fragmented areas were bound together by the vision to transform the trinational border zone into a coherent urban landscape. What primarily makes this project different from Hamburg or Heilbronn, where development is led within one political system, is that 3Land is coordinated across three national planning frameworks. The site's symbolic weight also lies in overcoming national boundaries and turning the Rhine from a dividing line into a joined metropolitan territory. Therefore, the key challenge of the project is accessibility, so new bridges and transport links were required to stitch together fragmented urban fabrics.

The logic of these transformations reveals three distinct approaches: HafenCity - a port-to-resilient city on water, Neckarbogen an industrial area-to-park-led project, which

used a national garden show as a catalyst; and. 3Land is a border-to-tri national metropolis project.

Comparison Between Development Strategies

HafenCity utilized a strategy of phased and contract-based urban expansion that was characterized by strong institutional centralization (Figure 51-a). The city of Hamburg established HCH as a development corporation which was exclusively dedicated to making decisions about redevelopment and consolidating land ownership. Additionally, the strategy relied on selling parcels to private investors under strict conditions defined by HCH. These conditions consisted of embedding requirements for flood protection, fulfilling sustainability certifications criteria, and public space provision directly into the land-sale contracts. This strategy provided a highly formalized model where quality is secured through binding instruments such as the HafenCity EcoLabel and contracts. The strategy also reflects Hamburg's position as a global city where redevelopment is used as a tool to attract international investment and increase city's competitiveness.

Neckarbogen followed an event-driven strategy (Figure 51-b). In this case, the municipality, through its housing and land company Stadtsiedlung Heilbronn GmbH, retained ownership of most of the site which gave it stronger leverage to shape the outcomes. The 2019 BUGA provided a tighter deadline for the first stage of the construction, but it also offered a showcase and an opportunity for innovative engineering solutions for the housing

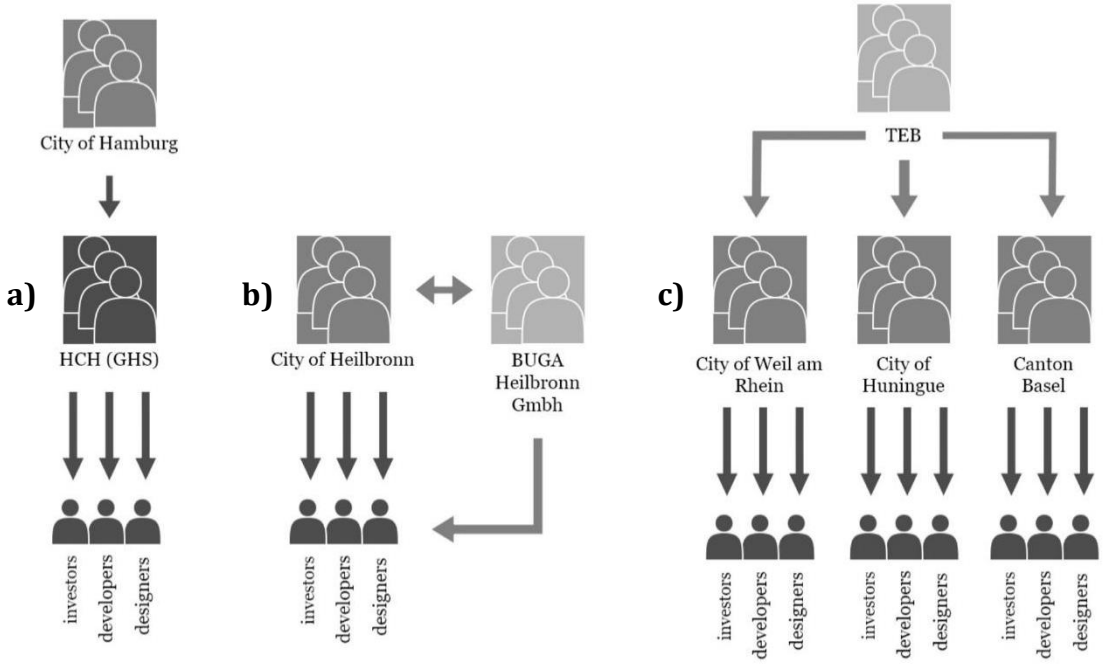


***Figure 51**: Governance structures and development models in the three case studies: (a) HafenCity, (b) Neckarbogen, and (c) 3Land. Made by author.*

units, accompanied by green infrastructure, and public spaces. This case was different from Hamburg - instead of relying on contracts with global investors, the city supported a mix of cooperative housing. The quality was ensured through competitions, municipal supervision through design manuals and building commissions. The result of this strategy was a more experimental and community-oriented development. The redevelopment is comparatively smaller than HafenCity in area but was equally as important for the city and tailored to the scale of a mid-sized city which aimed for local regeneration and identity-building.

The 3Land project is a cross-border strategy, where coordination across national systems is the central challenge (Figure 51-c). The difference from Hamburg or Heilbronn is that no single institution holds control over the process. Each of the cities within the area retains their sovereignty, and the TEB and IBA provided a framework for alignment of the interests of the three sides. The development strategy here deals less with fixed instruments and frameworks and instead focuses more on trinational strategies that define the baselines for open spaces and green infrastructures and criteria catalogues that ensure quality for the buildings.

When compared together, these three strategies showcase the influence of the different scale and different governance structures on redevelopment processes. Hamburg is a market-oriented but firmly regulated and centralized model; Heilbronn illustrates a municipally controlled and event-oriented model. Basel's 3Land, shows a cooperative model, where redevelopment is inseparable from the task of aligning national systems and overcoming political boundaries through negotiations. The differences between the redevelopment strategies clearly illustrate that riverfront brownfield redevelopments are profoundly conditioned by the institutions and political cultures and ambitions of the cities involved.

Comparison Between the Timelines

The three cases differ in their temporal structure and pacing of the projects (Figure 52-a). HafenCity's redevelopment unfolded in a period of over more than three decades. The first discussions about the project in the early 1990s were exploratory and were stabilised by early feasibility studies and development concepts (T1). The early steps transformed the idea of relocating parts of the port into a concrete vision for an urban district which was later consolidated in the 2000 Masterplan - the first major turning point (T2). In 2002, the FlSchVO codified the warft principle and ensured that the district could coexist with the tidal Elbe outside the main dike line. From this point onward, the project developed through many parallel phases where new B-Plans were introduced for separate districts, followed by the

implementation of the districts (T3). Construction proceeded incrementally, with each completed district becoming not only a physical realization but also a testbed for the unfolding development and tightening of the baselines (T3-T10). Over the following years, new layers of new requirements and baselines were introduced - sustainability was formalized through HafenCity EcoLabel in 2007 (T4) which later aligned with DGNB certification. Parallelly, social requirements were addressed with the introduction of affordable housing quotas in 2011 (T8). A revised Masterplan in 2010 adjusted building densities, programs, and open-space concepts (T5, T6). The timeline of HafenCIty reflects the logic of a phased megaproject - a long-term institutional commitment, adjustment of standards, and the gradual implementation of physical infrastructures and new regulatory mechanisms.

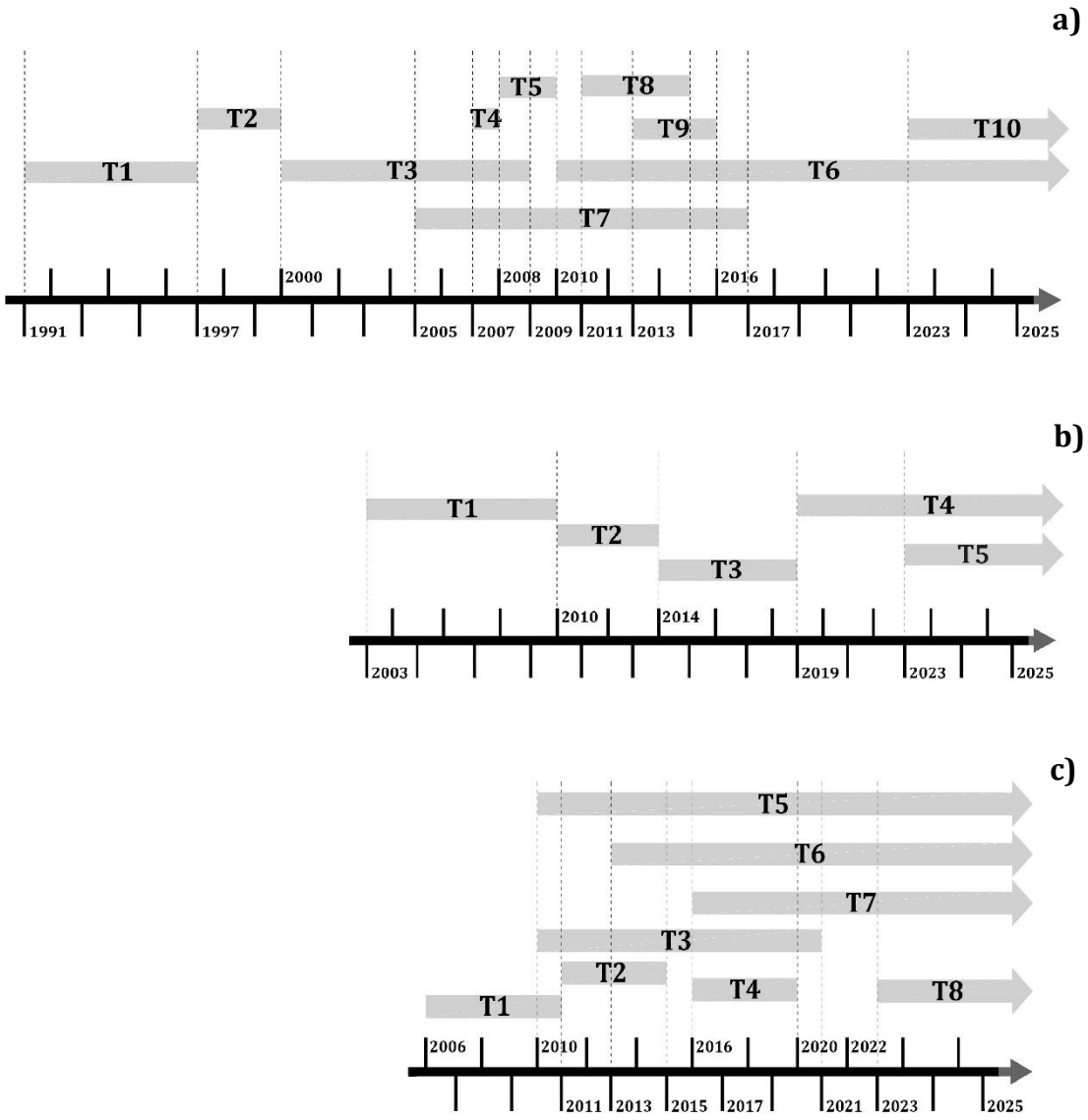


Figure 52: *Comparison of the temporal structure of the three case studies, illustrating the sequencing, duration, and overlap of translations (T1–Tn): (a) HafenCity, (b) Neckarbogen, and (c) 3Land. Made by author.*

The Neckarbogen redevelopment followed a much more compressed timeline compared to HafenCity (Figure 52-b). Conversations about transforming the former industrial lands along the Neckar began in the early 2000s, but a turning point came when Heilbronn secured the right to host the 2019 BUGA in 2005 after which the planning intensified (T1). From 2008 to 2014 there was an intensive planning process that constituted two successive masterplan competitions, the first one defining the framework plan the second refining it and integrating it with the vision for BUGA (T1, T2). Finally in 2014 the city formalized its strategy with the *Integrated Urban Development Framework*. Compared to HafenCity's gradual and decades-long phasing, Neckarbogen's unfolding was compressed into a series of rapid steps. In a period of five years contaminated soils had to be remediated, infrastructure installed, and large portions of the public spaces completed before the 2019 exhibition which, itself, served as a live demonstration of the new district (T3). After 2019, the project entered a second, slower phase of implementation of other plots (T4). Design quality was ensured through architectural competitions, a design manual, and sustainability standards that ensured innovation even after BUGA.

The 3Land project has unfolded through the slowest and most fragmented timeline out of the three cases (Figure 52-c), which reflects both its complexities of cross-border governance. The 3Land vision began to take shape in the 2009 – 2010 (T1). In 2011, the adoption of the *Development Vision 3Land* and the first trinational planning agreement in 2012 provided an initial framework, but implementation at that time was more about building consensus than delivering physical infrastructures (T2). The 2015 *3Land Urban Concept* was a milestone as it introduced shared spatial strategies for the whole 3Land area. In contrast to HafenCity's immediate focus on providing statutory baselines for project implementation or the tight exhibition deadlines for Neckarbogen, 3Land's timeline advanced through successive studies, agreements, and pilot projects. The studies, strategies and design frameworks addressed cross-border accessibility, ecological and recreational goals and building quality of the whole area. On the other hand, isolated interventions appear as pilot projects within the fragmented territory. The process continues with new updated planning agreements, yet every step requires lengthy negotiation among Basel, Weil am Rhein, and Huningue, as each is operating under distinct national planning systems and political agendas.

> It's a process that is going on; it's partly achieved… we want to build this bridge over the Rhine, which is a very long-term project; it will take at least 20 more years… It's not financed yet." (Interview 3, 2023)

In contrast to the previous cases, 3Land exemplifies a timeline without a fixed endpoint. Its process is not measured by single event, but accumulation of trinational

agreements and the gradual alignment of planning cultures, meaning that the timeline is about maintaining a delicate process of achieving consensus on a variety of goals.

The three timelines reveal clear contrasts. HafenCity is an image of a long-term, phased megaproject, which is structured around institutional continuity and sequential tightening of baselines. Neckarbogen illustrates a deadline-driven project, where an event accelerated the planning and construction into a short timeframe with successive translations, after which development continues more gradually. 3Land represents an open-ended process, where progress depends on negotiations and alignment across three countries and is not that dependent on fixed deadlines.

5.3. Cross-Case Reflections

Comparison of Power Dynamics Across Distinct Translation Phases

Initial Visions

HafenCity began in the early 1990s with feasibility studies which already placed the local Hamburg government in a strong central role. In T1, the network was structured not around statutory, but still, decisive OPP: the *HafenCity redevelopment vision* proposed by prof. Volkwin Marg and adopted by the Hamburg Senate (1997). The initial visions phase was not elaborated in this dissertation to trace the power dynamics, so the whole network is pointilized into this one OPP.

Neckarbogen developed its early vision within the framework of the BUGA 2019 application, which corresponds to a part of its T1 translation. The *Planning and Building Law Office*, the *Heilbronn City Council* and the *Mayor* were key human actors since the first feasibility study was introduced. The Main OPP node in this network that is also representing the initial visions phase is the *BUGA Feasibility Study* from 2005.

For 3Land, the initial vision phase was the most complex and fluid. The whole idea was initiated by Swiss actors but later expanded into a trinational collaboration. The Canton Basel's authorities appear more central to the network at this stage than Weil am Rhein and Huningue. The vision slowly expanded its area expanding the actor network and power became negotiated across borders and institutions, but *Canton Basel-Stadt (BVD)* remained the main human OPP. 3Land's *vision* phase shows a more distributed network, where power is also fragile - without a strong legal stabilizer, so the vision was still open for negotiations. The largest node of T1 network is *First test-planning for Basel-Nord (2009)* which appears as the main non-human OPP.

The initial vision phases in all three cases (T1) were important for setting the tone of actor constellations early, but not the way power was distributed later. In short, the three projects illustrate three archetypes of power dynamics for the initial vision: a centralized power dynamics for the agenda setting in HafenCity, a municipal vision aligned to the BUGA application in Neckarbogen, and a vision initiated in Switzerland, gradually taken up by French and German partners in 3Land.

Process of Development of the Planning Frameworks

During the *masterplanning* phase visions were translated into more concrete planning frameworks, and the distribution of power was reconfigured.

In HafenCity the process of masterplan development happened during T2, and it was framed as one translation. The document for the *Masterplan Concept*, later translated into masterplan brief, acted like the OPP. This artifact aligned human actors such as *Hamburg Senate*, *GHS/HCH*, engineers, *port and rail authorities* with non-human actants such as *Hydro-Numerical Storm-Surge Study*, the *Target-Elevation guideline*, the *City-and-Port Special Fund/Act*, *contaminated soils*, *existing quays* and *basins*, and the warft model and inscribed those elements into a coherent development script. In that period power was concentrated in local authorities' hands, particularly through the *Senate*, *B-Stadt* and *GHS/HCH*. Private sector actors were included through expert symposiums, but civil society remained peripheral at this stage. Thus, power dynamics for HafenCity during T2 was top-down and centralized. The *2000 Masterplan* was the key stabilizer of this network.

For the Neckarbogen case, the planning process unfolded in two translations. The first competition process (T1) resulted in a *Framework Plan* that stabilized the overall spatial structure and mobility baselines. The second competition, focused on the open space (T2) and the attention was shifted toward ecological ambitions that linked the district to the BUGA. Both competitions produced nodes that became OPPs for the process toward the *Integrated Framework Plan*. Thus, Neckarbogen's OPPs were iterative and layered: first the *Neckarvorstadt Competition Brief*, the *Framework Plan 2010*, *Urban Design Plan 2013* and finally the *Integrated Framework Plan* 2014. Each of them progressively filtered the infrastructural baselines. Key human OPP in T1 remained *Heilbronn Planning and Building Law Office*, which remained powerful in T2, but in that translation it shared the power with *BUGA Heilbronn 2019 GmbH*, *SINAI GmbH* and *Machleidt GmbH*.

3Land reached its *masterplanning* stage with the process of development of the 2015 *3Land Urban Concept* by LIN (T3) which formalized earlier visions into a shared spatial plan. The first *Planning Agreement (2012)* mobilized *Sub-Project 4* group that worked toward

developing the masterplan and these nodes were the largest non-human nodes in T2 network. Unlike the two previous cases, no competition was held to align the constraints (existing infrastructures, natural systems, or laws) and all the discussions went through this working group where the power was distributed across three municipal authorities which appear as the three largest human nodes in T2 network. The process was coordinated through TEB and IBA, with planners and designers serving as mediators between the three political sides and the plan.

Comparatively, the three cases show different configurations of power during the phase of masterplan delivery. In HafenCity the *Masterplan Concept* (later translated into masterplan brief) acted as a single OPP which centralized the power and aligned legal, infrastructural, and natural actants into one binding script. Local authorities also appeared as key human OPPs in the network. In Neckarbogen iterative OPPs hold the network together - competition briefs and the framework plans. Power was more distributed across those non-human actors and municipal authorities and BUGA agency. In 3Land, power was dispersed among human actors across the three municipalities, while power also became centralized in the *Planning Agreement* and *Sub-Project 4* - the key non-human OPPs that kept the trinational vision in motion.

From Masterplans to Statutory Alignment and First Infrastructures

In HafenCity, 2000 Masterplan was translated into binding B-Plans from 2001 onward, beginning with Am Sandtorkai / Dalmannkai district (T3). Power consolidated around HCH, who used B-Plans and land-sale contracts to lock in technical baselines. Design firms played role through the built artifacts, but their influence was confined to interpreting rules already codified by HCH. The first artifacts thus confirmed centralized control and made statutory codification the dominant OPP for subsequent development. The B-Plans and HCH constituted the most powerful nodes in the network, followed by AmtV/LSBG and the land-sale contracts as secondary OPP nodes.

Neckarbogen also moved from the *2014 Integrated Framework Plan* into *statutory B-Plans* which at the first stage were tied to BUGA 2019 – *BP 19/18* and *BP 19/16* Plans. Power was more distributed than in HafenCity: B-Plans translated the Integrated Plan and served as a further basis for implementation: investor selection procedure, building permits, architectural competitions - all subsequent OPPs that stabilized into artifacts. The City of Heilbronn authorities and coordinated the planning, but external actors also retained influence. Power dynamics in T3 were therefore shaped by statutory planning, design expertise, and institutions that led the event.

3Land experienced the most dispersed translations. No development company emerged to centralize the authority (like in HafenCity), instead, the masterplan functioned as a weak OPP, and the process was coordinated by TEB. Power remained dispersed and fragile, requiring constant renegotiation, so few iterative agreements were signed (in 2016 and 2022). No single OPP stabilized across the trinational development area, and first statutory documents emerged in Germany and France, while in Basel, the negotiation is still present and is expected to stabilize in 2026 with the approval of the *District Development Plan*.

> "It's more of a political and then planning process… at a higher level, it's strategic planning, cooperation" (Interview 3, 2023)

The distributed networks show different kinds of OPPs for each side. For Basel side, test plannings appear as largest nodes in the network (T5.1) – *The Ex-Esso Study* (2013), the *Programming Hafenareal Study* (2017), and the *Urban Development Concept* (2019). In Weil am Rhein the *Rheinpark Competition* with the *Process of Rheinpark Implementation* are the main non-human OPPs which show the fast implementation on that side of the border. Finally, in Huningue the *PLU Modification No. 2* acted as a key node in the network. The municipal authorities on the three sides remain as main human OPPs.

This section illustrates how authority crystallized differently across the cases. In HafenCity, the power dynamics were centralized with HCH and AmtV/LSBG as the key human nodes in T3. Neckarbogen illustrates a similar, but more hybrid, model, in which Heilbronn Planning and Building Law Office and BUGA Heilbronn 2019 GmbH were the main human OPPs in focus. In both HafenCity and Neckarbogen, the B-Plans act as the main non-human OPP. 3Land illustrates the dispersive power dynamics of cross-border projects, where translations into artifacts unfold slowly and are symbolic and uneven, as each partner contributes with a different weight. In the dispersed implementation phase, municipal authorities remain the human OPPs, while the non-human OPPs take up a different form. In Basel, test planning and its outcomes are central to the process; in Huningue, the statutory documents are key enablers of the redevelopment, while in Weil am Rhein, the implementation process advanced faster, so the competition and implementation of Rheinpark are central actors.

Comparison of the Development of Flood Infrastructure Baselines

HafenCity represents the most formalized and technically codified approach for flood infrastructures. From the early 1990s (T1), the warft concept was the central engineering baseline - even the early vision stage already carried a measurable parameter: the +7.5 m NN warft model. This was locked into law in 2002 with the FlSchVO which later directly influenced the first round of B-Plans that required plinth elevations, escape routes, and

watertight construction details (T3). The land-sale contracts stabilized the requirements further by obliging private developers to co-finance the flood mound system.

Neckarbogen followed a slower, incremental trajectory, where flood baselines were not prioritized and were gradually integrated into statutory documents. The systems around the Karlssee, Floßhafen, and *Wassertreppe* (water stairs) at BUGA Heilbronn are part of an integrated stormwater management concept that consists of several elements: the retention lakes act as open water bodies that store runoff, planted filter basins clean polluted street runoff before it enters the lakes, and pump stations and circulation loops that recirculate water between the lakes and the Wassertreppe. This infrastructure serves as flood retention, water purification, ecological improvement, and recreational functions. Furthermore, BP 19/18 (T3) fixed HQ100 flood lines at the Altneckar embankment, excluding building in the flood zone, while subsequent BP 19/22 raised the flood line to HQ200.

In contrast, the 3Land project illustrates a very different trajectory in which flood protection remained largely absent. Although the Rhine was symbolically reimagined as the backbone of the trinational urbanity, neither the first *Planning Agreement* from 2012 (T2) nor the 2015 *3Land Urban Concept* (T3) inscribed measurable flood-resilience requirements. The Rhine banks were planned to be free of construction. Fl-I on the Basel side is still negotiated indirectly, through landscape, rather than as a hard technical baseline. *PLU Modification No. 2* defines the flood zone that should not be built on. On the German side, the Rhine Park is built.

> "Flood resilience is not a matter in that project. It's simply not… here in Basel, it's not such a risk… We don't have floods. No, it's not another risky situation because the river is not like in Cologne or in Rotterdam." (Interview 4, 2023)

Comparison of the Development of Active-Mobility Infrastructure Baselines

HafenCity integrated AMI baselines incrementally. The 2000 Masterplan (T2) envisioned a walkable waterfront district, well-connected to the city center through multiple bridges. In the following years, B-Plans (T3) codified these visions - promenades along the water and elevated escape routes on the warft level that doubled as pedestrian corridors. By this, active mobility was embedded in public space design, but also as a safety infrastructure. Over time, active-mobility baselines were integrated into building plots through EcoLabel criteria (T4) the label introduced measurable standards like maximum car-parking ratios, mandatory bicycle storage, and modal-split targets which contractually binded private developers and investors. Active mobility dimension in HafenCity was never as dominant as flood protection, but it was anchored very early into a quantifiable dimension.

Neckarbogen positioned AMI as a visible structuring principle from early visions. First *Framework Plan* and the 2014 *Integrated Framework Plan* (T2) already envisioned a reduced car traffic in the district, introduced the closure of Kalistraße, riverside promenades, and continuous cycle paths linking the quarter with Wohlgelegen and the city center. Subsequent B-Plans, such as *B-Plan 19/18 Neckaruferpark* (T3) turned the visions into obligations and required specific design solutions for these infrastructures (water-permeable surfaces, avenue planting along foot and cycle paths and laterally drained surfaces). With this plan the Neckaruferpark promenade doubled as a recreational area and an important mobility corridor. Active mobility baselines were embedded into building plots as well, through DGNB pre-certification and the *Design Manual* (T3, T4) which set measurable baselines for active mobility and maximum car-parking ratios but was not contractual like HafenCity,

3Land demonstrates the earliest and strongest focus on AMI. The 2012 *Planning Agreement* (T2) explicitly fixed a Rhine pedestrian and cycle bridge and a harbor cycle bridge as sub-projects. The 2015 *Vision for Territorial Development* (T3) introduced new cross-border bridges (CH-FR, CH-DE, CH-CH) and declared Rhine banks car-free. The *3Land Urban Concept* also introduced parking strategies to suppress motorized use on the Rhine Island. Throughout the first translations, non-measurable baselines framed bridges as symbols of trinational collaboration and integration, and the measurable baselines fixed specific infrastructure projects and modal split goals. Compared to HafenCity and Neckarbogen, 3Land's active-mobility dimension was loaded with cross-border symbolic meaning (T3), which made it the most powerful driver of the redevelopment narrative.

Comparison of the Development of Blue-Green Infrastructure Baselines

HafenCity framed B-GI as secondary to flood safety and superstructures baselines. In the 2000 Masterplan (T2), pocket parks appear but are subordinated to the warft flood-protection model. The green spaces served more as amenity and branding than for ecological performance. B-Plans fixed non-buildable areas as public green spaces and set tree planting quotas and greening percentages. Blue infrastructure's functions were minimal - the 2000 plan preserved the existing port basins (Sandtorhafen, Magdeburger Hafen, Baakenhafen), but they were attributes for urban identity, imagined more as amenity water surfaces than ecological systems. The waterfront was seen as an industrial legacy, not as an ecological corridor.

> "… we're talking about a highly artificial and industrial environment… I think it's not really the right spot. If we look back into history, those quay structures don't really allow for a lot of re-naturalization. But what happened was really adding a great number of public spaces and green spaces within the project." (Interview 1, 2023).

There were two enforcement layers that stabilized the B-GI baselines into obligations for private plots. First, the B-Plans (T3, T6) quantified greening through roof-greening mixes, defined substrate depths and tree quotas. B-GI baselines were also tied to microclimate and retention goals. Clauses from B-Plans required rainwater from plots and roads to be discharged directly into harbor basins or the Elbe (HC1, HC4, HC6, HC9, HC11, HC13, HC14). Secondly, the EcoLabel criteria which became obligatory from 2010 (T6), contractually obliged developers to provide B-GI baselines. Through the label rules, developers had to provide roof greening, nature areas had to be biodiversity oriented, and use of native species and avoidance of use of pesticides was required.

Neckarbogen embedded B-GI early as a driver of the redevelopment, largely due to the BUGA 2019 ambitions. Test-planning and the 2014 *Integrated Framework Plan* (T2) already defined the green-blue structure of the quarter which consisted of Kraneninsel, Seepark, Neckaruferpark and north-south green corridor system which were backed by WSUD elements like the city lakes, street drainage system, courtyard and roof greening. BP 19/18 (T3) designated the riverbank park as public green space where building was prohibited because of the flood zone, imposed planting rules with native species, and quantified ecological compensation through eco-points.

Subsequent B-Plans - BP 19/16 and BP 19/22 (T3-T4) fix the B-GI baselines into the building plots. BP 19/16 sets quotas of ≥2/3 green roofs, intensive planting over garages, planted open areas, ≥1 tree/500 m^2, specified native-species palettes and bans on artificial turf/invasive plants. BP 19/22 sets courtyards as communal gardens, quotas of ≥75% green roofs ≥1 tree/200 m^2, and insect-friendly lighting for plots, alongside the public blue-green landmarks such as the peninsula park and the water playground at Floßhafen. Non-measurable statements from the B-Plans also framed B-GI as the *new face* of the district. The *Design Manual* for the building plots complemented the B-Plans by setting more detailed technical baselines for B-GI: number of trees per courtyard, their sizing and distancing, baselines on the species preferred, more than 75 % of roof area greened etc. The manual frames vegetation as a *structural design element*, coordinated planting palettes for a consistent identity of the quarter, encouraged climbing plants etc.

For the 3Land area, B-GI was addressed from the very beginning - the 2011 *3Land Development Vision* and 2012 *Planning Agreement* (T1-T2), frame green corridors along the Rhine, Wiese, and Huningue Canal as the backbone of a trinational landscape system.

Measurable baselines on B-GI remained vague at first, but the 2015 *3Land Urban Concept* (T3) progressively inscribed biotope connectivity, habitat protection, and car-free banks. Unlike HafenCity and Neckarbogen, 3Land did not employ eco-points or certification

to quantify ecological baselines; instead, it relied on spatial zoning and symbolic positioning of the Rhinefront as shared landscape infrastructure.

Comparison of the Development of Superstructure Baselines

Baselines for the superstructures, clustered into broad categories related to flood and water infrastructure, energy and carbon, mobility and accessibility, materials and circularity, biodiversity and microclimate, and social and governance clusters. Since AMI, Fl-I, and B-GI are discussed in dedicated sections in this research, the focus in this section will be on energy and carbon as well as materials and circularity in relation to superstructures, with the remaining categories only highlighted where they play a significant role.

For HafenCity case, a vision of mixed-use urban quarters with high architectural quality was established in the early phases - in the 2000 Masterplan (T2). In HafenCity, the superstructure baselines were stabilized by the tendering process itself. Here, HCH played the key role. The requirements for the first implementation were mainly set by the FlSchVO in 2002 and the B-Plans. During T3, the first implementation stage, baselines were enforced through land-sale contracts, which bound developers to follow provisions set by the Masterplan and B-Plans. B-plans incorporated binding numeric baselines, like rules for parking, noise protection, heat and hot water, materials, building volumes and rules related to flood protection. Thus, HafenCity followed a trajectory where building-level performance was made central to the governance of resilience.

From 2007 onward, HafenCity EcoLabel (T4) brought new set of measurable baselines that investors could follow, which went well beyond the requirements from the B-Plans. By 2010, stricter thresholds were introduced - EcoLabel Gold became mandatory for new plots and was implemented through the land-sale agreements. The label was later updated again (2017, Version 3.0), it was aligned with DGNB standards and Platinum certification (formerly Gold) became obligatory. Eco labels brought more than 30 new building performance indicators. Energy performance was addressed through this certification system by minimum 15-30-45% reduction below EnEV standards depending on building type, share of renewables for hot water (≥30%), mandatory monitoring of energy consumption for 2 years post-occupancy and target values for thermal comfort and air quality. Next, the use of materials was regulated by a ban on halogenated, heavy-metal, and biocide-treated products, minimum quotas of certified timber, requirement for life-cycle assessment, and modularity and modifiability of buildings.

For the Neckarbogen case, a vision of a socially mixed and sustainable neighborhood was established in the 2013/14 *Integrated Framework Plan* (T2). In comparison to HafenCity,

here the emphasis was not only on the architectural quality, but also on affordability and inclusion. The early superstructural baselines were defined by the framework plan and the BP 19/16. Through these frameworks' diversity of housing types, use of *Heilbronn Block* typology, social housing quotas, and sustainable urban design principles were set as guiding conditions of the BUGA-driven redevelopment. The framework plan also set some measurables for envelope performance and ventilation standards. BP 19/16 mainly consolidated rules on building volumes, parking and green roof baselines. In the period following the BUGA 2019 exhibition, for the second and third planning stage, these baselines were reinforced by new B-plans. Neckarbogen also aligned its building requirements with DGNB certification, since the first district was DGNB-pre certified in 2012 (Heilbronn.de, 2021).

The most comprehensive set of building performance baselines were set by the *Design Manual*, which set energy, materials and façade codes. Strict energy standards were set: heat loss transmissions' ≤ 0.3 W/m^{2}K, fossil insulation was banned, and ≥ 50% roof area was required to be covered with photovoltaics (≥ 25% in first phase). Materials used for building had to be recyclable, demountable, and low in grey energy; fossil-based plastics and polystyrene were prohibited. Additionally, non-measurable guidelines emphasized restrained façades, integration of photovoltaics in roofs (not façades), use of natural or durable materials (timber, mineral plaster, concrete, zinc), and harmonized color palettes. For these baselines to be implemented, the Manual functioned as a binding reference for design approvals - to obtain building permits, the developers had to follow its rules. A design advisory board reviewed projects and ensured the following of the Manual. Thus, Neckarbogen followed a trajectory where superstructures baselines emerged first through framework planning, next in B-Plans, and finally were codified in a *Design Manual* which was aligned with DGNB certification system.

3Land began with the weakest building baselines. The 2011 *3Land Development Vision* and 2012 *Planning Agreement* (T1-T2) did not define superstructures in measurable terms, but buildings were framed only in relation to future district identities and cross-border image. The 2015 *3Land Urban Concept* (T3) introduced typological guidelines such as mixed-use riverfront blocks, but these baselines were non-binding. Thus, these baselines remain fragmented and tied to local planning instruments of Basel, Weil am Rhein, and Huningue. In the later phase, through the IBA Basel process, the trinational partners develop a common criteria catalogue and certification scheme - the *Sustainable 3Land Durable* system (T4). This catalogue sets criteria and 31 indicators across five broad goals: opening closed areas, cooperative development, social and ownership diversity, priority for walking/cycling/public

transport, and environmentally friendly transformation. Through this catalogue, superstructures-related baselines addressed energy efficiency by monitoring consumption, grey-energy reduction, and participation in shared energy infrastructures. Materials and circularity were addressed by requirement for reuse of components, recycled concrete materials, recyclable construction, life-cycle oriented selection, and use of environmentally friendly building materials (ban on toxic substances, certified timber, regional sourcing).

6. INTEGRATION OF BASELINES: FROM INFRASTRUCTURE TO ARCHITECTURE

6.1. Cross-Infrastructural Interactions

During the course of the research, each infrastructural system (Fl-I, B-GI, AMI, and superstructures) was analyzed separately, but the comparative findings reveal that these systems are anything but separated - they intersect and interact with each other and evolve in interdependent ways (Table 1). This produced many synergies but also conflicts that conditioned the outcomes. Moreover, resilience is amplified with the multifunctionality of these infrastructures.

In HafenCity, the warft model conditioned nearly all the infrastructural baselines. Elevated plinths dictated superstructure shapes, height, influenced active mobility through bridges and escape routes. The flood baselines constrained the applicability of green infrastructures, as hard protective measures were prioritized over nature-based solutions. The push for high-performance superstructures in HafenCity conflicted with affordability which sheds light on the tension between sustainability and resilience standards and social inclusivity.

In Neckarbogen, cross-infrastructural coupling can be seen in the integration of water management with the landscape and the mobility infrastructures. The Neckaruferpark and the newly built lakes play the roles of flood retention, ecological compensation, pedestrian and cycling routes and recreational infrastructures. In this case as well, social housing quotas (set from the beginning) were requirements for achieving social diversity. In this case social resilience is also amplified by early set baselines.

In 3Land, cross-infrastructural interactions are least visible at this stage. Multi-modality appears in the merging of free space and in the creation of compensating habitats along the Rhine. This system is fragmented. As a result, its interaction with flood safety and building codes is underdeveloped. The lack of strong cross-system alignment makes resilience more a topic for discussion than something enforceable through the *Open Space and Nature Conservation Strategy*.

Table 1: *Comparative interactions between infrastructural systems*

	HafenCity	**Neckarbogen**	**3Land**
Fl-I vs. AMI	Bridges and escape routes were influenced by warft elevations; Mobility principles had to comply with flood baselines. • ***Reinforcement*** • ***Multifunctionality*** • ***Rigidity***	Mobility corridors double as drainage systems for open spaces. • ***Reinforcement*** • ***Multifunctionality***	No integration with flood safety. •***Absence***
Fl-I vs. B-GI	Green roofs and drainage baselines were introduced later. Water-sensitive park design in later stages. • ***Conflict, then alignment***	Park surfaces and new lakes provided flood retention, ecological and recreational functions. • ***Reinforcement***	Ecological corridors prioritized but without inscribed flood measures. • ***Absence***
Fl-I vs. Superstr.	Warft plinths dictate building heights, ground floor usage and shape. • ***Reinforcement*** • ***Rigidity***	HQ200 elevations set building flood safety, dictate building heights, ground floor usage. • ***Reinforcement*** • ***Alignment***	No integration with flood safety. • ***Absence***
AMI vs. B-GI	Promenades and public spaces integrated green and mobility infrastructure at later stage. • ***Reinforcement***	Promenades doubled as green corridors. • ***Reinforcement*** • ***Multifunctionality***	Rhine banks doubled as car-free ecological corridors • ***Reinforcement***
AMI vs. Superstr.	Car-parking quotas and bicycle storage linked promotion of active mobility to building standards. • ***Reinforcement***	Car-parking quotas and bicycle storage linked promotion of active mobility to building standards. • ***Reinforcement***	Car-parking quotas and bicycle storage linked promotion of active mobility to building standards. • ***Reinforcement***
B-GI vs. Superstr.	Facade greening and green roofs requirements tied superstructures to ecological goals. • ***Reinforcement***	Facade greening and green roofs requirements tied superstructures to ecological goals. Eco-points given for building courtyards. • ***Reinforcement***	Green roofs and vegetated terraces are required. • ***Reinforcement***

Social/ Economic vs. other systems	Affordability conflicted with high resilience, sustainability standards and image building goals; Social housing quotas introduced later. • ***Conflict, then alignment***	Social housing mix quotas were introduced early. Balance is sought between affordability with sustainability goals. • ***Alignment***	Image-building for the area raised fear of gentrification on the Swiss side. Social housing mix introduced in planning stages. • ***Conflict, then alignment***

There are observable differences in how cross-infrastructural interactions influenced resilience building trajectories. In HafenCity flood safety baselines cascaded into all other infrastructural systems and produced strong technical resilience but produced social resilience trade-offs. Neckarbogen case shows aligning of baselines that improve both technical, ecological and social resilience and shows how they are influenced by multifunctional design. 3Land demonstrates a fragmented landscape that risks infrastructures to evolve unevenly across systems. This cross-system comparison can confirm that resilience is not embedded in any single infrastructure, but is negotiated through interactions between various systems, which brings us back to the first observations on HafenCity and the intertwining of infrastructural systems (Figure 5).

6.2. Architecture as a Composite Infrastructural Layer

In contemporary riverfront redevelopments, the superstructure should not be understood as a separate design layer, but as a composite infrastructural stratum where multiple systems intersect. Baselines that refer to Fl-I, B-GI and AMI produce either constraints or affordances to the architectural systems. Through their mutual conditioning, infrastructural systems do not operate as simple and separate engineering layers, but they converge within the architecture. Thus, the building itself becomes an infrastructure which consists of environmental, structural, and regulatory systems, and is a physical condensation of multiple negotiations.

This conceptualization supports the notion of architecture as a condenser within infrastructural landscape, proposed by the *Landscape Urbanism Theory* (Waldheim, 2016). In this paradigm, it is argued that landscape has replaced architecture as the medium of urban order and architecture is redefined as part of urban logistics. Form emerges from flows, and the logic of the city becomes infrastructural rather than compositional. Similarly, Keller Easterling (2014, 2017) conceptualizes architecture as an agent which shapes dispositions, directs behavior and movement. Easterling further identifies infrastructure as a hidden layer of rules, protocols and organizational forms, and this idea focuses on how design operates

through standards, easements, and invisible technical agreements rather than through iconic forms. Allen, (1999) proceeds to describe architecture as an infrastructure of relations negotiated through multiple scales and by multiple actors. These paradigms of architectural thought blur the line between architecture and infrastructure, repositioning architecture as a composite infrastructural layer.

The empirical findings of this research align with these theoretical stances. The actor-network analysis approach demonstrated how architecture in the selected riverfront redevelopments is a material stabilization of prior relations. Across the translations the baselines for different infrastructures transformed also into design parameters at building scale – what began as a regulatory or environmental baselines, later became inscribed into the architectural form and its performance. The architectural-technical symbiosis such as HafenCity's plinth system, or Neckarbogen green roof/façade requirements exactly embody what these authors describe: architecture as infrastructural field.

Through the lens of ANT, at the moment the network stabilizes around an OPP (such as a flood ordinance, energy certification, or target-height guideline) what results from the alignment of these actors can be inscriptions like technical design parameters. Next, what was previously a measurable baseline (+7.5 m NN elevation, HQ100, or infiltration coefficient) transforms into a design element (foundation level, slab thickness) which is embedded in the construction drawing. By this the baseline migrated from the regulatory domain into the architectural one, as Easterling points out - *organization was made spatial*.

Translation of Flood Infrastructure into Superstructures

Fl-I represents the most decisive baseline in riverfront redevelopment because it fixes the hydraulic and topographical parameters that all subsequent systems must negotiate. These baselines mainly depend on the character of the river. In HafenCity, the warft system (+7.5 m NN) redefined the vertical logic of the entire district. In Neckarbogen, HQ100 as a limit, evolved into HQ200 and established thresholds for buildable and floodable zones; Finally, in 3Land, the flood baselines could not be uniformly established because of the differences of the tri - national jurisdictions. However, the flood zones were decisive for the building placement. Thus, in each case, the flood baseline acted as an OPP: it first defined whether construction could occur at all in each site and then conditioned the development of every other infrastructural layer. Moreover, the plinths, elevated squares, foundations, and façades are not only structural components, but they became artefacts that continued the work of the flood system at the architectural scale (Figure 7). So, it is no longer architectural composition, but its infrastructural performance which becomes important. The architectural

elements are designed to retain water, to provide continual mobility networks for emergency paths and so on. In ANT sense, the translation of a flood baseline to superstructure represents a moment of stabilization - the fixed elevation requirement or retention capacity becomes non-negotiable.

Translation of Blue-Green Baselines into Architecture

B-GI introduced a second layer of negotiation for the superstructures, but these requirements do not always become OPPs. This dimension is connected to the ecological performance of a superstructure, specifically the capacities for retention, infiltration, evapotranspiration, and biodiversity support. These ecological processes become integrated into the material of the superstructures and turn the buildings into micro-infrastructures within the broader environment. In this context, architecture is shaped by ecological performance criteria which aligns with Waldheim's argument that landscape urbanism replaces traditional composition with an infrastructural process.

The empirical analysis shows that the translation of B-GI baselines into superstructures occurs through a progressive process that starts with envisioning the *new block* in the urban redevelopments, especially represented with green roofs and later become a subject of certification systems through labels and awards. In HafenCity, the HafenCity EcoLabel set requirements for greening of façades and roofs; in Neckarbogen, the DGNB Platinum pre-certification also linked ecological performance to construction details and required retention roofs, native vegetation strategies; and in 3Land the *3Land Durable Catalogue* also attempted to connect ecological implementation to building envelopes.

From ANT perspective, the empirical analysis revealed that the availability of multiple criteria that the developer or architect could choose from to be able to certify a building, or the voluntary nature of certification systems (as in 3Land) prevented these baselines from fully stabilizing as OPPs. Nevertheless, stabilization for B-GI requirements occurred at the level of implementation of the buildings. This demonstrates that actors ultimately enrolled around these baselines and that certification systems acted as effective mediators within the network. Finally, the outcome is an architectural integration of B-GI.

Translation of Active-Mobility baselines into Architecture

A-MI dimension influences patterns of movement, but also the structural interfaces between the building and the urban realm. In this sense, active mobility becomes an active design parameter that influences the shape, the orientation of buildings and the access and flows inside those buildings. From the empirical analysis, the influence of mobility to superstructures was most visible in HafenCity. The elevated warft streets also required

elevated circulation networks and transitions between the raised plinths and the lower-level promenades. Moreover, the ground floor parking requirement and the mandatory access to elevated areas became an OPP for design of the buildings. Evidence from empirical research shows that in each of the cases, the low-car mobility strategies and the promotion of soft mobility, and better accessibility baselines dictate the spatial arrangement of blocks and their internal courtyards. This principle further determines the ground floor use in some areas and consequently the heights of ground floors, their openness towards the public realm and the façade detailing.

Figure 53: *Elevated plinth and public uses on the ground floor, HafenCity. Photo by author*

Figure 54: *Cantilevered residential and commercial blocks over promenades in HafenCity, Hamburg. Photo by author*

Through ANT perspective, each transport corridor, bridge, or accessibility regulation once stabilized in a binding planning document, can act as an active actant that constrains or enables architectural form. It can simultaneously define where entrances meet the streets, how ramps are engineered, or how emergency access integrates into flood-protected levels (Figure 53, Figure 54). In other words, buildings absorb movement infrastructures into their tectonic organization. This can be seen in integrating elevated pathways into first floors, cantilevering over public promenades, plinths containing parking or bicycle storage spaces; and ramps and bridges becoming an integral architectural element instead of appended elements.

Architecture – Between Infrastructural Performance and Urban Image

When the multilayered architecture is comparatively read, distinct modes of multi-modality emerge. The flood related baselines regulate the defensive characteristics of a superstructure. They define how a building defends and how it adapts to disturbances. The flood related baselines mostly are restrictive, not flexible, and if they exist, they are OPPs for any further design decision. The blue-green layer is mostly related to the productive or regenerative capacities of a building. Performance of the buildings in this sense connects to providing replacement habitats for certain species, enhancing the microclimate or improving the water retention. The AMI dimension operates differently in each project. For example, in HafenCity it operates as an asset to flood resilience but also to the continuity of the urban life, as is also the case in Neckarbogen and 3Land. The empirical analysis of planning documents showed recurring patterns where new architecture was expected to embody the context's recognizable urban identity or to shape its new identity. Consequently, beyond the infrastructural and performative dimension of the architecture, it was expected to operate as an active actor in shaping city's image.

In the case of HafenCity, since the initial discussion during the Expert symposium, generic and low detail buildings were rejected and distinctive and context sensitive architecture was required which would establish HafenCity's own architectural culture (Table 2). The Masterplan from 2000s frames HafenCity as *the 21st century city* and again sets the baselines for high quality architecture and making the history of the site a foundation for its identity. Next, the subsequent B-Plans defined more specific requirements for the plinth zone as a metropolitan base, use of facades in red brick for integration with Speicherstadt (Table 8, Table 13). Identity building was also addressed in B-Plans though requiring landmark architecture (Table 15).

In Neckarbogen the architecture's character was defined at later stage, mainly through the requirements of the Design Manual (Table 28). Baselines referred to material prescriptions and building volumes that would harmonize the district but will leave the buildings as individually recognizable. In 3Land, creating a trinational skyline with new landmarks was the explicit idea in the 2011 Development Vision (Table 31). This idea changed and visions became less grandiose, so in 2015 the *Vision for Territorial Development* (Table 33) required image building through innovative and attractive housing typologies and industrial heritage reuse. The importance of maintaining the industrial character of the area is also mentioned in *Urban Development Concept for Klybeckquai and Westquai* (Table 41), but these baselines are still open for negotiation as the visions have not fully stabilized into binding instruments. In Huningue, statutory documents require facades to maintain visual

continuity that respects the *Vauban* heritage, whereas in Weil am Rhein, the design of superstructures played no strategic role in image building.

7. DISCUSSION

7.1. Reflection on Research Questions

This dissertation aimed to investigate how infrastructural baselines for sustainability and resilience were embedded, negotiated, and transformed during the long implementation processes of riverfront redevelopments. The main research question guiding this dissertation was: How does gate-based phasing in large riverfront redevelopment projects stabilize technical baselines across infrastructural systems, resolve cross-system conflicts, and does it lead to alignment or difference across the cases?

Four operational sub-questions derived from the main research question were framed in the beginning of the dissertation (3.1).

RQ1: How and when did the sequencing of planning gates in each riverfront project shape the stabilization of technical baselines, and did the sequencing produce alignment or divergence across cases?

The findings show that baseline development is not a linear or purely technical process, but it emerges from translation processes. Measurable parameters are constantly combined with non-measurable ones.

In HafenCity, stabilization occurred very early. The warft model, for example, was introduced during the early 1990s feasibility studies (T1), was formalized in the 2000 Masterplan (T2), and was codified by the FlSchVO 2002 (T3), which legally fixed plinth heights at +7.5 m NN. Black-boxing moments were especially visible in the introduction of this model when resilience had become embedded as a non-negotiable technical baseline, alternative flood-protection strategies were eliminated, and created a rigid path dependency that left little room for later adjustment. The masterplan was a flexible framework, so it could be re-negotiated over the duration of the process, but once the baselines were embedded into the B-Plans, it became difficult to reopen them for that area. Gate-based phasing progressively narrowed design options, but it was always tied to the location, as the B-Plans were introduced progressively. However, although the ordinance functioned as the initial baseline, successive B-Plans translated it into progressively higher warft levels. The escape routes and promenades along the river remained a stable, fixed baseline throughout the whole process.

In Neckarbogen, early feasibility studies were closely tied to the BUGA 2019, and technical parameters were renegotiated several times through the iterative process of framework planning. B-GI was fixed early, and it served as the basis for further planning steps.

Integrated Framework Plan (T1-T2) oriented the project toward open space, ecology, and sustainable mobility, but left some room for re-negotiating baselines. The *integrated Framework Plan* was coupled with the *Design Manual,* which gave the limits within which the offered flexibility could operate. The BUGA 2019 and City Exhibition served as testing grounds for the further redevelopment of the planned area. Thus, the gate-based phasing did not fully close options but served as steppingstones where compromises were tested and adjusted. B-Plans were continually introduced after the exhibition for the rest of the quarters, together with a new Design Manual, and that is when new black-boxing moments arose. The redevelopment stabilized through a mix of binding rules and event-driven experiments - in a hybrid model that is neither rigidly codified nor endlessly open-ended.

In 3Land, planning is the most discursive and fluid process of all the cases. The early test planning and the *Development Vision* from 2011 (T1) produced an ambitious vision that acted more as an agenda-setting device than a stabilizer in the real sense of the word. The *Letter of Intent* and the *First Agreement* established cooperation; however, they still did not provide statutory obligations related to technical baselines. The *3Land Urban Concept* (T2) later became a reference vision across the partners, but it remained strategic and non-binding.

Interim uses and IBA involvement (T3) provided temporary stabilization, promotion of the project, and inserted the area into the *mental map* of Basel. Pilot projects also stabilized some fragments of the area, but *black-boxing* of baselines never fully occurred. Baselines in this case are fragmented across jurisdictions, with Switzerland, France, and Germany each inscribing only their own rules.

> "Guidelines which we all agree on define how to develop our common area. To put it in place and to realize it, that's done on the national level. We cannot establish a trinational legal framework, it doesn't work. So, everyone always has to go back home to develop it under their national frameworks." (Interview 5, 2025)

For this moment, the new Rhine bridge between Switzerland and France is the most important infrastructural element for which partners are aligned. Despite repeated agreements, the bridge remains unresolved due to legal complexities between France (EU) and Switzerland, which require a bilateral treaty (Interview 5, 2025). The extension of the *Third Planning Agreement* until 2028 indicates that the bridge has become a stabilized baseline, yet it continues to be negotiated in terms of implementation. Nevertheless, there is an absence of codified baselines, so it remains a delayed project. The Rhine bridge remains a long-term objective whose realization will extend over the next twenty years, primarily because its financing has not yet been secured (Interview 3, 2023). Therefore, financing functioned as an OPP in 3Land, which sometimes delayed the sequence of gates. There were

attempts to create tri-national sets of baselines for the 3Land area. The *Trinational Criteria Catalogue* (T3) was one of those tools, but with the extension of development, it became outdated, illustrating the difficulty of codifying baselines at the trinational level. The *Open Space and Nature Conservation Strategy,* on the other hand, is also retranslated on a local level but remains a symbolic guideline. This project exemplifies how gate-based phasing in a cross-border context, without stabilizers such as ordinances or binding contractual instruments, can delay and leave many parameters fluid. This leaves infrastructural baselines still open for negotiation. This also reflects the cross-border governance complexity of such projects.

The comparison of the three cases reveals that the redevelopment process yields highly divergent outcomes, yet attempts at convergence persist: all of the cases, at some point, invoked certification instruments as a means to stabilize sustainability goals. What emerges from the observations is that there is not a single model of how gate sequences stabilize technical baselines, but distinct context-dependent archetypes. HafenCity demonstrates early black-boxing and rigidity of the process. In this case, flood and superstructure baselines were locked in by law and contracts from the very beginning. Similar path dependence is described by Flyvbjerg (2014), who argues that when early visions for megaprojects become politically endorsed, they can often become locked in through mechanisms that make later revisions almost impossible. Neckarbogen demonstrates iterative stabilization, in which successive gates gradually narrowed the flexibility for the infrastructural baselines. Black-boxing for the B-GI and AMI happened earlier, and the superstructures' baselines developed gradually. The 3Land case remains open; the subsequent gates articulated the visions, but they were not stabilized for a long time. Neckarbogen's model relates Giezen et al., (2015) longitudinal study of Amsterdam's North–South Line. These two examples demonstrate how technical and governance contestation can reopen negotiations and introduce learning moments. That means that certain megaprojects retain adaptive capacity when decision gates remain open to renegotiation. This slightly contradicts 3Land's case, which illustrates that when gates fail to codify, the process can shift toward different goals.

RQ2: How did design manuals, certifications, and other codification tools influence development of infrastructural systems in riverfronts - which became binding design parameters, which stayed soft?

As already mentioned in the previous section, the certification instruments for sustainable buildings are one of the commonalities among the three cases studied.

In HafenCity, certifications became decisive ten years after the masterplan was introduced, and only after the early flood and planning baselines had already been fixed. The HafenCity EcoLabel was introduced in 2007 (T4) as an optional certification with several pilot

projects being certified after that, and in 2010 (T6), it became a part of the tendering process. This created a new layer of measurable baselines for superstructures - once embedded in land-sale contracts - standards became hard baselines that developers had to meet in order to proceed. By this, the certification became an enforcement tool within a strong governance framework. Finally, the launch of the DGNB-Special Award Eco Label illustrates an effort to align the local standards with broader European and global sustainability frameworks. Except for superstructures, the EcoLabel had an indirect influence on flood and mobility infrastructures, which were already codified through ordinances and B-Plans. Moreover, the Label codified some of the B-GI in the districts through requirements for green roofs, façade greening, and rainwater retention.

In Neckarbogen, certification played a different role, and it was introduced in the very beginning of the implementation process, two years after the Framework Plan was adopted. The DGNB certification system for urban districts was developed between 2009 and 2012 to assess sustainability on a neighborhood scale. This system extended the criteria of the DGNB building-level system. The certification cycle and actors involved were also different – projects could receive pre-certificates during planning, but after completion, they could finally be certified (Anders, 2013). The demonstration that the new district built for the City Exhibitions was DGNB Silver pre-certified gave the city a strong branding tool to signal the innovation, sustainability, and high quality of the new development to a broad audience. Unlike HafenCity, where certification became a stabilizer, in Neckarbogen, it functioned as a complementary mechanism for achieving quality and implementing it in the early planning instruments. The DGNB was applied not only for superstructures, but the criteria also touched on AMI (through bicycle and pedestrian infrastructure assessment) and B-GI (through biodiversity and microclimate-related criteria) (Table 24).

In 3Land, certification instruments never stabilized baselines as was the case in HafenCity or Neckarbogen. *Durable 3Land Catalogue* (2018) developed as part of the IBA Basel process and represented an attempt to create trinational criteria for sustainability and resilience across buildings, ecological, and mobility systems. The first pilot project that voluntarily agreed to comply with these standards was Les Jetées in Huningue (Regierungsrat des Kantons Basel-Stadt, 2022). However, there was no chance for it to be applied somewhere again, in any other case.

> "This catalogue has a bit of an unfortunate destiny. It was made, but I think it was never really used. … As soon as you try to establish something binding on the international level, it gets difficult. It didn't take long until one partner said, 'No, I'm not going to be obliged to follow these rules, we have our own national rules and policies." (Interview 5, 2025)

Unlike HafenCity EcoLabel or DGNB standards, which were revised over successive versions, the Durable 3Land Catalogue has not been updated since its introduction, which makes it particularly prone to becoming outdated.

> "The Durable 3Land criteria were probably developed at a time when we thought development would move much quicker. … By then the Durable 3Land criteria will be very old and might be out of date, because so much has changed. I am not sure if they will ever be applied, honestly… Basel now has a policy that the city must be carbon neutral by 2037, and other laws and regulations have also changed. So, the criteria in the catalogue would not meet the goals we have now." (Interview 5, 2025)

Comparatively, the three cases show that certification instruments have very different roles in the governance of riverfront redevelopment. In HafenCity, certification came late but became a decisive stabilizer. In Neckarbogen, DGNB came quickly and played a selective and demonstrative role as a branding device. In 3Land, the criteria catalog was introduced early and remained advisory and functioned primarily as a framework for dialogue. This suggests that certification instruments only become a true stabilizer when coupled with contractual or legal instruments - so enforcement is more important than labels. A further comparison between HafenCity and Neckarbogen shows two complementary models for ensuring architectural quality. In HafenCity, architectural quality was assessed through a multistage, plot-by-plot procedure where each building was certified separately. In Neckarbogen, a district-wide quality check was applied, so the city used a holistic evaluation system that ensured consistency. Both approaches were testbeds for new DGNB certification systems.

As infrastructures are intertwined, certifications extend beyond superstructures. They can also extend to shaping flood protection, mobility networks, and blue-green systems in parallel. Additionally, early pilot projects served as testing grounds for which pilots allowed standards to be scaled into binding obligations later, like the example of HafenCity. Finally, the slow implementation of certification in cross-border projects (like 3Land) may require mapping equivalent standards across countries (like DGNB in Germany) to be able to further grow into binding standards.

RQ3: When did cross-system conflicts in the riverfront areas appear, how were they resolved and what were the trade-offs of this process?

In HafenCity, trade-offs emerged firstly between heritage preservation of historic warehouses and existing quays and the requirement to raise plinths to +7.5 m NN. In Sandtorhafen and Speicherstadt, the historic warehouses sit much lower (around +4-5 m NN) and raising them was impossible. They were preserved under heritage protection, their ground floors were adapted for flood-compatible uses, while the rest of the redevelopment followed the warft baseline. Another example is the quays and elevated promenades along

Sandtorkai, Dalmannkai, and later Überseequartier that were codified as both public spaces and flood-escape infrastructure. The compromise for this conflict was to design enjoyable continuous waterfront promenades at lower levels, to keep a low, attractive city on the water, but to couple them with a redundant evacuation network of elevated escape routes and bridges that guarantee storm-surge safety. This duality of a flood-resilient, but heritage-sensitive city created a permanent maintenance obligation, so that the new structures are dependent on technical flood defenses. These cross-infrastructural conflicts were resolved through technical measures that were codified in legal frameworks (FlSchVO 2002 and the B-Plans).

The obligations for every developer in HafenCity were to integrate expensive technical solutions (elevated building floors, waterproof basements, and storm surge gates) into their plots. In addition, after tying land allocation to certification criteria, developers had to provide high insulation standards, renewable energy quotas, etc. These measures increased sales and rental prices - critics therefore described HafenCity as a secure enclave. NGOs and initiatives (*Not in Our Name* in 2009) argued that HafenCity's resilience and sustainability measures were being used as a marketing tool to legitimize its exclusivity. To mitigate this, affordable housing quotas were introduced late (2011 onwards) and covered only one-third of new units, so most early apartments actually catered to affluent buyers. In this case, the conflict lies in the trade-off: engineering resilience was achieved through financial models that privileged high-income groups.

In Neckarbogen, cross-infrastructural conflicts were not resolved by immediate ordinances, like in HafenCity, but through an iterative planning process and the B-Plans codification. This produced a dynamic where some baselines, like the ones for B-GI, were fixed early while others were postponed and renegotiated at later stages. A good example is the treatment of compensatory habitats. During the first BUGA-influenced plans, such as Neckaruferpark, the open-space design itself, with its large, unsealed surfaces and species protection measures, even created surpluses of eco-points for habitats. The park planning generated more compensation than needed, and later building plots used up that surplus (Stadt Heilbronn, 2015b). This was done with the further district urbanization, the additional interventions triggered new compensation obligations, which required temporary BUGA habitats (kingfisher breeding caves, moorhen sites, bat boxes) to be shifted toward other locations. Therefore, Neckarbogen followed an adaptive model where initial surpluses created by park landscapes were later re-allocated to offset the ecological costs of densification.

In 3Land, conflicts arose because of symbolic redevelopment visions and the public. The redevelopment proposals by MVRDV/Cabane/Josephy, which introduced high-rise towers and an island in the Rhine, provoked strong opposition in Basel, where residents who feared gentrification and the loss of affordable housing protested against the idea. These protests were localized and handled only by the Basel side, as German and French partners treated the vision more distantly. The response to this was a reorientation of further plans toward green space and reduced density. A second conflict arose from the attempt of sharing common baselines - while several instruments were introduced to provide common baselines across countries, they were never fully applied as partners favor their own statutory frameworks, so the tri-national instruments were left symbolic. Finally, the Rhine Bridge, which was envisioned as the flagship cross-border mobility project, illustrated how alignment around a shared symbol contradicted the legal and financial realities of the three countries. The absence of a Swiss French treaty delayed the project development far beyond its original timeline. In comparison to HafenCity and Neckarbogen's resolutions that were codified in their legal frameworks, the 3Land conflicts remain uncodified and are continuously redirected into local instruments. The trade-off from all of this is the absence of a binding resilience strategy that would retain the discourse for ecological corridors and cross-border connectivity. The *Strategy for Free Spaces and Natural Reserve Concept* was an attempt towards this, but it remains institutionally fragile and left to the will of each of the partners involved.

RQ4: Which actors played a decisive role in stabilizing infrastructural baselines in each riverfront project?

In HafenCity, power was strongly centralized from the beginning. HCH, together with the Hamburg Senate, and the FlSchVO 2002, acted as the key OPPs. By this, the flood infrastructures were codified early in the process and remained non-negotiable (the warft model and the minimum height). HCH was a key OPP also for superstructures - certifications (EcoLabel) reinforced this centralization and the power of HCH by binding developers to specific building requirements as a condition for land sales. These two tools shifted the aspirational sustainability goals for superstructures into obligations. Active-mobility baselines were becoming OPPs through the first B-Plans. B-GI baselines were secondary and often remained softer and aspirational.

In Neckarbogen, power was more dispersed, and during the pre-exhibition period, it operated through a coalition model. The coalition was made by BUGA GmbH and municipal authorities, which jointly negotiated baselines. The BUGA GmbH brought the event framework and the aim for ecological branding, while Stadtsiedlung Heilbronn GmbH and the

municipality authorities aligned the densification and housing affordability goals. Power was dispersed, so OPPs emerged through consensus between the dispersed power nodes. B-GI baselines became OPPs earlier in the process, because they were important for the BUGA's exhibition narrative and were strictly fixed in the first B-Plans. Mobility and modal split targets remained soft in the beginning but were integrated into later B-Plans as well. For the superstructures dimension, the Design Manual applied primarily to private plots and housing blocks from the earliest phases, as seen in the City Exhibition.

In 3Land, there was not a single actor that could stabilize infrastructural baselines. This process was mediated through a trinational network. The TEB functioned as the coordination mechanism that prepared meetings and translations, but without statutory power to impose binding rules. The City of Basel-Stadt was also one of the most decisive actors, as it is the partner that carries 50% of the budget, and by that it acts as the financial OPP. Every major project, especially the Rhine Bridge project, depended on Basel's parliamentary approval. Other higher-level authorities from the French and German sides, Huningue, Weil am Rhein, and their collaborators - Saint-Louis Agglomeration, Landkreis Lörrach, Collectivité européenne d'Alsace - contributed with weaker stabilizing capacity. The agreements signed between the partners and *Vision for Territorial Development* functioned symbolically, without legal force. Stabilizers emerged recently in France, with the PLU revision and its modifications, and in Germany, with the redevelopment process for Rheinpark. These two separate translations were dispersed and did not include a tri-national and mutual actor that contributed as a shared baseline stabilizer.

7.2. Theoretical Implications

The findings of this dissertation carry several theoretical implications for theories of cities as complex systems, ANT, governance theory, resilience theory, and the field of architectural-urban engineering. Firstly, what becomes clear is that cities do not function as trees but are way more complex and shaped by individual and collective decisions, which aligns with Michael Batty's understanding of cities as self-organizing systems networks. Furthermore, the changes in networks within each translation, resulting from local contestations and shifts in context, align with his claims that cities adapt and co-evolve through local, iterative processes. The processes through which the analyzed redevelopments unfold are clearly influenced by interactions and the equal influence of human and non-human actors. This aligns with Latour's argument about the role of networks in shaping realities, about the agency of non-humans, and with Keller Easterling's understanding of infrastructure as an active agent. Here, the mediating role of baselines is meaningful, as they

serve as theoretical links between material infrastructures and institutional frameworks. The answers to the questions: who sets them, how they are measured, and who enforces them reflect this. In ANT terms, baselines serve as OPPs that lock in minimum standards. Yet again, baselines reveal temporal fragility - what counts as adequate at one point may later be superseded by new risk assessments, as shown in HafenCity, where flood safety levels were raised from +7.50 to +8.70 m NN and beyond, and in Neckarbogen, where HQ100 limits were later raised to HQ200 thresholds. Thus, baselines embody both stability and contingency.

The results also contribute to the ongoing debate on resilience theory (Dahlberg, 2015; Dunn et al., 2017; Galimberti, 2021b). The theoretical implications suggest that resilience should be conceptualized as a socio-technical assemblage of baselines which condition how redevelopments along rivers confront uncertainty and negotiate trade-offs between infrastructures. As a starting point, they demonstrate that resilience is not a fixed standard, but it emerges as a series of negotiations and translations, is shaped by the interplay between measurable and non-measurable baselines and is contested through trade-offs. These findings support the relational and process-oriented understanding of resilience – resilience in not in a definitive state of equilibrium (Holling, 1973, 1996), but evolving and in a constant process of adaptations (Folke, 2006; Walker et al., 2004). Through the empirical analysis we can see that it evolves through temporal sequences where baselines sometimes reinforce each other and sometimes produce conflicts or gaps. Thus, resilience can be enabled by the flexibility of the framework plans and shaping infrastructures as an outcome of iterative negotiations that may be reopened or revised as the projects unfold.

Resilience in this dissertation is conceptualized as tri-dimensional, encompassing engineering, ecological, and social perspectives (Galimberti, 2021a; Roggema, 2021). The concept of sustainability is examined through its established triad of economic, social, and environmental pillars (Ahern, 2023). Empirical findings suggest that resilience and sustainability should not be treated as separate concepts and the analyzed infrastructural baselines reveal their entanglement. Firstly, ecological resilience depends on environmental sustainability (e.g., Neckarbogen's eco-points system for soil unsealing and requirement for native planting up to HQ100 line). Social resilience is deeply intertwined with social sustainability (e.g., HafenCity's one-third social housing quota in later B-Plans; Neckarbogen's and 3Land's social mix and housing cooperatives inclusion). Finally economic sustainability influences the institutionalizing and operationalizing of engineering resilience measures (e.g., HafenCity's Port Special Fund and land-sale contracts financing flood protection).

From governance perspective, empirical findings show that governance models condition how sustainability and resilience principles are institutionalized. HafenCity

demonstrates centralized codification enabled by strong influence of municipal authority and technical ordinances. This model can enforce resilience measures (fixed flood baselines) and sustainability measures (energy standards), but it comes at the cost of flexibility. Neckarbogen illustrates a model, where resilience was achieved by using more nature-based solutions which are inseparable from ecological sustainability goals (e.g., floodplain park, and unsealed soils), but also by inclusion of mix of housing models, it influences both social resilience and social sustainability dimensions. The combination of a *Framework Plan* and a *Design Manual*, brings regulated flexibility in the planning process. 3Land shows the fragility of shared resilience standards in cross-border contexts, where agreements with symbolic framings dominate but there is a lack of enforceable standards. This does not make the system inherently less resilient, but resilience is still dependent on locally regulated instead if shared transnational frameworks. These differences show that there is not simply a replicable model that can be learned from *best practices*, but it is dependent on locally specific models of authority, and negotiation.

Moreover, results confirm the multi-dimensionality and relationality of resilience. This means that technical safety measures like fixed flood levels, warft model, or prohibition for building inside the flood lines can exist only when combined with ecological, social, and economic framings. This is illustrated in the implementation of flood safety in HafenCity - it can only come into force when coupled with land-sale contracts, and the flood-protection associations[11] (economic and social coupling). In Neckarbogen's case, resilience emerges through the alignment of the design of AMI and B-GI (e.g., promenade along Old Neckar, permeable path surfaces, avenue planting). Finally, resilience is largely shaped by power constellations and governance models. HafenCity demonstrates how centralized models can enforce rigid technical baselines that produce robust hard infrastructures, but can also influence adaptability, by enforcing the residents to manage the spaces in flood risks by laws and ordinances. Neckarbogen shows how event-driven redevelopments can produce multifunctional and adaptive infrastructure. Finally, in 3Land, where flood risk has not been considered as an issue we can see more symbolic framing of the resilience concept.

7.3. Methodological Reflection

This dissertation has relied on a comparative methodology that has systematically traced infrastructural baselines and is grounded in ANT. This approach has its contribution to the methodological toolbox of researching redevelopment processes. The methodology

[11] Flood protection associations are private-law organisations formed by property owners to jointly operate, maintain, and manage shared flood-protection systems (FHH, 2002).

helps to capture the temporal evolution, power dynamics, and negotiations between stakeholders that shaped infrastructure, and it offers a replicable framework for future redevelopment related research.

The first strength lies in deconstructing the process into sequences of translations (T1, T2, T3…), which makes it possible to follow how visions were gradually stabilized (Langley, 1999). This allowed infrastructures to be studied not as a final product, but as an evolving outcome of negotiations across time. The method exposed the moments when abstract goals became OPPs - decision gates and when they failed to do so. Moreover, the baseline coding into measurable and non-measurable categories makes systematic comparison across different infrastructural domains operational and helps in capturing the qualitative and symbolic framings which are often overlooked when engineering indicators are analyzed. And indeed, this coding confirmed that non-measurable narratives play also an important role in shaping infrastructures particularly those tied to identity, legitimacy, and symbolism. Third, the use of actor-network mapping added a visual and relational layer to the analysis methods that clarified the roles of both human and non-human actants. By mapping the central nodes and marginalized actors across translations, the power dynamics behind infrastructural stabilization were made visible.

7.4. Practical and Policy Implications

The empirical findings of this dissertation carry direct implications for urban practice and policymaking in the field of riverfront redevelopment planning and infrastructural engineering. The case of HafenCity demonstrates that when baselines are codified into legal instruments, they can become powerful tools for shaping outcomes. This indicates that cities that aim for robust resilience should ensure that baselines are legally and contractually enforceable. Multifunctional integration of infrastructure proves particularly valuable as illustrated in both HafenCity and Neckarbogen. Particularly, Neckarbogen illustrates a multifunctional infrastructural design that combines ecological, social, and technical functions. Multifunctionality of infrastructures enhances livability and resilience (Alves et al., 2020; Elmqvist et al., 2015; Mostafavi, 2013). Regulatory frameworks should encourage such multifunctionality through design competitions, environmental compensation instruments, and flexible planning frameworks. 3Land case uncovered challenges of cross-border governance. The policy lesson to be drawn is that cross-border projects require specific governance instruments such as joint authorities, trinational planning agreements, or higher-level support mechanisms. 3Land case also implies the need of cross-border projects for stable institutional capacity such as permanent trinational offices and secured financing

mechanisms to ensure the projects' continuity beyond electoral cycles and avoid fragmentation; aligning of planning regulations to create bridging instruments is important for implementation of shared infrastructures; transnational financing mechanisms (e.g., EU Interreg); and building trinational legitimacy through participatory processes, instead of just top-down agreements.

Certification systems applied in all three case studies illustrate how sustainable and resilient principles at the building and district scale can be operationalized. Certification systems in the cases became tools that translated abstract sustainability goals into concrete design requirements. In the cases of Neckarbogen and HafenCity, these systems even become OPPs that extend municipal authority into the design and construction process. Empirical research also shows the importance of certifications as a tool in creating vertical integration and a way to include the goals from masterplan scale into architectural details. The updates of certification systems and requirements (such as the HafenCity EcoLabel example) reflect how shifting priorities can be integrated into baselines and shows their adaptive capacity.

Finally, the legitimacy of a redevelopment project depends on the narrative created around it. Across all cases, non-measurable baselines were coded. Almost in each case the projects were framed as the new face of the city, the aspirations were to bring the river back to the city, to create a walkable district, to improve the ecological function etc. These narratives proved essential in mobilizing public and financial support and maintaining political will. Narratives, visualizations, events (e.g. BUGA and City Exhibition in Neckarbogen, IBA exhibition in 3Land area or the architectural and planning competitions) can act as powerful mediators. Additionally, certificates and labels serve as tools that signal the high sustainability standards of these districts to the public and add to their legitimacy. The symbolic dimension of sustainability and resilience should not be underestimated, especially for vulnerable and relevant districts such as riverfront districts.

7.5. Limitations and Reflexivity

There are some setbacks to the methodology that need to be acknowledged. First, the use of ANT maps provided a valuable lens for analysis yet unavoidably involved reduction. Actants were coded from literature and networks were visualized in ways that simplify the complexity of real-world interactions, and, inevitably, some actors or processes may have been underrepresented. Next, comparability across cases was not straightforward, as each project followed a different sequence of translations and produced distinct artifacts.

Therefore, instead of applying a rigid chronological template, the research flexibly unfolded each case in its own temporal sequence.

A further consideration is the interpretive dimension of use of ANT maps and baseline coding. The analysis of ANT maps relies on subjective choices on how networks were traced. Moreover, the categorization of baselines into measurable (operational) and non-measurable (symbolic) dimensions also involved subjective judgment based on document wording.

In addition, the comparative methodology that was limited to only three cases with different governance settings proved valuable in identifying patterns among those cases, but, at the same time, the three cases reflect a specific German/European planning culture and do not represent the full spectrum of European riverfronts. These results are best interpreted as contextually grounded rather than universally generalizable. These methodological reflections point to the need for further comparative work across other contexts. Finally, the temporal horizon for the cases varies-each case was still in progress at the time the research was conducted. HafenCity is almost completed, Neckarbogen is only partly realized, and 3Land largely remains in a planning stage, except for some plots in Germany and France where implementation already started. Therefore, the conclusions drawn are based on ongoing processes. As can be observed from the empirical analysis so far, future shifts in contexts can reconfigure the trajectories observed here.

8. CONCLUSION

8.1. Synthesis of Key Findings

The central contribution of the dissertation is reconceptualizing gates and baselines as analytical tools. These tools can reveal when technical parameters become OPPSs, and when the sequencing of a process opens or closes negotiation about some technical parameters. These concepts are used as toolbox that demonstrated that infrastructural systems are not neutral engineering solutions but rather negotiated outcomes of a translation. Baselines and the final infrastructural artifacts emerge through successive rounds of actor alignments, negotiations between institutions and the public, gradual embedding of requirements into legal ordinances, local design manuals, certifications, and land-sale contracts. The framework of gates and baselines uncovers the ways in which infrastructures become progressively stabilized and fixed and shows that resilience and sustainability in riverfront projects are constructed through social and political processes as much as through technical design of infrastructures. Due to these conclusions resilience in riverfront redevelopments can be understood as an evolving attribute that emerges when measurable thresholds and symbolic framings are aligned or contested within networks of actors, institutions, and infrastructures. Across the observed redevelopment trajectories, resilience was shaped not only by engineering solutions but by the capacity to manage conflicts and competing objectives.

Riverfront redevelopments differ from other urban projects as the presence of the river itself introduces additional layers of complexity that shape how baselines are negotiated and stabilized. Hydrological risk can sometimes require safety thresholds, which can constrain design flexibility. Parallelly, rivers function as ecological corridors, so the redevelopments should provide continuity of habitats and species. Rivers also carry strong cultural and symbolic meaning, which makes the redevelopment trajectories dependent on political decisions that are often tied to heritage protection and identity building. In cross-border contexts, rivers act as a jurisdictional boundary, which requires trinational agreements. Finally, riverfront infrastructures are fundamentally multifunctional, which means that gate-based phasing produces context-dependent trajectories where resilience, ecology, mobility, and symbolic value must be balanced through trade-offs and renegotiated at each step.

Gate-based phasing in riverfront redevelopments does not produce a uniform model of alignment. Instead of that, stabilization depends on the governance context. Flexibility in

redevelopment processes can improve adaptability to unforeseen circumstances. However, if the process lacks clear structure and binding steps from the start, it can easily drift off course. Therefore, a successful redevelopment requires a well-conceptualized framework that combines firm, stabilizing gates, but leaves a room for adaptive responses to unexpected situations. Governance models strongly influence how these baselines and principles become institutionalized, reinforcing or constraining flexibility within the process. In centralized models (HafenCity), gates produce rigidity; in event-driven models (Neckarbogen), gates enable gradual stabilization; and in cross-border contexts (3Land), gates prolong the debates on baselines.

Normatively, the conclusion is that cities should strive for resilience models that combine enforceable technical baselines with multifunctional design and adaptive governance, which aligns with the discussion that foregrounds resilience as a property of multifunctional landscapes and infrastructures and calls for rethinking urban infrastructures by integrating multifunctionality, flexibility, and aesthetics (Ahern, 2023; Kato & Ahern, 2008; Tubridy, 2018). The challenge for policy and practice is therefore not only to codify resilience but to ensure that its benefits are equitably distributed and its infrastructure remain adaptable to future uncertainties.

8.2. Broader Reflections on Redevelopment Practices

The comparative analysis of the three cases revealed broader patterns in the evolution of European riverfronts beyond the analytical framework established for this dissertation.

First, redevelopments of this size are susceptible to the shift in paradigms, so in the last three decades, the practice of riverfront redevelopment has transitioned from prioritizing grey and technocratic infrastructures to more nature-based solutions that integrate hard and soft infrastructural systems. Due to the different timelines in which each project unfolded or is still unfolding, these effects are not equally visible everywhere. The most prominent example of this is the HafenCity *west-east* evolution. The earliest phases of the project implementation opted for hard infrastructural solutions, and, as the development progressed towards the eastern part, more landscape-oriented and ecological solutions were required. In contrast, Neckarbogen was landscape-oriented from the start, so incorporating nature as part of its infrastructure was a fixed baseline from the very beginning. 3Land, a case still in progress, illustrates the tendency to align ecological parameters with each infrastructural

decision made, which can also be exemplified in the research on possibilities for including an ecological corridor in the newly planned Rhine bridge.

Connectivity shows up as a key dimension of riverfront redevelopments, as earlier suggested in scientific literature (Kondolf & Pinto, 2017; May, 2006). The concept of connectivity encompasses ecological, spatial, and social relationships. When addressing social connectivity, it can be argued that longitudinal connectivity for motorized transport is being constrained on account of slow mobility modes. Notably, one of the main objectives in the three cases was establishing better lateral connectivity, first between inner-city neighborhoods and riverfronts, and then between the opposite riverbanks. This was considered important, as it improved the emergency responses to floods and enhanced the walking and cycling modes of transport in the new neighborhoods, which is also contributing to the idea of a *city of short distances*. This is mainly addressed through the introduction of new bridges, pedestrian corridors, and open-space networks. Moreover, lateral connectivity improves the visibility of the river. Ultimately, the vertical connectivity remains the most challenging of all, as access to water is still restricted. The design of public spaces, which include platforms, steps, promenades, and green embankments, indicates a desire for interaction with the river. However, swimming and amphibious uses are still not prominent and remain a challenge for river redevelopment in Europe. Finally, in ecological terms, longitudinal, lateral, and vertical connectivity is unnegotiable in these processes and is addressed through improving habitat continuity, providing reestablishment habitats, and observing the redevelopment within the wider context of ecological corridors, as outlined in the planning documents. Nevertheless, the scope of the dissertation did not include the evaluation of the true effectiveness of the implemented infrastructures in enhancing the ecology on the riverfronts.

The high-profile locations where these redevelopments take place position them as model quarters for innovation and urban quality. These ambitions can often lead to a process of gentrification, which immediately highlights the conflicts between social inclusivity and ambitious urban and architectural projects. If riverfronts once symbolized the industrial power of cities, they now become indicators of how cities confront climate change, of governance complexity, and social transformation. Reflecting on the debate about what constitutes a successful riverfront redevelopment, the three cases exemplify several characteristics that have contributed to overcoming conflicts related to land valorization, as well as characteristics that enabled or contested their realization. It could be said that successful redevelopment relies on a coordinating development body that can mediate among technical expertise, public expectations, and real-estate market forces. HafenCity's

technocratic model demonstrated top-down efficiency, but it was accompanied by very limited civic feedback, which led to several conflicts during the process. 3Land adopted a participatory framework after the first visions were presented and sparked opposition among the public. Since then, the redevelopment has promoted inclusion but slowed down its decision-making process. Nevertheless, both cases demonstrate that the capacity to adapt to external disturbances by reconfiguring actor networks and renegotiating responsibilities was crucial in resolving conflicts and maintaining progress.

The difference between the three projects is not only the type of infrastructure implemented, but also the temporal and institutional rhythms through which adaptation occurs. It can be concluded that resilience emerges from cultivating adaptive, learning-oriented governance. Flexibility, which can often be perceived as a weakness in planning, proves to be a valuable asset to the resilience and success of these redevelopments - the redevelopment bodies that succeed are those able to maintain flexibility. Ultimately, true resilience lies in the capacity of urban systems to remain adaptable in the face of uncertainty.

Beyond governance and planning dimensions, the instruments used for implementing superstructures on individual plots are crucial in translating the redevelopment goals into tangible, coherent urban form. From the initiation of the projects, the goal of architectural quality was established as a central OPP in all three cases. This baseline was continually ensured through organizing design competitions, providing quality manuals, and certification frameworks. The results clearly show that utilizing context specific and innovative tendering processes and applying certifications does work towards ensuring architectural quality and sustainability of these kinds of districts. Thus, the consistent pursuit of architectural excellence can serve as both a governance mechanism and an engineering practice.

Finally, reflecting on the long-duration processes in which these developments unfold, it becomes evident that a strategy of phased implementation, where the finished pilot plots and early public spaces are activated, is nonnegotiable. In such redevelopments, shaping the image of the place happens gradually through the process of implementation. Instead of promoting the final outcome as a marketing tool, the city image builds up with the accumulation of tangible milestones like public spaces, exhibition outcomes, or interim uses. These serve as tools that enable the public to have a lived experience of those places. The sites become activated in the early phases, and the redevelopment process itself becomes a medium through which the local attachment to the river becomes strengthened. For these goals, large-scale events like the BUGA or IBA exhibitions can serve as effective instruments.

8.3. Contribution to Knowledge

Firstly, the contribution of this dissertation is empirical and lies in providing original comparative results on the complex implementation processes of riverfront redevelopments in three cases. The research shows how these redevelopments unfold across different scales, governance and planning contexts, and it shows the convergences and divergences in redevelopment trajectories. The translation of visions into binding plans, ordinances, and infrastructural baselines is systematically analyzed, and by that, it was possible to document how controversies intersected with technical standards; how institutions mediated between political visions, technical baselines, and civil society. The mapping of actor-networks and infrastructural codifications fills a gap in the literature that pays less attention to the decades-long processes and their stabilization moments.

The demonstration of how infrastructural baselines can be traced across the entire process of large-scale urban redevelopment projects, and how they were shaped by power dynamics through time, is the methodological contribution of this dissertation. The systematic analysis of planning documents, legal ordinances, design manuals, strategic documents, and actor networks showed the gradual movement of technical requirements from provisional ideas to binding standards whose stabilization was linked to extensive negotiations between institutions, experts, and the public. A particular innovative approach to the analysis was the integration of actor-network mapping with the *gate* and *baseline* framework, which provided a clear structure that enabled the examination of how infrastructures were codified or revised at different moments during successive translations.

A set of transferable research tools made this approach operational. First, it was the deconstruction of the processes into translation timelines that made the important turning points and translations for the phenomenon analyzed in the specific process visible. A second tool is the standardized baselines' tables, which allowed for easier comparison between relevant documents. Finally, color-coded ANT maps made visible the interplay between institutions, existing artifacts, documents, and other active actants that influenced the infrastructures at that specific translation. These methodological devices offer a framework that can be adapted for studying other types of complex urban transformations.

A specific conceptual contribution of this dissertation lies in extending the use of ANT into the field of large-scale riverfront redevelopment. ANT was used in literature to trace complex, heterogeneous networks, but its use in tracing redevelopment processes with a systematic focus on infrastructures has rarely been done. This framework helps in bridging the gap between the production of abstract actor-network mappings and the concrete

codification of infrastructural standards. This also contributes to the discussion about how flexible, reconfigurable infrastructures can adapt to shifting demands and that resilience is an evolutionary process (LeCavalier, 2010; Waldheim, 2016).

Resilience cannot be defined as a benchmark, but as a multi-dimensional and shaped by the continuous interplay of requirements that tackle different infrastructural dimensions: flood safety measures such as plinth elevations, ecological resilience is embedded in providing continuous blue-green corridors, mobility infrastructures provide accessibility under stress, and socio-economic considerations like housing affordability and public-space provision enable social resilience. By showing the intersection of all these dimensions, this dissertation enriches theoretical debates on urban resilience by integrating it within the material practices of architectural engineering and the institutional processes of urban governance and bridges the divides between engineering-oriented and socio-political-oriented approaches to urban resilience.

8.4. Recommendations for Future Research

Multiple trajectories for future research remain open beyond the scope of this dissertation. Future studies can delve more deeply into the controversies that accompanied these riverfront redevelopments, like the critics mobilizing against gentrification in HafenCity or the public backlash of the first development concept for *City on the Rhine* by MVRDV. Investigations could be made into how such disputes were mediated through design decisions, which can show how the delivery of infrastructure becomes an arena of negotiation. This dissertation set limits on the level of detail of the ANT maps due to time and scope of the research, but the complexity of riverfront projects shows that actor constellations can always be expanded and studied more comprehensively. Future research could also extend more on the mapping of power dynamics and actor networks in greater depth. The scope of actors could be expanded to include the roles of less visible stakeholders, such as community initiatives, local organizations, financial mechanisms, and the use of data in informing infrastructural decisions. This can allow future studies to follow more subtle shifts, but with great influence on the redevelopment processes, which this research could outline only in broader terms.

Thirdly, the comparative lens can be broadened beyond German or European redevelopments to include smaller cases or cases that are non-Western riverfront projects. Limited resources, informal practices of riverfront appropriation, and different governance traditions could produce alternative infrastructural solutions and actor constellations that

should be examined by further research. A closer inquiry into these cases would provide a meaningful alternative perspective to the highly institutionalized projects such as the analyzed cases. Finally, future research could tackle user perspectives and everyday practices by asking how residents, workers, and temporary visitors experience the infrastructures once they are built. The actual resilience and legitimacy of any urban redevelopment depend on how the spaces are lived and used on the ground. Therefore, investigating everyday mobility, or informal appropriations of public space, could reveal gaps between design intentions and after-implementation reality. Insights into the social robustness of people who inhabit these projects would close the loop between the technical baselines, negotiations between actors, and the actual use of the infrastructures.

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10. APPENDICES

10.1. Abbreviations

AfSHB	Amt für Strom und Hafenbau (River and Port Engineering Office)
AfU	Amt für Umweltschutz (Hamburg Environmental-Protection Office)
AMI	Active-Mobility Infrastructure
Amt V	Amt für Verkehr und Straßenwesen (Office for Traffic and Road Engineering)
ANT	Actor-Network Theory
ASTOC	ASTOC Architects and Planners (Architecture and Urban Design Office)
AuBS	Arten- und Biotopschutzprogramm (Species and Biotope Conservation Programme)
AWP	AWP Landscape Architects (Urban and Landscape Design Studio)
BASF	Badische Anilin- und Sodafabrik (BASF Chemical Company)
B-GI	Blue-Green Infrastructure
Bau KG	Elbphilharmonie Hamburg Bau GmbH and Co. KG (Elbphilharmonie Hamburg Construction Ltd. and Co. KG)
BauGB	Baugesetzbuch (Federal Building Code)
Baumschutz-VO	Baumschutzverordnung (Tree Protection Ordinance)
BauNVO	Baunutzungsverordnung (Federal Land-Use Ordinance)
BMWSB	Bundesministerium für Wohnen, Stadtentwicklung und Bauwesen (Federal Ministry for Housing, Urban Development and Building, Germany)
BNatSchG	Bundesnaturschutzgesetz (Federal Nature Conservation Act)
BP	Bebauungsplan (Development Plan / B-Plan)
BPG	Basler Personenschifffahrtsgesellschaft (Passenger Shipping Company of Basel)
BRK	Bau- und Raumplanungskommission des Grossen Rats (Building and Spatial Planning Commission of the Basel Parliament)
BS	Basel-Stadt (Canton of Basel-City, Switzerland)
BSH	Bundesamt für Seeschifffahrt und Hydrographie (Federal Maritime and Hydrographic Agency)
Bstadt	Behörde für Stadtentwicklung (Hamburg Urban Development Authority)

BSU/BSW	Behörde für Stadtentwicklung und Umwelt / Behörde für Stadtentwicklung und Wohnen (Hamburg Ministry for Urban Development; renamed in 2015)
BUGA	Bundesgartenschau (Federal Garden Exhibition)
BUKEA	Behörde für Umwelt, Klima, Energie und Agrarwirtschaft (Hamburg Authority for the Environment, Climate, Energy and Agriculture)
BVD	Bau- und Verkehrsdepartement des Kantons Basel-Stadt (Canton of Basel-Stadt's Building and Transport Department)
BW	Baden-Württemberg (Federal State)
CH	Confoederatio Helvetica (Switzerland)
DB AG	Deutsche Bahn Aktiengesellschaft (German Railways Corporation)
DBG/ZVG	Deutsche Bundesgartenschau-Gesellschaft mbH / Zentralverband Gartenbau e. V. (German Federal Garden-Show Company / Central Horticultural Association)
DE	Deutschland (Germany)
DGNB	Deutsche Gesellschaft für Nachhaltiges Bauen (German Sustainable Building Council)
DIN	Deutsches Institut für Normung e. V. (German Standards Institute)
EAG Bau	Europarechtsanpassungsgesetz Bau (EU Law Adaptation Act on Construction)
EisenbG	Eisenbahngesetz (General Railway Act)
EnEV	Energieeinsparverordnung (German Energy-Saving Ordinance)
ERDF	European Regional Development Fund
ES IV	Esplanade IV (Sector designation, Huningue)
ESSO	Esso-Areal (former Esso site redevelopment, Basel)
ISOS	Bundesinventar der schützenswerten Ortsbilder der Schweiz (Federal Inventory of Swiss Heritage Sites)
FFH	Flora-Fauna-Habitat-Richtlinie (EU Habitats Directive 92/43/EEC)
FHH	Freie und Hansestadt Hamburg (Free and Hanseatic City of Hamburg)
Fl-I	Flood Infrastructure and river edges
FlSchVO	Flutschutzverordnung 2002 (Flood-Protection Ordinance)
FNP	Flächennutzungsplan (Land-Use Plan)
FR	France
GfÖB	Gesellschaft für ökologische Bautechnik (Company for Ecological Building Technology)
GHS	Gesellschaft für Hafen- und Standortentwicklung mbH (Port and Site Development Company)

GPL	Overall project management in 3Land
GPS	Global project steering group in 3Land
GRW	Gemeinschaftsrahmen Wettbewerb (Competition Rules Framework)
GSchG	Bundesgesetz über den Schutz der Gewässer (Federal Water Protection Act)
GVVG	Güterverkehrsverlagerungsgesetz (Freight Traffic Shift Act)
GSchG	Bundesgesetz über den Schutz der Gewässer (Federal Water Protection Act)
HafenEG	Hafenentwicklungsgesetz (Port Development Act)
HBauO	Hamburgische Bauordnung (Hamburg Building Code)
HCH	HafenCity Hamburg GmbH (successor to GHS)
HHF	HHF Architects (Basel-based architecture office)
HHL	Hafen und Hafenlogistik GmbH (Early HafenCity Logistics and Planning Company)
HHLA	Hamburger Hafen und Logistik AG (Founded 1885 as Hamburger Hafen- und Lagerhausgesellschaft mbH)
HmbBNatSchG-DurchfG	Hamburgisches Gesetz zur Durchführung des Bundesnaturschutzgesetzes (Hamburg Act on the Implementation of the Federal Nature Conservation Act)
HmbGVBl	Hamburgisches Gesetz- und Verordnungsblatt (Hamburg Law and Ordinance Gazette)
HOCHBAHN AG	Hamburger Hochbahn AG (Municipal U-Bahn and Bus Operator)
HPA	Hamburg Port Authority
HPVO	Hafenplanungsverordnung (Harbor-Planning Ordinance issued under §§ 4-7 Hafen-EG)
KlGrasHfPlV HA	Hafenplanungsverordnung Kleiner Grasbrook / Steinwerder (2004) (Port Planning Ordinance for Kleiner Grasbrook / Steinwerder, 2004)
H-VO 2004	Zweite Verordnung zur Neufestlegung der Hafengebietsgrenze (Second Ordinance redefining the Port-area boundary, 2004)
HVV	Hamburger Verkehrsverbund (Hamburg Transport Association)
HWaG/ HmbWG	Hamburgisches Wassergesetz (Hamburg Water Act)
IBA Basel 2020	Internationale Bauausstellung Basel 2020 (International Building Exhibition Basel 2020)
IBS	Immobilien Basel-Stadt (Real Estate Agency of the Canton of Basel-Stadt)
ISOS	Bundesinventar der schützenswerten Ortsbilder der Schweiz (Federal Inventory of Swiss Heritage Sites)

LaPro / ABSP	Landschaftsprogramm einschließlich Arten- und Biotopschutzprogramm (Landscape Programme including Species and Biotope Plan)
LIN	LIN Architects Urbanists (Berlin–Paris office)
LSBG	Landesbetrieb Straßen, Brücken und Gewässer (State Office for Roads, Bridges and Waterways)
LSV	Lärmschutzverordnung (Federal Noise Abatement Ordinance)
LUBW	Landesanstalt für Umwelt Baden-Württemberg (State Institute for the Environment Baden-Württemberg)
MLR	Ministerium für Landesentwicklung und Wohnen Baden-Württemberg (Ministry for Regional Development and Housing BW)
MVRDV	MVRDV (Rotterdam-based architecture and urban design office)
NHG	Bundesgesetz über den Natur- und Heimatschutz (Federal Act on Nature and Cultural Heritage Conservation)
NLG	Gesetz über den Natur- und Landschaftsschutz des Kantons Basel-Stadt (Cantonal Nature and Landscape Conservation Act)
NZZ	Neue Zürcher Zeitung (Swiss daily newspaper)
OAP	Orientation d'Aménagement et de Programmation (Urban Development and Planning Orientations, France)
ÖKVO	Ökokonto-Verordnung Baden-Württemberg (Ecological Compensation Ordinance Baden-Württemberg)
OPP	Obligatory Passage Point (ANT concept)
ÖV	Öffentlicher Verkehr (Public Transport)
PBefG	Personenbeförderungsgesetz (Passenger Transport Act)
PGRI	Plan de Gestion des Risques d'Inondation (Flood Risk Management Plan, France)
PLU	Plan Local d'Urbanisme (Local Urban Development Plan, France)
PPA	Projet Partenarial d'Aménagement (Partnership Urban Development Project, France)
PS	Political Steering Committee in 3Land
RISA	Rain Infrastructure Adaptation (Hamburg's rainwater strategy/guide)
SA	Société Anonyme (Swiss joint-stock company / public limited company form of Novartis AG)
SBB	Schweizerische Bundesbahnen (Swiss Federal Railways)
SBB Cargo	SBB Cargo AG (Freight Division of the Swiss Federal Railways)
SINAI	SINAI GmbH (Landscape Architecture Firm)

SRADDET	Schéma Régional d'Aménagement, de Développement Durable et d'Égalité des Territoires (Regional Spatial and Sustainable Development Plan, France)
SRH	Schweizerische Rheinhäfen (Swiss Rhine Ports Authority)
STA BVD BS	Städtebau und Architektur, Bau- und Verkehrsdepartement des Kantons Basel-Stadt (Urban Development and Architecture, Department of Construction and Transport of the Canton of Basel-Stadt)
STEK 96	Stadtentwicklungskonzept 1996 (Hamburg's 1996 Urban Development Concept)
TA Lärm	Technische Anleitung zum Schutz gegen Lärm (Technical Instruction on Noise Abatement)
TEB	Trinational Eurodistrict Basel (Basel Cross-Border Planning Body)
UN	United Nations
UN SDGs	United Nations Sustainable Development Goals
UNFCCC	United Nations Framework Convention on Climate Change
UVPG	Umweltverträglichkeitsprüfungsgesetz (Environmental Impact-Assessment Act)
VO	Verordnung (Ordinance / Regulation)
WADI	Hamburger Sturmflutwarndienst (Hamburg Storm Surge Warning Service)
WG	Working group
WG BW	Wassergesetz Baden-Württemberg (Water Act of Baden-Württemberg)
WHG	Wasserhaushaltsgesetz (Federal Water Resources Act)
WSA	Wasserstraßen- und Schifffahrtsamt (Federal Waterways and Shipping Office, Germany)
WSU (BS)	Wohnraumentwicklung und Stadtentwicklung (Section for Housing and Urban Development in the Department of Construction and Transport of the Canton of Basel-Stadt)
WSUD	Water Sensitive Urban Design

10.2.Summary Tables of Planning Documents

The following section lists the measurable and non measurable baselines of key documents - legal documents, design manuals or reports/syntheses of events that contributed to shaping the infrastructure in the riverfront redevelopments. Measurable baselines are requirements that can be translated into numeric values, maps, technical standards, or legally fixed categories. Non-measurable baselines are requirements that are framed as aims, visions, or qualitative guidance. It should be noted that not all possible baselines are captured here; the aim was to provide a general orientation of which requirements are measurable, and which are not and how baselines have changed in general.

Hafen-City

Table 2: *Expert Symposium - Conclusions from the workshops and statements of representatives (GHS Gesellschaft für Hafen- und Standortentwicklung mbH & Stadtentwicklungsbehörde der Freien und Hansestadt Hamburg (STEB), 1999).*

	Measurable	**Non-measurable**
Fl- I	/	No flood barrier like London or Rotterdam. Warft (Terp) Principle adopted. Polder system rejected. Celebrate the water's presence.
AMI	/	A broader commitment to integrating mobility with public space, recognizing the potential for sustainable, human-scale movement in public spaces, streets, squares, promenades, terraces, riverside walkways, and viewpoints, must be a priority.
B-GI	/	/
Superstruct.	Floor Space Ratio of 2.5. Average urban density between 3.0 and 3.5. 5,000 to 6,500 housing units, accommodating up to 12,000 residents.	Rejection of generic or low detail buildings. distinctive, context-sensitive architecture, ideally selected through design competitions with international participation (except in exceptional cases). dense urban fabric, buildings with mixed-use programming. rejected large shopping mall and monofunctional areas, need for own architectural culture for HafenCity. Building in phases.

Table 3: *Masterplan Concept document (requirements for the competition brief) (GHS Gesellschaft für Hafen- und Standortentwicklung mbH, 1999).*

	Measurable	**Non-measurable**
Fl- I	Minimum building platform height: +7.50 m NN (Warft principle). Windward edges up to +8.40 m NN. Fire brigade requires two flood-protected escape routes per sub-area (>+7.50 m NN). Flood protection organization responsible for barriers and gates.	Location outside main dike line requires structural and organizational flood solutions. Emergency service access must be guaranteed even during storm surges.
AMI	Pedestrian promenades along all harbor basins and the Elbe waterfront and link them into the Elbe Hiking Trail. Bridge connections: Rathaus-Sandtorkai, Jungfernstieg-Brooktor, Burchardplatz-Ericus, Oberhafen-City-Süd; traffic forecast: 79,000-86,000 vehicles/day.	HafenCity to become a walkable, permeable urban district integrated with historic city. Continuous, publicly accessible waterfront experience. Strong public transport integration demanded (U-Bahn, S-Bahn, bus, people mover studied).
B-GI	Preservation of harbor basins as retention and ecological areas. Biotopes mapped: 28 types, including 0.2 ha willow floodplain scrub, 0.8 ha reedbeds, 2.1 ha mudflats (protected under §20c BNatSchG). Green corridors linking to First Green Ring / Elbe landscape axis; Integration of ≈30 ha of water surfaces into open space system.	The knowledge about existing ecological patterns should be considered in detailed planning. Integration of harbor basins in design of open spaces. Ecological protection in the process of transformation of waterside into promenades is important. HafenCity as part of Elbe Landscape Axis.
Superstruct.	Housing target: approx. 5,000-6,000 new dwellings. Mixed-use requirement: offices, retail, culture, housing.	Innovative typologies and flexible block structures.

Table 4: *Winning Concept 1999 (ASTOC / KCAP) (Meyhöfer et al., 1999).*

	Measurable	**Non-measurable**
Fl- I	Building areas raised to +7.5 m NN using Warft principle.	Flood protection is integrated as part of urban form.
AMI	New bridges across canals and Magdeburger Hafen integrated; Continuous waterfront promenade laid out.	Connection to Speicherstadt and city center.
B-GI	Harbor basins preserved; Continuous waterfront promenades and parks.	Water as structuring element of identity; design ensures every neighborhood has direct relation to water and green corridors.
Superstru	Program: ≈110 ha building land; ≈5,200 dwellings; ≈700,000 m^2 GFA offices/services; ≈330,000 m^2 GFA retail/leisure/culture	Fine-grained urban block typology defined with flexible uses.

Table 5: *HafenCity Masterplan (GHS Gesellschaft für Hafen- und Standortentwicklung mbH, 2000).*

	Measurable	**Non-measurable**
Fl- I	Building platforms (warft) at +7.50 m NN. Windward exposed edges (Strandkai, Baakenhafen) up to +8.40 m NN. Four flood gates at access roads. Escape and emergency routes to flood-safe areas at +7.5 m. Promenade strips at lower quay level: occasional flooding during storm surges accepted. Continuous flood protection line connecting HafenCity to inner-city line, integrating Speicherstadt.	HafenCity is positioned as a *flood-resilient city on the water*, with safety equivalent to inner-dike areas while keeping the open waterfront character. Surface water drainage: generally discharged directly into Elbe and basins via short routes. Retention and pre-treatment (swale, infiltration trenches) to be examined in urban land-use planning. Runoff from traffic areas pre-cleaned before entering receiving water/sewage system.
AMI	Continuous quay promenade of ~10 km. 11 ha public squares and promenades. Parking: reduced ratios compared to inner-city averages, to discourage car dependence. Bridges: Kibbelsteg, Oberbaumbrücke connection, Magdeburger Hafen footbridge. Pedestrian bridge at Zweibrücken Center to Entenwerder Elbe Park, linking into the Elbe Hiking Trail.	HafenCity is envisioned as a pedestrian- and cycle-prioritized district. Public spaces and ground floors are designed as a seamless urban movement network.
B-GI	Preservation of harbor basins: Magdeburger Hafen, Brooktorhafen, Baakenhafen, Sandtorhafen. Integration of tidal dynamics at Magdeburger Hafen and Baakenhafen (tidal inlets, lowered edges). Preservation of mapped ecologically valuable areas.	Water and greenery are framed as identity-defining elements. If needed: compensatory green areas, planting of open interstitial spaces, ecological upgrading of quay walls.
Superstruct.	Total built-up floor space: ~1.5 million m^2 GFA. Block typologies with mixed-use ground floors. Parking in ground-floor garages or underground parking near waterside.	Mixed uses: housing, culture, leisure, offices, retail. HafenCity as the *city of the 21st century*. High-quality architecture and identity for Hamburg. Traces of port construction and railroad history to be preserved, giving the new district a sense of identity rooted in the site's past. Creation of neighborhoods with their own identity.

Table 6: *Masterplan reprint (HCH GmbH, 2006).*

	Measurable	**Non-measurable**
Fl- I	Building platforms (Warft) required at +7.5 m NN. Four flood gates planned at access roads to integrate HafenCity with the main dike line. Emergency access routes defined until completion of full barrier system.	HafenCity is positioned as a *flood-resilient city on the water.* Commitment to equivalent safety to inner-dike areas while keeping an open waterfront character.
AMI	Continuous quay promenade (~10 km). 5.8 ha parks, 11 ha public squares and promenades. Planned U4 subway extension (Überseequartier, Lohsepark stations) and Elbbrücken S-Bahn station. Modal split target: max. 45% of trips by private car (vs. ~70% citywide).	HafenCity is envisioned as a pedestrian- and cycle-prioritized district. Strong links to Speicherstadt and city center emphasized.
B-GI	≈3 ha of private green space to be publicly accessible. Preservation of harbor basins and canals as ecological + recreational assets. Integration of tidal influence in Magdeburger Hafen and Baakenhafen.	Water and green are framed as defining elements of identity. Promise to create a *maritime character* with ecological corridors.
Superstruct.	≈5,500 apartments, 20,000 jobs. ≈1.5 million m^2 GFA. Block typologies with mixed-use ground floors.	Emphasis on mixed urbanity: housing, culture, leisure, offices, retail. HafenCity framed as a *city of the 21st century*, delivering identity and architectural quality for Hamburg.

Table 7: *Masterplan update (Senat der Freien und Hansestadt Hamburg et al., 2011).*

	Measurable	**Non-measurable**
Fl- I	Terp principle: all areas raised to at least +7.5 m NN. Design flood level for eastern HafenCity +8.10 m NN (+8.30 m NN incl. freeboard). Shore edges exposed to waves require up to +8.60 m NN protection. Versmannstraße constructed at flood-safe level, connecting to Freeport Elbe Bridge. Each island must have 2 independent flood-protected access roads.	Keep historic quay walls and promenade areas at lower level to preserve proximity to water (not raised). Option of future flood barriers/dams to link HafenCity to inner-city protection line

AMI	Cycling quota: pedestrian and bicycle facilities included in every new road plan. Parking reduction baseline: goal to keep private transport ≤30% modal share. New wholesale market bridge connection to Amsinckstraße.	HafenCity as a high-quality pedestrian- and cyclist-friendly district, integrated into regional cycle routes (Elbe Cycle Path, Veloroute 9)
B-GI	27 ha public open spaces planned. 4 ha Lohsepark with 550 new trees. 1.5 ha Baakenhafen leisure island. 28-30 m wide tree-lined Elbe riverside park at Kirchenpauerkai	Water and green framed as defining elements of identity. Call for balance between designed *green* and natural wilderness.
Superstruct.	Up to 3,400 apartments in Lohsepark, Baakenhafen, Elbbrücken. Baakenhafen building height: 5-7 stories (raised from townhouse typology). Mixed-use ratio by zone: Baakenhafen peninsula 80:20 housing: offices, north of basin 50:50, head of basin 25:75'. Heat supply concept (2009 concession to Dalkia): predominantly renewable, CO_2 emissions baseline 89 g/kWh (vs. 175 g/kWh in western HafenCity). Gold HafenCity Ecolabel requires a high proportion of buildings.	Ecological function of harbor basins is to be preserved. Tidal sill option in Baakenhafen under study.

Table 8: *Flood Protection Ordinance (FHH, 2002).*

	Measurable	**Non-measurable**
Fl- I	Flood protection systems must permanently ensure a protective height of at least +7.50 m NN. Floor height of apartments/overnight rooms must not be below 7.50 m NN. Flood protection systems must be designed so they can *effectively fulfil their purpose at any time.* Openings below 7.50 m NN must be equipped with *flood-proof closures*. Elevated areas must be ≥7.50 m NN and withstand storm surges without damage. Annual inspections of structures, seals, closures, pumps required. A maintenance plan must exist, listing installations, maintenance needs, timeframes. A flood protection plan must exist, defining responsibilities, alarm procedures, communication, escape routes. Annual storm surge exercises required.	Property owners are responsible for compliance; Flood protection associations may be formed; are mandatory if joint measures are necessary. Appointment of a flood protection officer and deputy mandatory. Water authority may require higher protection levels "if necessary"; Duty to inform residents and users about storm surge risks. Work on flood protection structures prohibited during storm surge season (15 Sept - 31 Mar), except emergency works.

AMI	From every building, escape routes with min. height 7.50 m NN must connect to flood-safe public ways. From other areas, escape routes must connect to flood-safe zones, adequately marked.	Obligation to maintain always-accessible escape routes and continuous connectivity.
B-GI	/	/
Superstruct.	Apartments/overnight rooms below 7.50 m NN prohibited. Use of unsuitable open areas: no overnight stays, no storage during storm surge period.	/

Table 9: *Act on the Hamburg-Altstadt 32 / HafenCity 1 B – plan (FHH, 2004).*

	Measurable	**Non-measurable**
Fl- I	First upper story ≥ +5.0 m above street. Reference height 7.9 m NN for full storeys. Parking only below +7.5 m NN. Special structural flood measures are required at edges of flood-prone areas. Rainwater from p(A) core area discharged directly into Elbe/Sandtorhafen.	/
AMI	Walking, cycling, and emergency access rights are defined along Am Sandtorkai, Dalmannkai, and Sandtorhafen. Pedestrian/cycle paths and access for emergency vehicles guaranteed.	Footpaths to be designed with water and air permeable structures.
B-GI	≥50% of non-buildable plots greened. Tree quotas: 1 small tree /150 m^2 or 1 large tree /300 m^2. 1 tree per 4 parking spaces. Native deciduous species are required. Underground garages must be provided ≥50 cm rootable substrate (80 cm per tree over 16 m^2). Open soil: 12 m^2 per tree crown.	/
Superstruct.	Dwellings permitted in core areas. Hot water: ≥30% renewable systems. Max roof pitch 15°, no staggered storeys, exceptions for technical equipment only. Building boundaries can be exceeded by balconies/loggias up to 1.5 m.	Mixed-use demanded (housing, offices, leisure). Noise protection through double facades, glazed loggias, bedrooms facing away from the noise.

Table 10: *Ordinance on the Hamburg-Altstadt 36 / HafenCity 4 B – plan (FHH, 2007).*

	Measurable	**Non-measurable**
Fl- I	Rainwater to be discharged into Elbe/Sandtorhafen.	/

AMI	Rights-of-way reserved for public paths; Underground garages only outside buildable plots.	Creation and maintenance of generally accessible paths.
B-GI	/	/
Superstruct.	Noise: ≤30 dB(A) indoor bedrooms at night. Balconies/loggias may extend 1.5 m over boundaries. Renewable hot water ≥30%;	Commercial-residential mix. Parking only in underground garages outside buildable zone.

Table 11: *Ordinance and Justification on the HafenCity 11 B - Plan (BSU, 2014; FHH, 2014).*

	Measurable	**Non-measurable**
Fl- I	Warft raised to ≥ 8.3 m NHN (roads up to 8.7 m); Flood-prone areas marked. Buildings in wind-/wave-facing plots: base zones must be at ≥ 9.5 m NHN. Parking spaces only in underground garages below +8.7 m NHN. Rainwater from mixed-use areas/roads south of Versmannstraße must be discharged directly into Baakenhafen.	Special structural flood measures are required at edges of flood-prone areas.
AMI	Promenades and cycle routes at Versmannkai kept at quay level (~+5 m). Arcade depths ≥ 8.2 m. Rescue/escape roads: streets planned at 8.3-8.7 m NHN.	Creation and maintenance of generally accessible paths. Versmannstrasse is part of the HafenCity rescue route concept.
B-GI	Non-built areas must be ≥ 50% greened; Rights-of-way areas: ≥ 20% greening. Tree quotas: 1 large tree/300 m^2 or 1 small/150 m^2 (rights-of-way: 1/500 m^2 or 1/250 m^2). Roofs: ≥ 30% extensive greening (15 cm substrate) + ≥ 20% intensive greening (50 cm substrate). Substrate thickness for underground garages: 80 cm for trees (16 m^2 area), 50 cm for shrubs/perennials; Avenue planting: three-row tree lines along Versmannstraße.	Greening framed as improving microclimate (dust binding, shading, recreation). The greening of inner courtyards… can contribute to shading, dust reduction and recreation.

Superstruct.	Elevated plinth: upper edge of the floor edge of the 2nd floor at 5.5-6.5 m above ground (as exemption, gallery allowed ≤ 50% of floor, setback ≥ 4.5 m from the facade). Building heights at 24.5 m; some up to 34.5 m. Apartments not allowed on ground floors in areas (A); permitted as exception in (F). Noise: bedrooms ≤ 30 dB(A) indoors at night (with open windows/loggias). Outdoor areas ≤ 65 dB(A) daytime. Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Restrictive advertising rules framed as preserving cityscape identity. Advertising > 2 m^2 or above eaves prohibited. Clear heights for building over traffic corridors: ≥ 4.5-5.0 m. Color scheme restricted to white, beige, yellow, blue to distinguish Baakenhafen from Magdeburger Hafen. Building boundaries can be exceeded by balconies/loggias up to 1.5 m.	Mixed-use quarter principle (⅓ subsidized housing).

Table 12: *Ordinance and Justification HafenCity 14 B – Plan (BSW, 2016; FHH, 2016).*

	Measurable	**Non-measurable**
Fl- I	Warft levels at 8.7 to 9.5 m NHN. Parking spaces only in underground garages below +8.7 m NHN (exceptions only if road access higher). Rainwater from special-purpose roads, green areas, water houses must be discharged directly into Baakenhafen/Norderelbe. Additional structural measures required at flood-prone edges.	Special structural flood measures are required at edges of flood-prone areas.
AMI	Rights of way: Hamburg authorized to create and maintain publicly accessible footpaths. Walking and driving rights across quays and pedestrian areas secured.	Creation and maintenance of generally accessible paths.

B-GI	Non-built areas must be ≥ 50% greened and 1 large-crowned tree every 300 m^2 or 1 small-crowned tree every150 m^2. Rights-of-way areas: ≥20% greening and 1 small-crowned tree every 500 m^2. Roofs: ≥30% extensive greening (≥15 cm substrate) + ≥20% intensive greening (≥50 cm substrate). Trees must have min. trunk circumference of 18 cm (large) or 14 cm (small). Substrate thickness for underground garages: at least 80 cm for trees (16 m^2 area), 50 cm for shrubs/perennials. Roofs: ≥ 30% extensive greening (15 cm substrate) and ≥ 20% intensive greening (50 cm substrate).	Green roofs and open-space planting framed as microclimate improvement.
Superstruct.	Core areas (A): apartments not permitted on first floors; Elevated plinth: upper edge of the floor edge of the 2nd floor at 5.5-6.5 m above ground (as exemption, gallery allowed ≤ 50% of floor, setback ≥ 4.5 m from the facade). Additional storeys above limits prohibited (except recessed technical floors). Restrictive advertising rules framed as preserving cityscape identity. Advertising > 2 m^2 or above eaves prohibited. Noise: bedrooms ≤ 30 dB(A) indoors at night (with open windows/loggias). Outdoor areas ≤ 65 dB(A) daytime. Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Advertising > 2 m^2 or above eaves prohibited. Clear heights for building over traffic corridors: ≥ 4.5-5.0 m. Color scheme restricted to white, beige, yellow, blue; (zone D) only light-colored. Building boundaries can be exceeded by balconies/loggias up to 1.5 m.	Restrictive advertising rules are framed as preserving cityscape identity.

Table 13: *Ordinance and Justification on HafenCity 6 B – Plan (FHH, 2013, 2018c).*

	Measurable	**Non-measurable**
Fl- I	Warft levels at 8.7 to 9.5 m NHN. Rainwater: must be discharged directly into Magdeburger Hafen/Baakenhafen.	HafenCity promised equivalent safety to inner-dike areas while preserving proximity to the water. Option of future flood barrier linking Magdeburger Hafen into a protection line. Special structural flood measures are required at edges of flood-prone areas.

AMI	Promenades: 12 m wide, along Magdeburger Hafen and Baakenhafen. Continuous Elbe Riverside Hiking Trail with a proposed footbridge. *(nonbinding)*	/
B-GI	Tree quotas: 1 large-crowned tree/300 m^2 or 1 small-crowned/150 m^2 of right-of-way area. For underground garages, soil: ≥80 cm substrate per tree (16 m^2) when planted on garages. Area (C): ≥50% must be greened, and substrate thickness for underground garages: 80 cm Trees must have min. trunk circumference of 18 cm (large) or 14 cm (small).	Greening framed as microclimate improvement (dust binding, shading, recreation). Open space to combine greenery with children's play/leisure areas
Superstruct.	Parking only in underground garages below +8.0 m NHN. Core area (A): housing permitted only above 1st floor. Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Elevated plinth: upper edge of the floor edge of the 1st floor at 5 m above ground (as exemption, gallery allowed ≤ 50% of floor, setback ≥ 1 m from the facade). Additional storeys above limits prohibited (except recessed technical floors). Noise: bedrooms ≤ 30 dB(A) indoors at night (with open windows/loggias). Outdoor areas ≤ 65 dB(A) daytime. Restrictive advertising rules are framed as preserving cityscape identity. Advertising > 2 m^2 or above eaves prohibited. Vibration protection of buildings must be ensured through structural or technical measures according to DIN 4150. Building boundaries can be exceeded by balconies/loggias up to 1.5 m.	Emphasis on ensemble quality and *maritime triangle* urban identity. Restrictive approach to advertising: no large signs, to preserve cityscape. Noise sensitive architectural design required.

Table 14: *Ordinance and Justification on HafenCity 9 B – Plan (FHH, 2018a, 2018b).*

	Measurable	**Non-measurable**
Fl- I	Warft levels ≥ 7.5 m NHN; some raised to 8.5-8.8 m; Additional special construction measures at flood-prone edges. Rainwater west of Hongkongstraße must be discharged directly into Magdeburger Hafen. Pumping station in Shanghaiallee for wastewater. Shoreline: 10 m promenade.	Special structural flood measures are required at edges of flood-prone areas.

AMI	Promenade 10 m wide at 4.3-5.5 m NHN + 10 m wide city loggia at 8.5 m NHN, both with public right of way. Public rights of way through Kaispeicher B and arcades. Streets Koreastrasse/Hongkongstraße width 14.4-18 m with pedestrian and cycling area defined.	Integration into Green Ring network and city-wide promenade system. Connection to Überseequartier via the bus bridge. Accessibility to quays from different locations.
B-GI	Roof greening: (L) ≥ 40% roofs with ≥ 50 cm substrate for shrubs. Core area (M): ≥ 30% roofs extensive greening (15 cm substrate) + ≥ 20% intensive greening (50 cm substrate). Courtyard (J, M): ≥ 50% planted; 1 tree planted per 300 m^2; soil depth ≥ 80 cm. Substrate thickness for underground garages: 50 cm. Street trees: rows on Shanghaiallee, Überseeallee, Koreastrasse, Hongkongstraße. Site-appropriate deciduous trees ≥ 18 cm trunk circumference. Hedge plants must have a minimum height of 80 cm.	Vegetation to improve ecosystem and microclimate, dust filtration, shading, and urban quality.

Superstruct.	Building heights defined. Parking only underground (< 7.5 m NHN). Facades in red/reddish-brown brick). Vibration protection of buildings must be ensured through structural or technical measures according to DIN 4150. Building boundaries can be exceeded by balconies/loggias up to 1.5 m. Noise: bedrooms ≤ 30 dB(A) indoors at night (with open windows/loggias). Outdoor areas ≤ 65 dB(A) daytime. Additional soundproofing measures required for levels over 70 dB(A) daytime and 50 dB(A) at night on the sides of the buildings. Elevated plinth: upper edge of the floor edge of the 1st floor at 5 m above ground (as exemption, gallery allowed ≤ 50% of floor, setback ≥ 1 m from the facade). Additional storeys above limits prohibited (except recessed technical floors). Advertising > 2 m^2 or above eaves prohibited. Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Apartments not permitted on ground floor, and in some cases first and second floors. Minimum clear heights for cantilevers and passages (≥ 4 m).	Plinth zone as *metropolitan* base. City loggia as defining design element. Emphasis on architecture, identity, and integration with Speicherstadt. Integration of historic warehouses into new quarter; Restrictive advertising rules are framed as preserving cityscape identity.

Table 15: *Ordinance on HafenCity 16 (2021) B – Plan (FHH, 2021).*

	Measurable	**Non-measurable**
FI- I	Warft levels ≥ 8.7 m NHN; some raised because of integration with existing infrastructure (e.g., bridges, roads). Rainwater discharge: From core area MK1 into Oberhafenkanal; From area MK2 and green areas into Norderelbe. Compensatory floodplain measure: 1,369 m^2 at Neuengamme allocated to MK1. The bank reinforcements of the core area "MK 1" are to be clad with structurally rich clinker brickwork up to 0.2 m above sea level.	Special structural flood measures are required at edges of flood-prone areas.
AMI	Established rights of way for pedestrian and cycle paths (must be built, maintained for public access). Pedestrian and cyclist bridges planned (linkages across Oberhafenkanal, Elbbrücken area).	/

B-GI	Undeveloped areas must be ≥ 15% greened; Tree quotas: 1 large tree/500 m^2 or 1 small/250 m^2. Substrate layers (≥50 cm, ≥100 cm at tree pits and at least 16 m^2 area for trees). Rights-of-way areas: max 15% greening. Tree quotas: 1 large-crowned tree/500 m^2 or 1 small-crowned/250 m^2. Trees must have min. trunk circumference of 18 cm (large) or 14 cm (small). Substrate thickness for underground garages: at least 50 cm for trees (at least 16 m^2 area for trees). Roof greening: MK1 roofs up to 7th floor must be greened ≥30%, with ≥15 cm soil depth. On the area for planting trees and shrubs along the railway line, a hedge with a minimum height of 1.8 m must be established within a minimum 1.2 m wide open vegetation area and maintained as a clipped hedge at a minimum height of 2.2 m.	/
Superstruct.	Core area MK2: only hipped roof, red brickwork allowed. Core area MK1: 55th floor designated as public viewing/visitor floor. Ground floor MK2: restricted to social, cultural, and gastronomy uses. Retail: only small/local retail supply, no shopping centers or large-scale retail. Retail uses are only permitted on the ground floors and first basement floors (warft floors). Parking is only allowed below +8.7 m NHN (underground or garage floors). Elevated plinth: upper edge of the floor edge of the 1st floor at 5-65 m above ground. Additional technical floors and technical structures are not permitted, except for weather stations, lighting protection and beacons for air traffic control. Vibration protection of buildings must be ensured through structural or technical measures according to DIN 4150. Appropriate structural sound insulation measures must ensure compliance with an average internal sound level of 40 dB(A) in common rooms during the day with closed exterior components and 30 dB(A) in common rooms at night. Glass facades >75% or >6 m^2 panes must include bird-protection measures (structuring, markings, translucent glass, etc.) Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Advertising limited, lighting must avoid insect penetration and light pollution.	/

Table 16: *Ordinance and Justification on HafenCity 13 B – Plan (BSU, 2022; FHH, 2022).*

	Measurable	**Non-measurable**
FI- I	Warft levels ≥ 8.5 m NHN; some raised to 8.9, 9.1, 9.3 m NHN. Rainwater: from special-purpose roads/green spaces must be discharged into Baakenhafen or Norderelbe.	Special structural flood measures are required at edges of flood-prone areas.
AMI	Rights of way: public footpaths and cycleways must be built, accessible, and maintained.	Streets and promenades framed as publicly accessible connections (north-south visual axes, integration with Elbe cycle path).

B-GI	Non-built areas and designated roofs: ≥40% greening. Tree quotas: 1 large-crowned tree/300 m^2 or 1 small-crowned/150 m^2. Rights-of-way: ≥15% greened, with 1 tree/500 m^2. Roofs: ≥15 cm extensive greening (all), ≥20% intensive greening with ≥50 cm substrate. Underground garages - Substrate: ≥50 cm generally, ≥100 cm per tree (16 m^2 area). Tree/hedge specs: large-crowned ≥18 cm trunk circumference, small-crowned ≥14 cm, hedges ≥80 cm.	Promenades and parks along Baakenhafen and Elbe to provide public access to the water areas. New Park in the south to connect to Elbe Hiking trail. New habitats for woodland breeding species to be created.
Superstruct.	Core areas "(C)" above 2nd floor only housing. Core areas "(M)" must be contiguous blocks unless shielded by noise walls. Elevated plinth: upper edge of 1st floor at 5–5.5 m above ground (zones D/E differ: 2nd floor 7–7.5 m / 1st floor 1–1.5 m). Gallery allowed if ≤ 50% of floor area and set back ≥ 4.5 m from façade (exception for G zones). Facades: predominantly red/brown brick, ceramic, or colored concrete; certain zones light-colored only. Additional storeys above limits prohibited (except recessed technical floors). Core areas (C) - Retail: only small-scale/local supply; no malls or large-scale retail and only on ground and mezzanine floors. Urban areas must stick to "Hamburg Retail Guidelines". Heating and hot water: new buildings must connect to renewable-based district heating (exceptions if ≤ 15 kWh/m^2a). Vibration protection of buildings must be ensured through structural or technical measures according to DIN 4150. Noise: bedrooms ≤ 30 dB(A) indoors at night (with open windows/loggias). Outdoor areas ≤ 65 dB(A) daytime. Parking spaces are only allowed in underground garages or below +8.7 m NHN. Building boundaries can be exceeded by balconies/loggias up to 1.5 m. Advertising > 2 m^2 or above eaves prohibited. Clearances: overhangs allowed only above 4.3-8.5 m depending on location.	Facade materials framed as identity-building. District-wide noise-sensitive planning: bedrooms facing away from rail, offices with quiet break rooms, contiguous building blocks shielding Versmannstraße.

Table 17: *Criteria for HafenCity Environmental Label from the Sustainable Construction in HafenCity manual (HCH GmbH, 2024).*

	Measurable	Non-measurable
Fl- I	/	Prevention of heavy metal discharges into water bodies (implemented into overall sustainability logic).

AMI	Provision of sufficient bicycle parking (numeric ratios tied to use type). At least 2.4 m long clean-walking zone at main entrances. The bicycle parking spaces have a medium level of comfort according to Annex 4. *Car-free living* principle is embedded through 0.2 parking spaces per apartment measures.	/
B-GI	Design at least 70-80% (depending on the type of building) of the roof area as either a green roof, solar active surfaces, and/or roof terrace.	/
Superstruct.	Primary energy demand (at least 15 - 30 - 45 % depending on the type of building) below EnEV reference values. Target values for indoor air quality and thermal comfort (parameters according to DIN EN 15251 and compliance to DIN EN ISO 7730 regarding draught). Target values for acoustic comfort and sound insulation. Values for visual comfort (e.g. over 40% of the usable areas have an average daylight factor of at least 1% via side windows or a daylight factor of 2% via skylights or a combination of the two types of lighting). Use of environmentally friendly building materials – explicit regulations on halogen-containing building materials and products, volatile organic solvents, biocides or fungicides, hazardous substances and products, wood from sustainable sources, avoiding heavy metals.	The required space for technical equipment should be minimized, and their visual appearance should be adapted to the roof's other uses. Family-friendliness and flexible uses. Low-maintenance windows. Low renewal cycle of floor coverings, water saving fittings, modularity and modifiability od architectural design.

Table 18: *Sustainable Construction in HafenCity Version 3.0 (GföB & HCH GmbH, 2017).*

	Measurable	Non-measurable
Fl- I	/	/

AMI	The bicycle parking area is max. 35 m away from the respective entrance. The bicycle parking spaces have a medium level of comfort according to Appendix 4. 10-20% of bicycle parking spaces have a charging option for electric bicycles depending on the certification (different percents for daycare centers).	Reducing motorized private transport and offering alternatives such as cycling and car sharing. Shifting traffic to bicycles. Public accessibility of Warft and ground levels.
B-GI	At least 50% of the roof area will be developed as a green roof.	Requirements for the fifth façade - the roof areas (this can include green roofs).
Superstruct.	Energy demand ≤ EnEV reference values reduced by 30-40% depending on building type. Additional insulation standards. Each building must generate renewable electricity equivalent to what can be produced by photovoltaic on 30 % of its floor space. Use of environmentally friendly building materials – explicit regulations on halogen-containing building materials and products, volatile organic solvents, biocides or fungicides, hazardous substances and products, use of certified wood from sustainable sources, avoiding heavy metals. Target values for indoor air quality and thermal comfort (parameters according to DIN EN 15251 and compliance to DIN EN ISO 7730 regarding draught). Target values for acoustic comfort and sound insulation.	Developers may combine insulation, heating, cooling, and renewable energy strategies to meet total primary energy demand targets. Renewable contribution should come from photovoltaic systems installed on roofs or façades Accessible and family-friendly buildings.

Table 19: *DGNB Special Award Ecolabel which refers to the criteria catalogues of the DGNB system in the 2023 version (Deutsche Gesellschaft für Nachhaltiges Bauen – DGNB e. V. et al., 2023).*

	Measurable	Non-measurable
Fl- I	Climate risk analysis with future horizons and vulnerability mapping. Documentation of climate-adaptation measures. Alignment with local/regional adaptation strategies. Use of nature-based solutions. Submission of resilience data to certifying body.	Existence of sustainability specifications (Pflichtenheft). Sustainability goals in design competition. Integration of findings without numeric threshold.
AMI	Mobility concept with CLP minimums. Reduced car parking quotas. Bicycle-parking ratios and car parking restrictions.	Promotion of sustainable mobility culture. Public accessibility and walkability principles.

B-GI	Water concept with flow rates and retention targets ≥ 4 CLP. ≥ 40% of outdoor areas biodiversity oriented. ≥ 50% of suitable roofs are green. Biotope area factor ≥ 7 CLP. Use of native species; no pesticides, or fertilizers;	/
Superstruct.	CO_2 balance ≤ reference value. GWP from manufacturing ≤ reference. LCA required in early approval phases. Energy performance ≥ 25–40% below GEG. Passive and renewable targets (60–80%). ≥ 80% certified wood. Indoor VOC tests. thermal comfort per DGNB limits. Circularity via resource passport transparency. Target rates for circularity. Commissioning, FM check, manuals, sustainability info system.	/

Neckarbogen

Table 20: *BUGA 2019 Feasibility study (Stölzer & Stölzer, 2005).*

	Measurable	**Non-measurable**
Fl- I	Flood retention basins listed as ongoing city measures: Leintal, Rotbachtal, Deinenbachtal, Böllinger Bachtal. Dam improvement at "Am Neckar" industrial area.	Goal of sustainable development of riverbanks and riparian landscapes. Riverbanks to be *renaturalized* and made accessible for recreation.
AMI	Continuous pedestrian and cycle paths are planned along Neckar and Neckar Canal (north-south axis). New and widened bridges: Bleichinsel bridge, Peter-Bruckmann bridge, Lohtor bridges, pedestrian/cycle bridges over Neckar Canal (Schwabengarage, Kölle), pedestrian bridge at station. Cycle paths in Theresienwiese and Böckingen.	*BUGA of short distances* - emphasis on accessibility by foot, cycle, and public transport.
B-GI	Creation of 70-100 ha BUGA park. Large new Böckingen leisure and swimming lake. Continuous Neckar promenade, wet meadows, naturalized riverbanks. Integration into Heilbronn's three *green rings* system.	*Blue-Green belt* between Neckar River and Neckar Canal. Reconnecting citizens with the river; Neckar re-branded as identity element. Parks as *mediating element between city and countryside*. Green corridors to structure the area. The area should be part of the green Neckar axis. Redesigning the Neckar River in a natural way.

Superstruct.	New high-quality residential and service buildings on Fruchtschuppen and Wohlgelegen sites (≈60 ha brownfields). Relocation of festival grounds; potential new large event hall.	Vision of *living on the Neckar*, iconic riverfront architecture with charisma. Symbiosis of building and nature on contaminated soils (demonstration of sustainable construction). The exhibition should show exemplary construction on water. Buildings to create symbiosis with the river.

Table 21: *Limited open urban planning ideas competition "Masterplan Neckarvorstadt" Call for proposals - short version (Stadt Heilbronn, 2008).*

	Measurable	**Non-measurable**
FI- I	/	Riverbanks are designed as defining open spaces.
AMI	/	Integration of higher-level transport: road/rail requirements, station area reorganization. Networking of different urban areas.
B-GI	Neckarpark and green belts along Neckar and Neckar Canal integrated.	*Blue-Green belt* as structuring concept between Neckar and Neckar Canal. Re-establish Neckar River as identity element and public space backbone. New inner-city open spaces and green spaces.
Superstruct.	Mixed-use urban district with housing, services, and commerce planned on ~101 ha competition area (Fruchtschuppen ~31 ha).	Conception of an attractive urban district.

Table 22: *winning proposal by Steidle Architects + t17 Landscape Architects - explanatory report from the winning team and plan analysis (Stadt Heilbronn, 2009b).*

	Measurable	**Non-measurable**
FI- I	The H100 floodplain is maintained as a landscaped green area.	/
AMI	New pedestrian and bicycle bridge linking district to station (landmark bridge with ramps, stairs, elevators). New east-west road/bike axis (Europaplatz - Fruchtschuppen esplanade - Theresienstraße). Südrand Bahnhof axis: parallel to station, linking Neckarpark and Neckarinsel - new east-west axis.	Bridge designed as symbolic threshold and urban landmark. The bridge should also serve BUGA 2019 visitors, as an entrance to the exhibition from the station.

B-GI	Non-developable zones defined over former harbor basins due to poor foundation and groundwater conditions. Exposure of harbor basins to create new water landscapes. North-south green corridor system.	Use of historic harbor basins (Floßhafen, Karlshafen) as design elements, reinterpreted as *urban harbor basin* and *scenic bathing lake*.
Superstruct.	New mixed-use quarter on Fruchtschuppen site. Structured building typologies: open blocks oriented toward Neckarpark, Esplanade, and City harbor.	Vision of a new quarter with distinctive identity. Neighborhood structured around characterful outdoor spaces: Neckarpark-City Harbor, Landscape Park-City Harbor, Esplanade-City Harbor.

Table 23: *baselines from the Framework plan (2013-2014 update, approved 2014) (Dokumentation Modellquartier Neckarbogen, 2017).*

	Measurable	**Non-measurable**
Fl- I	Two lakes (city lake and recreational lake) integrated into Heilbronn's water system. Rainwater collection/use and decentralized greywater options (WSUD toolkit). Street drainage solutions (e.g., open rainwater collector / linear drainage).	/
AMI	Target modal split 30% car / 70% eco-mobility. Westrandstraße with separated footpath / cycle path / vehicle lane. Bicycle parking integrated in public space and front zones of the buildings. Wooden footbridges along recreational lakes; Direct pedestrian and bicycle connection to the main station (new station bridge).	*Low-car, not car-free* district. Voluntary behavior changes via attractive offers/smart services. City of short distances. Connected path network.
B-GI	Large parks defined: Kraneninsel, Seepark, Neckarpark East-west green belt. Tree grid with modular spacing (10-15 m) and species selection tied to street hierarchy. Courtyard typologies (semi-public) and roof gardens as green infrastructure.	Open-space goals: minimize ecological footprint. Integrate WSUD; mitigate urban heat. *Urban landscape* identity. *Green quarter* with continuous landscape connections. City lake as central element.

Superstruct.	Net building land 81,800 m^2; GFA 228,700 m^2. ~1,500 units; ~3,500 residents. Uniform eaves ~20 m (reached at least once per block). Ground-floor commercial/public uses in defined edges (Westrandstraße/Stadtsee). Envelope performance: HT′ ≤ 0.3 W/m^2K (standard) or ≤ 0.2 W/m^2K (innovation). Ventilation concept per DIN 1946. Aim to stay below future legal minimums (forward-compatibility).	Flexible plots. Use of *Heilbronn Block* (permeable block). Small-scale functional mix. Public-private contact zones. Social mix embedded in sustainability aims. Ecologically harmless materials; demountable/homogeneous constructions; provide LCA proof.

Table 24: *DGNB New Urban Districts system criteria catalog (Anders, 2013).*

	Criteria later evaluated by indicators
Fl- I	Water and soil protection. Water circulation systems. Rainwater management.
AMI	Quality of transport systems. Quality of bicycling infrastructure. Quality of pedestrian infrastructure.
B-GI	Biodiversity und interlinking habitats. Changing urban microclimate. Consideration of possible impacts on the environment.
Superstruct.	Life cycle assessment. Total primary energy demand and renewable primary energy share. Energy-efficient development layout. Resource-efficient infrastructure, earthworks management. Noise protection and sound insulation. Social and functional mix. Social and commercial infrastructure. Use of existing structures. Energy technology.

Table 25: *Explanatory statement B-Plan 19/18 "Neckaruferpark" (Stadt Heilbronn, 2015b).*

	Measurable	**Non-measurable**
Fl- I	HQ100 flood line defined at Altneckar embankment. Flood zones cannot be used for building. Surplus of unsealed soils: +0.51 ha (≈92,600 eco-points).	Riverbank Park framed as new *face* of Neckarbogen toward the Neckar. Floodplain dynamics recognized. Hard banks and planted bank zones.

AMI	Closure of Kalistraße. Promenade along Alteckar with foot/cycle path and avenue planting. At some points the promenade runs along the water. The paths should be made with water permeable surfaces or lateral drainage.	Goal to link Neckarbogen district with city center and Wohlgelegen via riverside pedestrian and cycle path.
B-GI	Neckaruferpark is designated as public green space. Planting requirements: trees up to HQ100 line must be native, site appropriate. Tree replacement rule (§9 (1) 25b BauGB): lost trees must be replanted with suitable native species. Preservation of valuable existing trees; planting of new trees. Species protection measures required: construction clearance only Oct-Feb. Bat boxes (3); nesting boxes; 4 kingfisher cavities; moorhen habitat (50×3 m). Compensation surplus: ≈1,600 eco-points (fauna/flora) + ≈92,600 eco-points (soil).	Park terraces and riverside promenades designed for direct public access to river. Species and habitat protection framed as *overcompensation* that also offsets deficits in adjacent BP 19/16.
Superstruct.	/	/

Table 26: *B-Plan 19/16 "Neckarbogen Ost" (Stadt Heilbronn, 2015a).*

	Measurable	**Non-measurable**
Fl- I	/	Except public traffic areas - all paths and patio areas must be constructed in a water-permeable manner or drained laterally via unsealed areas.
AMI	Bicycle parking: ≥1 space/dwelling, weather-protected, integrated into building/garage. Communal bicycle facilities: WA ≤4.5% / MI ≤6% of plot area, max height 2.8 m, roof + ≥50% facades greened. Above-ground car parking generally prohibited (only exceptions in some mixed-use areas if integrated into main building).	/

B-GI	Roof greening: ≥2/3 of roof area (for communal terraces 1/3), substrate ≥13 cm. Underground garages: intensive greening, substrate ≥0.5 m (≥0.8 m at tree sites); Open plot planting: WA ≥60%, MI ≥40% permanent greenery. Tree planting: 1 medium- to large-crowned deciduous tree per 500 m^2, trunk Ø 18-20 cm; Compensatory habitats: wall lizards (4,200 m^2), sand lizards (320 m^2 + 960 m^2), hawk moths (900 m^2), hedgerow bird habitats (90 m). In general, residential areas, at least 60% of the area must be designated as permanent planting areas, and in mixed areas, at least 40% of the area must be designated as permanent planting areas.	Preference for native species. Conifers excluded. Artificial turf, plastics, reflective/fluorescent finishes excluded.
Superstruct.	Buildable land areas fixed. Floor space ratio up to 0.9 (with underground garage exception). Building heights fixed per plan. The gross floor area of the top floor must be at least 75% of the floor below. Roof superstructures permitted up to 1.5 m (if ≤25% of roof area and indentation of at least 3m from underlying facades); Balconies up to 2 m^2 (WA4); Advertising limited. Noise protection: façades must comply with DIN 4109, mechanical ventilation required if >50 dB(A) at night.	High-quality design requirement: brick, concrete, glass, metal; reflective plastics prohibited. Façade bases integrated into ground-floor design;

Table 27: *B-Plan 19/22 "Neckarbogen Mitte" (Stadt Heilbronn, 2020).*

	Measurable	**Non-measurable**
FI- I	HQ200: 154.91-155.60 m NHN used for design. For the building and traffic areas within the planning area, a flood-safe planning elevation of approximately 156.00 m above sea level (relative to the design event) is provided, so that all areas in the planning area are located above the design event. Preventive flood protection is also achieved by prohibiting any apartments below the specified ground floor height. Paths and squares (except for public traffic areas) must be constructed in a permanently water-permeable manner or drained laterally via unsealed surfaces.	Water bodies (Floßhafen lake) framed as identity-giving elements.

AMI	Modal split target 70% eco-mobility / 30% private cars. Streets are designated as bicycle zones with 30 km/h speed limits or as pedestrian and cycle path areas. Pedestrian areas at Floßhafen and along Paula-Fuchs-Allee. No above-ground parking; underground garages only, 0.8 spaces per unit. Private bicycle parking facilities should primarily be located on buildable land, e.g., on ground floors or underground garages. In principle, high acceptance should be ensured through easy accessibility and short distances.	*Low-car, short-distance urban district* guiding principle. Principle of the *self-explanatory street* with high design quality and a good recreational function, thus enabling multimodal mobility.
B-GI	Green roofs on ≥75% of roof area (substrate ≥13 cm, phosphorus-free). At least 60% of the non-buildable land areas must be permanently designed as planting areas. ≥1 tree per 200 m^2. Public green space (peninsula park, water playground) permanently secured. Planting requirement: medium-large crowned trees in traffic areas and courtyards. Insect-friendly lighting: ≤3000 K (2700 K recommended), the installation of nesting boxes on the buildings.	Open space concept frames Floßhafen as *riverside square* and identity elements. Courtyards as communal gardens for social interaction.
Superstruct.	Building heights: 5-6 storeys depending on block. Density ranges: 0.7-0.75 (up to 0.9 with underground garage cover). Ground floors mandatory for commercial/public uses along Paula-Fuchs-Allee and Floßhafen. Passive soundproofing: DIN 4109, mandatory mechanical ventilation above 50 dB(A). Outdoor areas along Paula-Fuchs-Allee must have glazing/protection if >62 dB(A).	Ground-floor *urban floors* as eye-level social space. Semi-open perimeter block typology ("Heilbronn Block").

Table 28: *Design Manual (Sinai Gesellschaft von Landschaftsarchitekten, 2015)*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	Minimum of 2 m^2 per dwelling unit for bicycle storage. Distribution: one-third on ground floor, one-third in courtyard, one-third in underground facilities. Max. 25% of front garden areas can be used for covering bicycle parking.	Facilities must be comfortable, weather-protected, and near entrances. Design should blend into architecture (materials, colors, planting).

B-GI	Resilient species specified (Hanging Serviceberry, Butterfly bush, Star bush). Green facades permitted only in specific areas (courtyards, recreational lake). At least three medium-sized trees (15-20 m) per farm/courtyard must be planted. Exotic, invasive species prohibited (e.g., Ailanthus, Prunus serotina, Rhus hirta). At least three medium-sized trees (15-20 m) must be planted per farm or courtyard. Minimum planting requirements follow DIN 18916 (August 2002): 6 m^2 open area and 16 m^3 root-penetrable space per tree. Specific species lists provided for climate trees (e.g., Field maple, Birch, Hackberry), flowering trees (Serviceberry, Whitebeam, Ornamental cherries), and group trees (Oak, Maple, Birch, Hornbeam). Shrubs must be selected from approved species lists: bird-feeding shrubs (e.g., Serviceberry, Barberry, Spindle tree), flowering shrubs (Witch Hazel, Magnolias, Lilac), shrubs with edible fruits (Chokeberry, Barberry, Quince). Root space, soil volume, and open surface must meet DIN standards.	Climbing plants should enhance ecological and aesthetic qualities but not dominate the urban image. Community gardens encouraged in courtyards. Roof gardens are considered part of communal open-space system. Preference for hedges, grasses, or low-structural barriers over opaque fences. Trees chosen must contribute to identity and urban climate, supporting seasonal variation. Subtle foliage colors preferred; very striking hedges or conifers discouraged. Coordination of planting across sites to ensure consistent identity. Vegetation is treated as a structural design element, shaping identity, ecological value, and neighborhood atmosphere. Roof terraces to be planted and used as semi-public green spaces, contributing to water retention, microclimate, and identity.

Superstruct.	Transmission heat loss (HT') limit values: 0.3 W/m²K (standard) or 0.2 W/m²K (for innovative projects). Ventilation concepts must comply with DIN 1946. Fossil insulation materials are prohibited. Differentiated house types: multi-story apartment buildings, solitary towers, twin towers, townhouses, terraced houses, and special use buildings. Mix of typologies mandated per block to guarantee diversity. General eaves height: 20.5 m. Variation allowed between four to six stories depending on block and location. Nine to twelve-story high points permitted orientation and urban accents. Construction tolerance: ± 0.25 m possible with approval. Commercially usable ground floor: clear height 3.6-4.0 m; standard floors: 3.2 m. Clear room height: approx. 2.8 m, set as a minimum for high-quality housing. All buildings must have walkable flat roofs. At least 50% of roof area must be covered with photovoltaic panels (average, per building). For the first construction phase: minimum 25% of photovoltaic roof coverage required. Maximum 25% of a top floor may be used as a private roof terrace. At least 60% of façade length of top story must align with normal floors below. PV modules allowed horizontally or with up to 20% south-facing incline. Roof structures (staircases, access) must be minimized and integrated into building volume. Facades should have 30-40% window opening ratio, adjusted depending on orientation (south-facing can exceed with justification). Buildings should be oriented all-round (ideally windows on 3-4 sides). Ground floor height: 3.6-4.0 m clear (to enable flexible uses). At least 50% of ground floor area must be occupied by commercial, social, or residential functions that communicate with the street. In less urban areas: balconies must be limited to max. 2 m² with open parapets.	Energy-efficient and airtight building envelopes are required to reduce energy consumption. Buildings should ensure high interior comfort and reduce condensation risks. Innovative and *unconventional* ventilation strategies are encouraged. Intelligent user management systems (apps, touchscreens) should make energy flows visible to users and raise awareness of environmentally friendly operation. Use of ecologically safe, recyclable, and demountable construction materials. Preference for renewable raw materials (e.g., wood) to reduce ecological footprint. Constructions should allow later dismantling, reuse, and renovation without damaging the primary structure. Life cycle assessment of buildings required. Building volumes should harmonize while remaining individually recognizable. Roof areas are framed as part of a *Second City Level.* Materials on roofs (stone, wood, plants) should foster dialogue between built and natural elements, reinforcing identity. Uniform façade appearance with moderate variance required. Facades should maintain calm, restrained structure rather than sculptural forms. Ground floors must serve as active meeting zones between public spaces, semi-public courtyards, and private residential areas. *Dead* street façades (e.g., garages or blank walls) are prohibited. At recreational lakes or less central locations, larger balconies and more variation are permitted. Projections like bay windows generally discouraged in main streets to preserve flat façade design. Facades should be derived from construction logic, ensuring clarity and readability of buildings.

	Loggias and balconies must align rhythmically with façade design. Facade materials must allow recyclability. Untreated, natural, or durable materials (e.g., timber, mineral plaster, concrete, sandstone, zinc sheet) are prioritized. Fossil-based materials (polystyrene, non-recyclable plastics) are not allowed. Plaster facades must use a predefined color palette (122 colors, 6 gray tones). Garish or overly bright colors are prohibited. Parking spaces are only permitted in underground or multi-story garages. Multi-story garages must respect eaves heights (14.1 / 17.3 / 20.5 m).	Avoidance of short-lived, fashionable, or high grey-energy materials. PV modules in facades are generally excluded, unless they are integrated discreetly with approval. Color scheme must harmonize within each block and be approved by the building committee. Wood as façade material allowed only up to building class IV (due to fire safety). Parking structures should integrate bicycle facilities, charging points, and mobility services. Garages must have transparent/green facades and blend into urban design, avoiding blank walls.

3Land

Table 29: *Urban Development for the Rhine port of Klybeck-Kleinhüningen (Feddersen et al., 2006).*

	Measurable	**Non-measurable**
Fl- I	Removal of sidings at Rhine bank (2006-2016).	/
AMI	Truck ban on Klybeck shore (2016 step). Shore fully dedicated to non-motorized traffic (2016 step).	Character of Rhine bank shaped by *slow traffic* (walking, cycling).
B-GI	New water basins proposed between Rhine and Altrheinweg. Integration of Wiese riverbanks and Stücki-Wiese-Wiesenplatz green corridor (2006-2016). Forecourt upgrades (Altrheinweg) with green spaces or water basins.	Riverbank is treated as continuous public landscape, that crosses port borders.
Superstruct.	First waterfront residential uses at Wiesendamm/Uferstrasse and Novartis site (2006-2016). Stepwise release of Klybeckinsel for higher-value urban uses once leases expire (2029, 2049). Proposed first step structural development areas.	Klybeck Island as mix of interim, cultural, and urban uses. New neighborhoods directly connected to the riverbank. Preservation of unique port-industrial identity in Kleinhüningen. Structural development left open (according to concept).

Table 30: *Synthesis Report - Klybeck-Kleinhüningen - Test Planning with Port Logistics Option (BVD et al., 2010).*

	Measurable	**Non-measurable**
Fl- I	/	/

AMI	Planned Rhine promenade (continuous foot/cycle path Dreirosenbrücke - Weil-Friedlingen). Extension axes from Klybeck to Rhine should be fixed and temporary crossings to the Rhine should be provided. New Rhine bridges: one at Wiese estuary (Basel-Huningue, phase III) and pedestrian/cycle bridge at border (phase II).	*Reduction in private motorized transport* through mobility management, parking reduction, car-free living pilots. Better integration of Klybeck area. non-motorized transport should be prioritized early on so that development can be successful and all necessary investment should be made in advance/with the development.
B-GI	New green/open spaces planned in defined areas. Possible Altrhein water basin in place of port station (phase IV). Rhine/Wiese riverbanks to be preserved as part of biotope network and compensation measures required for lost ecological functions.	Requirement for remediation of legacy waste.
Superstruct.	Westquaiinsel: high-density development, tall building typologies (phases I-III). Klybeckquai: medium density, lower building heights, aligned with existing neighborhood fabric. Preservation/possible reuse of landmark silos, cranes, Brasilea building.	*Balanced mix of uses* (housing, work, culture, education, leisure). *Living on the Rhine* objective. Parceling principle: *barcode* structure. Trinational identity building.

Table 31: *3Land Development Vision (MVRDV et al., 2011).*

	Measurable	**Non-measurable**
FI- I	/	/
AMI	New Rhine bridges proposed: at Wiese estuary, Dreiländereck, and other cross-border points - each bridge with a different modal focus. New Rhine bridge is the most important development measure. Continuous active mobility paths along the Rhine front.	Bridges as symbolic cross-border connectors.
B-GI	Green corridors identified: Rhine, Wiese, and Huningue Canal interlinked as continuous landscape system. Development zone positioned between Basel-Nord and large-scale natural landscapes (Sundgau, Rhine floodplains, Wiese valley).	Nature and waterways are framed as backbones of the landscape.

Superstruct.	District identities defined in 8 functional zones.	Creating a trinational skyline and new symbolic landmarks - bridges, skyline, marina.

Table 32: *3Land Planning Agreement (Kanton Basel-Stadt et al., 2012).*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	Fixes a new Rhine pedestrian and cycle bridge and a harbor cycle bridge as sub-projects.	Active mobility was prioritized along riverfront. Better cross-border transport links are required. Accessibility and continuity of the banks of Rhine.
B-GI	/	Creation of more high-quality open spaces for people. Preservation of valuable natural areas.
Superstruct.	/	/

Table 33: *Spatial Concept 3Land - Vision for Territorial Development (Team LIN, 2015d).*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	New Rhine bridge Basel-Huningue. New pedestrian/cycle footbridges (CH-FR, CH-DE, CH-CH). Multimodal corridors and stations defined. Banks kept car-free. Parking strategy: car-minimal Rhine Island, reduced parking in Huningue South, no Park+Ride inside perimeter. Integration of Weil am Rhein shopping area into pedestrian and cycling network. General accessibility to the banks of Rhine.	*Linear centrality* across Rhine. Porosity and cross-border tariff unification. Active mobility as trinational daily practice. Bridges to contribute to cross border accessibility.
B-GI	Three new large parks (Huningue Sud quarry park, central park south of port, green corridor in Weil am Rhein). Common framework of parks that cross borders and reconnection of large green spaces to Rhine. Green corridors linking Rhine, Wiese, Huningue Canal. Huningue Park 1.7 ha, Weil riverbank park 0.7 ha, Weil corridor 2.7 ha, Strandpark c.a. 1.3 ha. Park Urbain c.a. 3.8 ha etc. Compensatory habitats are required if dry corridors are affected.	Nature and waterways as backbone of trinational identity. Promenades and green streets as ecological and social connectors; *Nearby nature - metropolitan nature* concept. Compensation framed as opportunity to add quality to neighborhoods.

Superstruct.	Programming targets for offices, industry, culture/creative/hotel, schools, retail defined numerically.	Image-building through innovative and attractive housing typologies, trinational campus, cultural anchors. Industrial heritage reuse.

Table 34: *Spatial Concept 3Land - Transformation Strategy (Team LIN, 2015e).*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	New bridges and phasing targets set: CH-FR (Basel Hafeninsel-Huningue, to be finished~2020), CH-DE (Basel Hafeninsel-Weil/Friedlingen, to be finished ~2025), CH-CH (Novartis-Huningue Süd, to be finished ~2030). Full Rhine banks reserved for pedestrians/cyclists without motorized traffic.	Bridges as symbols of trinational cohesion. Active mobility as daily cross-border integration. Mobility framed as backbone of trinational centrality.
B-GI	Three large parks realized: Huningue urban park (former quarry), Basel Strand/Island Park, Weil am Rhein Green Corridor. Connection of large landscape areas - Rhine, Wiese, Huningue Canal reconnected into continuous corridors. Rhine banks opened and fully public; expansion of Rhine Park via pilot plot. New green streets linking neighborhoods to waterfront.	Rhine in the middle as a goal. Connecting green corridors to accessibility corridors.
Superstruct.	Programmed areas across zones defined numerically- housing/work in Huningue South. ZAC Canal living and working. Basel Hafen-South housing/public. Huningue riverbank housing/leisure/hotel. Phases of superstructures developments are defined. Goal to reuse emblematic industrial buildings (Rhenus, Kesselhaus, etc.).	Area should have high degree of flexibility and exact development cannot be foreseen in advance. Hybrid *architecture-as-infrastructure* required for the area.

Table 35: *2016 3Land Planning Convention (Kanton Basel-Stadt et al., 2016).*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	/	Global transport strategy prioritizing walking, cycling, and public transport. Growth of motorized individual traffic is linked to urban development. Better cross-border connections ensuring accessibility by public transport and soft mobility.

B-GI	/	Preservation of valuable natural spaces with the Rhine as central free space. Creation of more high-quality green and leisure spaces for residents. Landscape is key factor for urban quality and identity.
Superstruct.	/	Extension of existing and creation of new districts with exemplary transformation processes.

Table 36: *Trinational Traffic Study (Ledergerber et al., 2017).*

	Measurable	**Non-measurable**
FI- I	/	/
AMI	Continuous Rhine promenades and riverbank cycle paths required. Mobility network within 15 km radius to connect surrounding municipalities by bicycle. Establishment of mobility hubs (Huningue Pont, Kleinhüningen) integrating public transport, e-bike stations, charging points, and repair facilities. <u>Rhine bridge conclusions</u> Steep variant (7 % gradient) preferred to preserve continuity of Rhine promenades. Variant 1 (north of Wiese estuary) performs best for traffic flow. Variant 2 (south) is better for urban integration. Bridge designed to carry public transport and pedestrians/cyclists (not private cars). Continuous connection of both riverbanks to the existing Rhine promenade network.	Promote short-distance, multimodal accessibility within the trinational core. Reinforce the image of the Rhine as a continuous pedestrian and cycling corridor. Ensure user comfort and attractiveness through seamless transitions between modes. Make active mobility the default mode for cross-border commuting. Car-reduction and prioritization of walking, cycling, and public transport over private car use. Active-mobility continuity across all new bridges and harbor crossings. <u>Rhine bridge conclusions</u> Bridge conceived as symbolic and functional connector of trinational cooperation. Enhance urban, ecological, and mobility synergies across the Rhine. Represents a *spine* for active-mobility integration in the 3Land area. Serves as catalyst for low-traffic, multimodal urban development. Supports phase-based, flexible implementation of cross-border accessibility goals.
B-GI	/	/
Superstruct.	/	/

Table 37: *2019 Certification Process Manual (Ville de Huningue et al., 2020).*

	Measurable	**Non-measurable**
Fl- I	/	/
AMI	/	Priority given to walking, cycling, and public transport. Dense, gap-free and safe pedestrian network required. User-friendly bicycle parking; Mobility management. Efficient parking: reduced spaces per apartment/office, use of collective garages.
B-GI	/	Short, safe routes within green and open spaces. Climate-adapted planting, dismantling sealed areas. Creation and safeguarding of habitats (through roof/ façade greening, biotope connections).
Superstruct.	Indicators for energy efficiency: reduction of grey energy, reduction of operating energy (monitoring, BIM, tight building envelope), cooperative infrastructures. Circular economy indicators: reuse of materials, recycling of demolition material, accessibility of components, selection of long lasting and low maintenance materials.	Sustainability is added value for acceptance and planning legitimacy. Variation in ownership and investor types (private, institutional, non-profit). Diversity of target groups (price segments, typologies, lifestyles, age). Conversion of existing buildings.

Table 38: *2020 Strategy for Free Spaces and Natural Reserve Concept (IBA Basel 2020, 2020a).*

	Combined measurable and non-measurable baselines
Fl- I	*In the Neighborhoods:* Use of vegetation-capable edges and flood-tolerant species to balance drainage and habitat functions. *On and along the Rhine:* For riverside path above embankment: Surfaces that are as permeable as possible. *On and along the Rhine*: Surfaces that are as permeable as possible. Bank structures capable of vegetation. Demolition of built-up embankments to restore natural profiles. Sectionally natural water edges / bank areas. *To and across the Rhine*: Possibly near-natural water edges / bank areas.

AMI	*<u>In the Neighborhoods:</u>* In green areas - footpaths only, peripheral cycle routes. *<u>On and along the Rhine:</u>* Paths as linear corridors for orientation and movement toward the Rhine. *For waterfront promenade* - Generous dimensions, high-quality design; Wide, separate pedestrian / cycle paths; MIV-free or mixed area Velomit delivery. Continuous row of trees or avenue i.e. shaded footpaths *For riverside path above embankment* - Mixed footpaths / cycle paths; Paths are accompanied by species-rich meadows and/or ruderal strips. *New Harbor Bridge - Combined* pedestrian/cycle bridge; High-quality integration of ramps and stairs into public spaces. *<u>To and across the Rhine</u>:* Priority LV, pedestrian/cycle path separated (if possible) or combined, car free (existing: in mixed traffic); Easy, pedestrian-friendly crossing of intersecting traffic axes; Preservation of existing road axes to the Rhine; Opening new visual relationships/ road axes in extension of existing roads. *Water corridors along Wiese, Canal de Huningue* - Footpaths and cycle paths mixed or separate. *New Rhine Bridge* - separate pedestrian/ bicycle lanes; High-quality integration of ramps and stairs into public spaces. *<u>Superior / Metropolitan Parks:</u>* Linear movement and stay functions combined within green corridors. Integration of paths with views and orientation toward the Rhine. Accessibility within a radius of 500 m for residents. Completely car-free, bicycles only on main roads.

B-GI	<u>*In the Neighborhoods*</u>: *For avenues and streets* - Min. double / single row of trees; *Border design* with as many layers of underplanting as possible (e.g. meadow, perennials and/or shrubs); Selection of tree species based on ecological value and taking into account climatic changes. *For green areas* - Tree-shaded and sunny areas; As high a proportion of unsealed areas as possible; Integration of water elements; Undisturbed and species-rich vegetation areas with great structural diversity and a high proportion of native vegetation. *In squares, areas for specific use and areas used for sports* - Tree planting, unsealed and vegetation-capable areas with ecological value; Stepping stone elements / structures for the biotope network; Integration of water elements *For areas used for sports* - Tree planting in peripheral areas that do not affect the main use. <u>*On and along the Rhine*</u>: The waterfront functions as biotope network and habitat for flora and fauna. *For waterfront promenade* - Species-rich meadows or ruderal strips are part of the promenade. *For embankment* - Bank structures are capable of vegetation; Selective water access and natural seating steps (paving joints, etc.). *Water Zone Leisure* - Natural entry and exit options for Rhine swimmers while ensuring the ecological connectivity of the riverbanks and the ecological logical functions of the shore areas (e.g. shore vegetation, gravel beach, gravel banks, boulders, groynes, fascines, etc.). *For bridgeheads* - Trees and ecologically valuable green structures are an integral part, as high a proportion of unsealed areas as possible. *New Harbor Bridge* - Ecological networking using vegetation strips. <u>*To and across the Rhine*</u>: *Local biotope networking* - Diverse, interconnected green structures throughout the new districts, for example: rows of trees along streets or paths with ecologically valuable, climate-resistant and age-resistant street trees; Roadside or path side vegetation strips (meadows, herbaceous and perennial margins, ruderal areas) with structural diversity and a high proportion of native vegetation; Green facades. *Water corridors along Wiese, Canal de Huningue* - Generous dimensions of the entire corridor; Structurally rich and species-rich; Native vegetation (biotope network for meadows, woody plants and dry, warm habitats). *Dry, warm habitats along the harbor railway* - Consistently sunny, dry, warm meadows and ruderal areas; Undisturbed and species-rich vegetation areas with great structural diversity and native vegetation *Dreirosen Bridge* - Consider the integration of green structures (woody plantings and vegetation areas) to increase the quality of stay and to promote ecological connectivity on the spacious sidewalk areas. <u>*Superior / Metropolitan Parks:*</u> Creation and integration of valuable natural areas that are as connected and little used as possible and as undisturbed as possible; Structurally rich and species-rich habitats with native vegetation. *Specific Gleispark (Basel)* - Sufficient proportion of dry, warm habitats to connect the Rhine embankments with the railway areas; Integration of existing valuable natural values and qualities in contiguous areas; Protection through inclusion in nature conservation and nature reserve zones; If natural values worthy of protection cannot be preserved after weighing up all interests: restoration or otherwise appropriate replacement of these values (national and cantonal nature conservation legislation); Avoiding interruptions in the biotope network axis; Integration of industrial and transport relics.

	Rheinpark and Vis-à Vis - Design enhancement of the existing park; Expansion to include new open space functions; Promote and develop ecological connectivity along the banks of the Rhine; Preservation of the existing old tree population and supplementation with new plantings. *Specific open space in the Technology Park (Huningue)- Preservation* and further development of the valuable tree populations under ecological aspects as well as for the quality of stay and open space functions in accordance with the development projects; Identification of protected areas with priority for ecology within the park; Arrange intensively usable open space functions at the edges; Greening of roofs and facades; As low a degree of sealing as possible (building height greater than floor plan length); Use of native plant species; Natural and structurally rich design.
Superstruct.	<u>*In the Neighborhoods:*</u> Use of high-albedo surface materials for reflectivity. <u>*On and along the Rhine:*</u> Buildings and industrial structures developed together with open spaces in a site-specific manner. Green facades on building fronts facing corridors. <u>*To and across the Rhine:*</u> Water corridors along Wiese, Canal de Huningue and (Dry, warm habitats along the harbor railway - Avoidance of buildings that impair the biotope network.

Table 39: *ExEsso Synthesis Report (Departement für Wirtschaft, Soziales und Umwelt des Kantons Basel-Stadt & Bau- und Verkehrsdepartement des Kantons Basel-Stadt, 2013)*

	Measurable	**Non-measurable**
Fl- 1	/	/
AMI	Public Rhine promenade. The Rhine promenade, the eastern bank of the future Rhine Island, and the future Altrheinweg quay are the fundamental concepts for connecting to the urban system of public outdoor spaces in the Rhine harbor area. Optimized connectivity to Germany is the goal. The connection to France is integrated into the bridge. Mixed traffic zone on the newly created Old Rhine bank, access to all plots from the east. The bridge to France is the key point for the development.	Traffic calming across the Rhine Island. Prioritize public transport, walking, and cycling. Develop unconventional mobility concepts and reduce parking ratios. Maintain continuous cross-relationships between Klybeck and Rhine Island. All measures to improve accessibility for public transport, pedestrians, and cyclists. Linking and networking with existing and new open space elements in the Klybeck and Kleinhüningen districts. A key element that defines the city's identity is the Rhine riverbank - intended to be linked to the "city coast" and thus contributes to the overall structure and connectivity both in terms of open space and ecological aspects.

B-GI	The design of the Rhine banks and the planned *Old Rhine Branch* should be carried out in such a way that the current situation is enhanced regarding biodiversity. Improve biodiversity and ecological continuity along Rhine and Wiese. A strategy for safeguarding ecological qualities arises from the open space networks and corresponding development requirements.	Open spaces to remain public and water-connected, not private courtyards. Pocket parks and east-west *cross spaces* between building plots.
Superstruct.	Building heights and density range were numerically tested. Pilot-phase *pioneer* and interim uses to activate Rhine promenade before full port relocation. Architectural and exterior accents at the north and south tips of the island. Integration of heritage silos, warehouses, cranes as identity carriers.	Upwardly compatible phasing, each building must add urban quality. Mix of investors and cooperative actors. The development must serve as a model for energy efficiency (energy generation by buildings and energy consumption, avoiding the use of non-renewable energy). Use of innovative concepts (infrastructure, passive energy, etc.).

Table 40: *Programming Port Area Klybeck/Kleinhüningen - Final Report (Bau- und Verkehrsdepartement des Kantons Basel-Stadt, Städtebau & Architektur, Planungsamt, 2017)*

	Measurable	**Non-measurable**
FI- I	/	/
AMI	Implementation of continuous cycle paths and parking facilities for businesses. Pedestrian bridge Dreiländereck and Kleinhüningen–Huningue Rhine bridge. Urban corridors linking Klybeck district with Ackerstrasse and Inselstrasse should be extended to the Rhine.	Better pedestrian and bicycle connections between districts and the Rhine.
B-GI	30 m-wide Rhine promenade designed as continuous open-space corridor. Green axis from Rhine to Wiese with accessible neighborhood parks. Reduction of traffic areas for renaturation and permeability. At least 9 m^2 green space per resident within mixed-use areas.	Generous renaturation, green, and recreational areas along Rhine and meadow. Integration of water-oriented districts with small, local squares instead of large parks.

Superstruct.	Building heights: 30 m general maximum; landmarks up to 110 m at urban interfaces.	Mixed-use typologies combining housing, workspace, culture, and leisure to avoid mono-functionality. Energy-efficient, sustainable lifestyles encouraged through local services and short routes. Development is aimed at socially mixed neighborhoods, cooperative housing models, and flexible ownership structures.

Table 41: *Harbor Front Conversion - Urban Development Concept for Klybeckquai and Westquai (Bau- und Verkehrsdepartement des Kantons Basel-Stadt & Städtebau & Architektur, 2019)*

	Measurable	**Non-measurable**
F| - I	/	Maintain the dual function of the Rhine as port and urban landscape.
AMI	Car-free Rhine promenades; New bridges across Rhine and harbor linking CH–FR–DE. Cross-district bicycle routes along Rhine, Wiese, Altrheinweg, and Mauerstrasse. 15 m-wide residential and 5–8 m commercial cross-streets connecting old and new. Pedestrian-only cross-streets inside Gleispark.	Priority for walking, cycling, and public transport. Limit private motorized transport; Promote cross-border accessibility and *integration into trinational mobility network*. Encourage *short-distance living–working relations* and *internal permeability*.
B-GI	Gleispark: 900 m long, 40–90 m wide linear park on former port railway. Publicly accessible Rhine promenades: 19.5 m width (Klybeckquai), 16.5 m (Westquai). Three waterfront squares: Uferplatz, Inselplatz, Wiesenkopf. 45–50 m × up to 80 m. Tree-lined Avenue along Rhine with interrupted openings to water.	Preserve biotope corridors along Rhine and Wiese as supra-regional ecological axes. Combine sports, leisure, and ecological functions in the track park. Continue Kleinbasel Rhine promenade character.
Superstruct.	Building density defined. Building heights: 20 m (adjacent Klybeck), 30 m (waterfront), 65 m (high points). Footprint limit: 900 m^2 for high-rise towers. 12 m height for workshops and small-scale riverside buildings.	Maintain industrial character: reuse of silos, cranes, truss bridges. Architectural guidelines: coherent façades, roof greening, reuse of red/yellow plaster and brick. Integration of protected port buildings and silos. Roof greening and gardens. Restrained façades and slender tower proportions aligned with silo massing. Promote reuse and transformation of port structures (not museum preservation).

Table 42: *PADD Orientations from PLU Revision (ADAUHR ATD68, 2019)*

	Measurable	**Non-measurable**
Fl- I	/	Rhine flooding risk integration in project design; Urban design must account for flood safety near Rhine and Canal banks. Integrate risk awareness into project planning through prevention of foreseeable natural risks.
AMI	Development of north-south multimodal corridor (Avenue d'Alsace-Saint-Louis). Soft-mobility network connecting Rhine, Canal, and surrounding communes.	Prioritize walking, cycling, and public transport as per 3Land *Transport Study* (2017). Promote short daily trips and give greater space for cyclists and pedestrians. Encourage cross-border accessibility between Huningue, Weil am Rhein, and Basel. Gradual reduction of car dominance near historic centre and riverfront. Park-and-ride and multi-level parking provisions.
B-GI	Integration of green corridor along railway line and green spaces at port area/ferry pier. Tree alignment protection (road RD107, Place Abbatucci). Compliance with SRCE (Regional Ecological Coherence Scheme).	Reinforce green and blue continuities along Rhine and Canal and protect ecological corridors. Promote renaturation of redevelopments in Rhine banks, canal banks, brownfields and industrial sites. Create borderless ecological corridors across the three countries. Integrate nature within urban redevelopment (roof/façade greenery). Maintain balance between built and green areas.
Superstruct.	/	Foster functional mix in riverfront and Canal redevelopments. Encourage reuse of existing structures; maintain valuable industrial heritage. Promote architectural diversification and adaptive reuse.

Table 43: *Regulations from PLU Modification No. 2 (ADAUHR & Ville de Huningue, 2023)*

	Measurable	**Non-measurable**
Fl- I	/	Development operations must take into account the risk of rising water tables and bring the subsoil levels into line with the most recent and most refined regulatory elements at the time of the urban design studies. Rainwater from roads must be directed to swales before infiltration. Water from the waterproofed surfaces of car parks must be evacuated after passing through a hydrocarbon sludge separator unit with appropriate characteristics. Rainwater drainage will be ensured by devices adapted to the operation and the terrain.
AMI	/	A soft link between Rue de l'Industrie and Quai du Rhin is reserved. Reserved space No. 12 provides pedestrian/cycle access to connect the parts of the town separated by the railway line.
B-GI	In 1-AUb, at least 50 % of the total area of each land unit must be treated as a permeable space, comprising at least half of green spaces, mostly wooded. In 1-AUa, at least 50 % of the total area of the sector must be treated as quality landscaped open space, predominantly planted. In 1-AUe, green spaces on the ground of each lot must represent at least 20 % of the surface area of the lot.	Sector 1-AUc Existing afforestation must be preserved; tree cutting is allowed only for site needs or safety. Minor developments are permitted if compatible with afforestation maintenance. Sector 1-AUe Green and wooded spaces must align with sector guidelines. Areas classified under Article L.151-23 must preserve and strengthen an ecological corridor free from construction, except for traffic routes. Sector 1-AUc (Article L.151-23 zones) Areas designated under Article L.151-23 must remain predominantly wooded. Sector 1-AUe (Article L.151-23 zones) Designated areas must maintain and reinforce existing wooded and semi-open environments, forming a continuous biotope interrupted only by pedestrian or cycle paths. Other green areas must comply with OAP requirements.

Superstruct.	Maximum height in 1-AUb: 47 m. Maximum height in 1-AUe: 15 m, locally 23 m for one signal building. Maximum footprint in 1-AUb: 25 % of the land unit (excluding covered parking). Maximum buildable area in 1-AUe: 30 000 m^2. Maximum per lot 60 %; Parking minimum 1.5 spaces per dwelling in 1-AUb.	Constructions must comply with current thermal regulations and strive for high environmental quality. In 1-AUe, constructions must favor the use of sustainable and short-circuit materials. Constructions must be carried out in such a way as to enhance the site and create a quality urban façade. The development must create an architectural alignment along the Quai de la République.

Table 44: *Development and Programming Orientations (OAP) from, PLU Modification No. 2 (ADAUHR & Ville de Huningue, 2022)*

	Measurable	**Non-measurable**
Fl- I	Depth of basements must be checked and brought into line with the most recent regulatory elements regarding the risk of water-table rise. Two underground levels maximum are allowed for parking due to groundwater conditions.	/
AMI	Only one motorized access permitted for 1-AUb, via Rue de la Libération. Main mall dedicated to pedestrians and cyclists, including cycle-parking areas. Cycle network continued along the Rhine banks, connecting to other parts of the city. Allée des Marronniers must be at least 15 m wide, including traffic and landscaping.	Traffic and parking organized to avoid transit near Weil-am-Rhein square and the public park. Pedestrian and cycle movement prioritized along the Rhine banks and rue de France.
B-GI	Sector 1-AUb: Green spaces with medium and low-stem trees will be created at a rate of at least 25% of the surface area of each land unit. Permeable open spaces required to enable rainwater infiltration; rainwater harvesting systems recommended. Sector 1-Aue: A group of lands with an area of more than 2 hectares in a single block forming an ecological corridor. These cross-roads will be planted in several layers… at least two, the most important of which is located to the south of the site. Landscaped or planted pedestrian crossroads must be at least 19 meters wide. All these green corridors are unbuildable, in open ground and cannot accommodate parking.	A green buffer area to the north of 1-AUb towards Rue de France must be maintained or redesigned. The proportion and layout of green spaces must ensure good connection to Huningue's green-and-blue network.

Superstruct.	1-AUb: Maximum total floor area 17 000 m^2 (excluding parking and technical rooms). Building height ranges: 25-58 m (50-58 m on Rhine side; 20 m street side for residential). 1-AUa Sector 2: Heights 50-58 m near square; 25 m along Marronniers. 1-AUa Sector 3: Max 58 m Rhine side; 35 m street side. 1-AUa Sector 4: Max 35 m. 1-AUa Sector 5: 58 m Rhine side; 20 m street side. 1-AUe: 3 levels max; one lot may reach 23 m / 6 levels on 80 ares maximum.	Buildings must create a gateway effect at Rue de France facing the footbridge and align with the SIGNAL building. Built volumes along the Rhine must ensure a continuous urban front with 25 m-wide open green breaks. Sector 1-AUb: Architectural alignment with Plein Ciel and Rue de France required. Sector 1-Aua: Architectural style must be harmonious and coherent across the whole project site.

Table 45: *Preparatory Study for the Redevelopment Area "Friedlingen Town Centre" (Stadt Weil am Rhein & Stadt- und Grünplanungsabteilung Stadtbauamt Weil am Rhein, 2016)*

	Measurable	**Non-measurable**
Fl- I	/	Rhein accessibility and experience to be enhanced.
AMI	Existing overregional cycle paths and local links to Dreiländerbrücke.	Reduce barrier effects of Hauptstraße and Colmarer Straße. Improve continuity of pedestrian and cycling routes.
B-GI	Rheinpark expansion planned after relocation of port. Design competition "Green Campus Friedlingen" 2016; implementation 2017-2021. Grass + artificial turf field (≈ 6,000 m^2).	Increase green and open-space share, particularly for children and youth. Make the Rhine visually and physically accessible. Introduce buffer green structures along Colmarer Straße.
Superstruct.	Energetic renovation of 3 private buildings per year at €20,000 each (2016-2022).	Promote energy-efficient refurbishment of private and public buildings. Improve architectural appearance and reduce vacancies. Strengthen social security and neighborhood identity.

Table 46: *Friedlinger Dialog (Stadt Weil am Rhein, Stadtplanungsamt, 2015)*

	Measurable	**Non-measurable**
Fl- I	/	Valorization of waterfront areas "in terms of accessibility to the Rhine" and "development under the premise of accessibility and continuity"

AMI	Annual modal-split survey as part of an integrated transport development concept. Continuous cycle-path routing with signage from *Dreiländerbrücke - Weil Zentrum*.	"Continuity" and "connection elements".
B-GI	Design parameters in framework tender: green-space and walkway ratios to be defined.	Central, expandable open space in Friedlingen with favorable location on the Rhine. Promenade/waterfront area to be developed under the premise of accessibility and continuity.
Superstruct.	/	Experimental space for compact building structures with residential, cultural and service uses. Preservation and valorization of identity-forming elements.

Table 47: *Rheinpark Competition Winning Concept (Stadt Weil am Rhein et al., 2016)*

	Measurable	**Non-measurable**
Fl- I	Promenade lowered by approx. 50 cm compared to the park to create a view of the water and improve access to the Rhine.	/
AMI	North-south cycle path incorporated into the riverside promenade.	Direct connection under the Rhine Bridge for cyclists. Promenade designed for better orientation and balcony-like experience toward the water.
B-GI	Existing inlets are retained and developed into a bathing bay. Existing tree population is largely preserved. Weak trees removed. New plantings added considering flowering and climate compatibility.	Central area kept free of use, developed as a loosely treed park. Strip of grasses and perennials with wooden decks for lounging.
Superstruct.	/	/

Table 48: *Sanierungssatzung (2016 + Erweiterung) (Stadt Weil am Rhein, 2016, 2017)*

	Measurable	**Non-measurable**
Fl- I	/	Redesign of the Rhine riverbank and the existing Rhine Park.
AMI	/	Increase of connectivity within the district. Creation of cultural axis through Schusterinsel.
B-GI	/	Improvement of green and open spaces.

Superstruct.	/	Promotion of energy-efficient refurbishment of private and public buildings. Correction of design deficiencies / improvement of architectural appearance.

10.3.Expert Interviews

Some interviewees verbally indicated during the interviews that they would be willing to be cited by name. However, no formal written consent for identification across all forms of dissemination was obtained. Therefore, all interviewees are anonymized and cited using numeric identifiers. Role-based descriptors are provided in the interview transcripts below.

Interview 1: Explorative interview with representative from the management board in ASTOC, conducted online on 10 October 2023

Interviewer: Can you briefly introduce yourself and your expertise?
Interviewee: I'm an architect and urban planner by training. I'm for 15 years here with ASTOC architects and planners. And since last year part of the management board.

Interviewer: What is your role in your institution and the river redevelopment project?
Interviewee: I wasn't personally involved in the early stages of the HafenCity project.

Interviewer: What sets this project apart from other projects of your prior experience in terms of its objectives and functions in the urban environment?
Interviewee: I think, if we take a look at the project, and the importance and the impact of the project as such. It's of the highest priority because of its location and the possibilities and opportunities it created for the city of Hamburg. So, you often have large-scale urban projects, so they are important by size. But in this specific case, you just don't have only the sheer size of 150 hectares. Also, the location, the key location for the city of Hamburg, makes it very special. Specifically, Hamburg was for many decades basically blocked from access to the river Elbe. And with the opening of these key areas of these plots within the old harbor area, it was possible to bring Hamburg as a city and the inner city towards the water and open up several kilometers of new waterfront for the citizens. And I think this makes it special on the one hand, and on the other hand, if you look at the conceptual approach to the project, the idea was to actually really increase the inner city in this case, which means taking as a model, building density, but also mix of users and extending the inner city of Hamburg by 40%, within the limits of this new project. So also, conceptually, when we talk about the mix of function and the density, it's a very central and very urban concept.

Interviewer: How did the river's proximity affect each stage of the redevelopment project - preparation, planning, execution, and operation, especially when compared to redevelopment initiatives you have worked on, situated away from water bodies?
Interviewee: I think one of the key differences is twofold. On the one hand, the asset of having those old port structures, decayed structures, spanning out like fingers and creating several kilometers (I think some 10 kilometers) of new waterfront, which makes the development of this area extremely attractive for future users either commercial users but also for residential users. Water is always an asset, and normally, people are looking for this kind of closeness to water, which brings more quality to the surroundings. So that's, more or less, the positive part about the location. So, its proximity to the inner city, on the one hand, the location at the water, and being in harbor basins, create a long order of the positive side. On the other hand, it was very challenging to create a city from scratch on these former docklands because of the flood

risk of this area, especially if you take a look at the river Elbe, and the actual flood protected new height level of the city of Hamburg. We are talking about a difference of 8-7 meters that has to be bridged by the new development. And when we talk about infrastructure, access roads, all these had to be flood resilient and had to be designed in a way that you maintain access and escape routes even in a flood situation. This means that the key access routes are actually artificially elevated to be above 8-7 meters. And then again, if you balance out the necessity of creating an artificial new ground floor level that is flood-protected on the one hand, but also you want to have access to the actual water of the river, all of a sudden, you have to bridge more than eight meters of height difference. And there comes the whole challenge of creating an attractive open space concept. And this was mainly conceived by EMBT Miralles in Barcelona. And they did big parts of the actual open space concept, for example, creating public spaces, public squares that are stepping down from the flood-protected ground floor level all the way down to the water with ramps and stairs and seating areas, and kind of not making it so obvious that they are bridging a high height difference. Another strategy, you will find if you take a closer look, there are promenades between the water level and the ground floor level, you will find promenades about half height between those two levels just for public access, so people can walk a lot closer to the water during most time of the year. And in extreme cases, of course, these areas can get flooded, which also means that you have to choose a more robust design in the public spaces as well.

Interviewer: To what extent was flood resilience and associated risks considered during the preparation of the project? How does this project enhance fluvial flood resilience?
Interviewee: Basically, what the project had to accomplish is creating this new artificial ground floor where you would have all the fire brigade, firefighting accesses, the flood, the escape routes in case of flooding so if you, let's say, layer catastrophic scenarios, let's say, you have a flood situation and on top of that, you have a fire in one of the buildings you have to make sure that both situations can be controlled. And this way, also, if you take a look at the HafenCity layout and the plan, you will find that there are bridges at the back, at the northern edge, of the project that link the inner part of the HafenCity to the existing city, or the former central part of Hamburg, to create these flood-protected access routes. And of course, this also has several effects. We've just talked about open space design, but it also affects the design of the buildings themselves. For example, we still have underground parking and also some shops at this level, at minus one. This means that you have two choices: either you block it off in a waterproof scenario with big, massive doors, where you can protect some shops. But also, you have the challenge that those parking garages need to be flooded in an extreme case. So basically, it was also challenging for architecture to make underground parking garages that have the capacity or possibility to be flooded in a controlled way.

Interviewer: Did you include public participation in the process and how?
Interviewee: There have been several means of public participation. I'm not sure if I can recall all of them. For example, there was, from the very beginning, a kind of visiting tower, where you could go as a citizen and get firsthand information on the new projects that are going on in development. And this tower was able to be moved during several phases of the project. So, as it started closer to the existing inner city, the tower then moved further along as the project continued through the early 2000s and 2010s, until today. So that's basically getting information and participation information on the site, which is one key aspect. Then, on the other hand, in the castle house, you have this huge urban model, where you also find lots of information about the project in general, but also specific parts of the project. They have a very active website, where they inform about all kinds of projects, new openings, and so forth. And another aspect is that in all the plots, you would have architectural competitions to ensure and maintain a high level of quality, from the urban design, all the way to architecture and project delivery. And then regarding public participation, I'm not 100% sure, in the early stages of the project, how they involve citizen participation and information.

Interviewer: Has the river undergone a process of re-naturalization? What difficulties are associated with re-naturalizing rivers, including pollution concerns?
Interviewee: That is an interesting question. I think we have to keep in mind that we are talking about these former harbor structures. We are in a highly industrialized environment. All the riverfront of the harbor is basically artificially constructed quay structures, with those I'm not really sure the term in English, like those folded steel plates and stone walls that actually form the harbor case. So, from scratch, we're talking about a highly artificial and industrial environment. Regarding your question, have there been any efforts for re-naturalization? I think it's not really the right spot. If we look back into history, those quay structures don't really allow for a lot of re-naturalization. But what happened was really adding a great number of public spaces and green spaces within the project. If you take a look at the numbers, there are more than 30%, I think it was 38% of public open spaces or green spaces, or in total, so it's comprised of public spaces or publicly accessible spaces on private land. So, for a project of this size and in this location, the amount of public space is relatively high and generous. Does it really affect flora and fauna? Yes, we have a lot more trees than we had before in the harbor area. I mean, that was probably a completely hostile environment for plants and animals. So, now, yes, we have a lot more trees, we have parks. But still, all the parks and promenades and squares are often more or less urban in atmosphere and environment. So, I would say yes, in a sense, nature has been reintroduced, but still in a very urban context.

Interviewer: Would you say that the project really brought the people to the river? And to what extent? Because they still don't have contact with the water, right?
Interviewee: You have visual contact. So, I think on the plus side are the gains for the city of Hamburg and its citizens that you are actually able now to walk several kilometers of new waterfront. You have the views of the water, you have the breeze, and the wind. And you can really feel that if you live in Hamburg, you really live in an important port city, and you live by the river. I think this is something where the HafenCity project really helped a lot to create this kind of maritime atmosphere. On the one hand, if you walk along in the HafenCity, on the weekend, or in the evenings, you will see that on those public squares that are extensions of the harbor bases, you will see lots of people just hanging around, watching the sunset, enjoying the view of the water, and people do sports there. Also in the more eastern part, the new part of the HafenCity, which is currently still under construction, there has been introduced, in one of the basins, a new park in the water. And I've been told that even in the very beginning, the park was there first. And there wasn't even a building surrounding it. So, people would flock there on the weekend to do sports, bring their families, and so forth. So, it was already a destination and a place to be, even though there weren't any construction or buildings surrounding it. So, in that sense, I think the project and the urban design, and especially the excellent landscape design, made it possible and accessible for the people to be close to water, and really using it, are they getting all the way to the water? I mean, this is a relative question; you can step down quite a bit, then you have some floating elements as well. So, it's not really that you get an urban beach where you can actually dip your feet in, and you know, go for a swim. This is not really the case, but I think the closeness and the connection with water are something that has been successfully established.

Interviewer: Do you think the riverfront redevelopment project has effectively combined improving the city's image, creating public spaces, establishing ecological and transportation paths along the river, and integrating flood control infrastructure?
Interviewee: If we start with a question about the city image, I think HafenCity has done a lot for Hamburg as a city in general. It became a tourist destination on its own. So, if people go to Hamburg for a short visit, a lot of them also visit HafenCity as a destination. And of course, lighthouse projects like the Elbphilharmonie basically support this in a big way. And also, the fact that there you have a publicly accessible terrace at half the height of the building, all these

things help to add to the positive city image of Hamburg in general, and also help to add interesting additions to the skyline, and so forth. Hence, the project added to flood control, of course, yes, I would say so. As a matter of fact, as I just described earlier, all the measurements that have to be undertaken in order to make the whole project feasible, to make the whole new flood-protected ground floor, added a lot to the flood control in general. By public space and just described, there are more than a third of publicly accessible green and public spaces. And regarding connection, I think the project also made a big contribution. For example, at the very, very beginning of the project, there was only a tram line projected within the HafenCity. And as the project evolved, it became apparent that it had to be improved a lot to increase the capacity. So, the extension of the new subway line has now stops within the HafenCity and actually reaches the output, preparing the "Leap of Hamburg", over the Elbe - an idea that is almost a century old. And finally, it is within reach. So, the infrastructure that has been prepared within the HafenCity project also makes it a lot easier to finally, after this project is finalized, prepare the "Leap over the river Elbe", to the southern parts of the city, and create further extensions there. So that's the connection of the subway line on the one hand, and of course, there's also the river taxis or the bus-like boat running in regular service along the river Elbe and HafenCity. Of course, this also became one of the destinations or stops on this route. The last question is regarding ecological corridors. I think that's a question where this project probably doesn't add as much as other projects, just because of the fact that we are in this inner-city location in a highly artificial urban environment.
Out of the five points you mentioned, I would say that the ecological corridor is something that has been established on a lesser intensity, even though, of course, before it was a completely hostile environment. And now we have parks and trees and tree-lined streets and so forth. This had been introduced, but not emphasized on its ecological value, but rather emphasized on the function as a public space within an urban environment.

Interviewer: In what manner do you believe digitalization could have positively influenced the overall progression of the project? Was it used in any way the data, big data or simulations during the planning process of the project?
Interviewee: I'm not 100% sure to what extent it has been used regarding, let's say, creating the architecture. Because we, as urban planners, weren't really involved in those stages. And also, when we talk about, let's say, the generation of the concept 20-25 years ago, we still have images here of huge urban planning models with different materials and stuff. So, the level of digitalization back at the very beginning of the conceptual phase wasn't as advanced as it is today. From my personal experience, and background, I can't really give you a specific answer which tools were used at which, at which stage, but in comparable projects, we did wind simulations, and you know, things like heat islands, or like, you know, create simulations where you can see which areas of the city might be affected by heat islands where you need more shading, which kind of surfaces you could use to improve the microclimate within the city and so forth.

Interviewer: What do you think could have helped in making this project? How digitalization could have helped, especially in the context of improving flood resilience and calculating risks?
Interviewee: I'm not 100% sure if I can give you a satisfying answer on that. I mean, I'm pretty sure that the engineers who were involved in creating the flood protection concept also 20 years ago to calculate, you know, flood risks, 100- and 200-year level of water, and so forth. So, I think those tools have been used to the extent that it was available.

Interviewer: Thank you for the interview!

Interview 2: Interview with a senior architect, Miralles Tagliabue EMBT, conducted online on 02 October 2025

Interviewer: How would you describe your role in the planning process and how did you get involved with the HafenCity project in the beginning?
Interviewee: In the beginning it was the decision of the City of Hamburg. There was a wall, there was a port, and this wall meant that this part of the city was never really a part of the city because there was the fence and you could never enter. For somebody from Hamburg it was just like a white area, like nothing on the map.
They decided to do the conversion of this area, which is quite big. In total it's around 150 hectares, 170, something like this - 150 hectare - and they decided, as it's very central and by the riverside, to do a conversion of the port. They already had the new port, to reuse this part of the city as a city center, with different functions: with working spaces, with living, everything.
First was the decision of the city of Hamburg to re-urbanize this area, which was very industrial, but decadent industrial. Then they did a master plan, Kees Christiaanse/KCAP, I think from Rotterdam and they did a master plan to see how it could be: to have a structure, the morphology, how to connect all the points with the city center, how to connect to the riverside, how to deal with the UNESCO - which was not UNESCO at this time - but with this ancient part, and how to develop a city.
The first idea was to make a very dense city, to try to do the maximum, very dense. And they did a structure which completely forgot the landscape part of the project. Then they realized: okay, we have now a project, we can count the residential buildings, we know the square meters, but we don't really have quality in the space. We don't have quality in the surroundings, in the parks. Everything was forgotten: how to deal with the water, how to make it accessible, how to create quality or comfort in a new city.
Then there was [Mr. Walter], the mayor of the city. He decided to do a competition, a landscape competition, and this landscape competition we participated in. I went to Hamburg. I remember it was very cold, very hostile, the atmosphere over there - the quay was nearly one kilometer long and very cold and very unfriendly. This was our first analysis of the space. And then you have the phenomenon of Hamburg with the tides, the cold weather, the fog - this was what we found, what we know as Hamburg.
Then we decided from the office to introduce something very Mediterranean, to change the scale completely, to change the scale from the big transatlantic boats which were going there, to a different scale with smaller boats. Hamburg had a system of the transatlantic and the Ewer boat, which is a small boat to distribute goods in the city. And then we said, okay, let's do the scale as well in the public space. Let's do a very playful intervention. Let's start to do wherever we can touch, wherever we can add, wherever we can do something different, let's do it different.
I think our solution was the only one which was so radically different. The others more or less respected the lines, they did a little bit of pavement, but there was missing this kind of change of scale.
For us it was about putting the human being in the focus, and everything was turning around this. Wherever we could gain some free space, we did it. We went in with a very organic language, because organic language also responds to this organic type - the water going down, growing.
We won the competition by this design. It was very risky, because it was not a design you normally win a competition. But Herr Walter, [who was the mayor of the city], liked our design very much and he said: okay, we have to do something like this, as the master plan which existed was too hard, too dense.
So we put a contrast program to this and we developed something which was very Mediterranean, very playful, inviting people to come back - not just to use the flats, but also the outer space. This was the way we went.

Interviewer: When was this competition held? Did the results from the competition then feed into a correction of the new master plan, or how was it?
Interviewee: The competition was in 2002. We had a kind of frame planning, which was the master plan from KCAP, and we had infrastructural requirements. For example, they wanted a bicycle way, they wanted several connections.
We had to respect the accessibility to the quay walls. We had to think about different levels, because they decided to make a quay wall which is 3.50 meters higher and never flooded. In HafenCity we have different levels: one is the level of the water, which is like zero, but this varies 3.50 every day. Then we have the level of the ancient quay walls, which is around 4.50, and then we have the 3 meter higher level, which is the city level and normally not flooded. So we have these three very important levels. And the main question was how to connect them, because you don't want to have levels which you cannot access.
And how can you use the parts which are down? Because we had to take distances from the engineering. It was very complicated, there were so many factors to consider: the property of the port authority, the property of the city, the property of the quarter, then the engineering. There were so many people involved that we had to say, okay, we have to make a balance between all this and do a kind of optimization. What can we do to fulfill all the requirements and at the same time respect the intersections between the different authorities? This was a very long process.

Interviewer: Which agencies or stakeholders were involved at that time?
Interviewee: At that time it was on two levels. One was the public level and the other one was the private level. Some of the plots were already solved. Some buildings were already done, like the SAP building was already existing. One side was already done, the north side. But this was the reason why they decided to make a landscape competition, because it was too strict, there was no quality. Nobody wanted to go there and nobody really believed that you could ever give life to something like this, because it was just this very long drive, 12 meters, and there was no way to go there. There was no reason to go there because there was no quality. This changed very much with our design approach and with our design proposal.

Interviewer: Did you receive some official brief from the HafenCity Agency?
Interviewee: Yes, there was an official brief for all the participants of the competition. These were the guidelines for us: for example, here we want a bicycle way, we need 5 meters for the maintenance cars, we need accessibility for inclusion, we want a maximum of green, we have engineering requirements, we have these kind of properties... All this was given very well, because it is very complex, and this was our base for the design.
But in an office like ours, where we work very experimentally, first we don't look so much at these conditions. First, we do a kind of morphology on top of the site, to see what we can do, how we can transform it, how we can get from the big scale to a smaller scale, to something more friendly and playful. And then we adjusted it to the requirements of the HafenCity company.
It was a process in two directions: first we were very free and experimental, then we got the guidelines and limitations, and we adjusted the idea to those limitations.

Interviewer: How did your concept change from the initial idea until the end, when you got the limitations?
Interviewee: It changed. There are two parameters why it changed. One parameter is because this project was around 25 years long, and in 25 years urbanism is changing a lot. For example, the idea to have more green - this is something that came up in the last 25 years. When we started, they said they didn't want green because green is difficult to maintain, difficult to clean. And now they say they want a lot of green because of the insects. This ideology in urban planning has changed a lot, also influenced by the politics of the European Union. That was one factor.

The other factor was that because of our intervention, the prices went up, because the place became more attractive. The square meter price went up a lot. Then companies were attracted much more. For example, Deutsche Bahn wanted to move to HafenCity because they liked the place, but politics said no, you stay in Berlin. Still, it was more and more attractive for companies to put their seat in HafenCity.
It became a quarter that was very innovative, a pioneer quarter, and it promised to have very high quality in the landscaping. The investors were better, and they also delivered better architectural quality. Everything went up. They even say that part of HafenCity is now the most expensive in terms of real estate. The Marco Polo Tower is one of the most expensive parts, due to the river location and the landscaping we have.

Interviewer: So your bureau worked first on the west side and then you continued with the development on other parts? So which parts of HafenCity?
Interviewee: Not exactly. We did a pioneer project of Western HafenCity, which was like the supports, and it went very well. So they decided to do a second competition.
That was around Magdeburger Hafen. It was the next part. But they didn't allow us to join the competition anymore, because they didn't want to have this kind of connection. If we won the next part, and then the next part... In Germany you try to avoid anything that could look like manipulation. So we couldn't participate.
By coincidence, one office beside us in Barcelona, only 50 meters away, Beth Galí, won. She was inspired by our work and also introduced something more playful with stripes. She used a stripe system and took some details of inspiration, for example the differences between levels and other things. But we couldn't join further competitions in HafenCity. We were blocked. The park was then done by Vogt, a Swiss office.
We also joined the competition for Brooktorhafen with the mountain, but it was won by another office, I don't remember which one. It was clear they didn't want our office anymore. They wanted more variety, more diversity. We did the most urban part of the city, while the other parts are more residential, more green, with less intervention.
And we had maybe the part with the most architectural intervention.

Interviewer: So did you in any way include ecological green infrastructure, apart from the park?
Interviewee: Yes. It was actually one of the most basic goals, because HafenCity from the beginning wanted to achieve platinum standard. They also had the framework plan from Hamburg, which was very strict regarding trees and green. They wanted a high standard, and from the beginning, in every decision, the first step was always to try to make as much green as possible, to survive the trees. But it was very hard to plant trees in this part of the city, which is very windy. You have to plant the tree, you have to maintain it, and we had to change a lot.
We also used a lot of recycled materials - most of the main surfaces you see are recycled. We used many local companies, within a short distance, mainly from Hamburg, to keep an economic circle for Hamburg. We tried to avoid any kind of construction which was not necessary, and to elevate some things with green or with earthworks. But you always have to consider the structures: you cannot just put as much earth as you want. Sometimes you can add only one meter more, and that is enough, because of the engineering.
This was, what I told you before, it was a balance between all these conditions.
HafenCity put a condition about a budget, the money. To say, OK, we had to plan to fulfil a certain budget, which means we could spend maybe 250 euros a square meter or 400 euros a square meter, and we still generally included. Sometimes we had a curve which was very big — when we talk about a curve building in the water, we talk about 10,000 euros a meter. And sometimes you have a curve which is like 500 meters; you make it smaller, 400 meters, and then we talk about a million euros. This was a little bit what we had to consider as well, where we said it was like a slight modification of our concept, but it didn't destroy the concept.

The concept was so strong that we could keep as much as possible, but we did some adjustments in this way. And this was also part of the ecological idea — to spend less material.

Interviewer: So how did the branding, the image building of HafenCity and the image of Hamburg influence your design decisions?
Interviewee: I think we did create a brand for HafenCity. We did a branding, and I have seen it in many publicities. Sometimes when you see an publicity you recognize a detail and immediately know this is HafenCity, this is our work.
It's used everywhere — for mountain bikes, for cars, for all kinds of things. You see it a lot, and you recognize right away that it is HafenCity. This is because we did a kind of catalogue of detailing. Everything we built was very specially detailed, very carefully detailed. We didn't use any standard detail; we planned everything. Especially, we developed the lighting family with the lamps, which are exclusive for HafenCity.
We did the furniture, we developed it on our own. Even the trees — the selection of the trees is very special there, which one doesn't see so quickly, but it was very carefully done. So you recognize our language of the office; in any corner, wherever you look, you recognize something from us.
The dike - we developed patterns for the bricks — like the fish and the crosses and everything we used, we found these in Hamburg in a way, but we adapted it, we redesigned it to make them fit for this HafenCity project. That's why it became a very strong brand, also connected to Hamburg, because we researched Hamburg materials, researched Speicherstadt patterns, which we reused. So, there is a very good connection between the brand HafenCity and the brand Hamburg.

Interviewer: So how does the public space work? How did you intertwine it with the existing situation of the Speicherstadt, the old warehouses?
Interviewee: They have very exact property lines, which we always respected, also because of intersections and responsibilities for later use — who is cleaning if something happens. So this was very defined.
We connected it through the materials. For example, in Kibbelsteg, when you see the main road coming from Kibbelstegbrucke, we used asphalt — which was a little bit more clear because of Hamburg - they preferred clearer color. We played with the materials like fragments. We worked with pavements which are in stripes, which can adapt very easily to different situations and organic shapes. They can adapt to all the buildings done by different architects, and they can adapt to the parks. We didn't make clear axes or strict lines, we tried instead to do more of a patchwork, a collage of materials and elements.
This created a very good way to connect it with the existing city, but on the other hand it is still recognizable as something new — you don't see clear limits, you don't see where it starts and where it stops.
It is very much a weaving with the existing city, with the water, with the topography. And we achieved this through the materials — with bricks, asphalt, green, and our zig-zag shapes. Not as a straight line, but always shifting a little bit. In this way, we achieved a very good integration of this new land into the city of Hamburg.

Interviewer: Also, one part of the design of the whole place in Hamburg is the integration of the elevated paths. Were they part of your design as well, how were they integrated into the whole system?
Interviewee: When you talk about the elevated parts, do you mean the bridges or the housing?

Interviewer: Well, it's like an integrated system of paths, partly housing, partly bridges, that you can use to escape in case of flood, right?
Interviewee: Yes. This follows a plan of Hamburg. For example, there is a project by Zaha Hadid near the Elbphilharmonie. They did a complete dike system in Hamburg. The idea is

that we have the old walls at level 4.50, and then they add 3.50 meters, they raise the level to 8 meters.
They have garages inside, which connect from the top down to 4.50. So you always have a connection between 4.50 and 8 meters. Sometimes you need 60 meters of ramps because of inclusivity — maintenance cars have to go down, ambulances have to go down, handicapped people go down these ramps. We integrated these ramps into the system of walls. Sometimes by moving a wall you create a ramp, or you integrate a ramp in a very natural way.
On the other side, we have a kind of a system that brings people down to the water, like the staircases at Magellan Terraces and Marco Polo Terraces. There you also always have ramps that bring you in a natural way down to the water.
And on the other hand we achieved a system of terraces which offer very comfortable spaces to stay — small niches for people to meet, a very cozy atmosphere with trees and elements of wood where you can sit and enjoy the view to the water. This was an important part of the project, to connect the different levels.
This 3.50 which is the dike, we designed different patterns (the wall warft walls).
In the beginning the plan was to have one quiosk down there. But this worked so well at the Kaiserkai, close to the Elbphilharmonie, that they put a lot of gastronomy there, with the flood protection walls and the gates, the doors.
And when you go to the Dalman promenade — it is like the Rambla in Barcelona — there are so many people, it is so busy, with gastronomy and a big offer of quality. Nobody expected to achieve this. It was a complete surprise, and it was achieved by our planning, because people understood: we can go down into the garage, we can open it, we can offer gastronomy, and it will work, it will be accepted.

Interviewer: And the wall actually is integrated into the building somehow. So how did the private developers collaborate with the public space design to have this integrated design in this?
Interviewee: Yes. The main part was the city. They gave a subvention to the private developers, about 250 euros per square meter, to realize our design. They gave the subvention, they paid the part, but the developers had to deal with us. We had to agree about the open space and about the facade. Not a complete facade, but the intersection with our wall. We did the detail of the finishing of the wall. Sometimes it went up, sometimes the buildings go down. We had different elements: sometimes glass, sometimes buildings going down, sometimes houses sitting on top.
We did different details for different situations.

Interviewer: So for each plot there was a different scenario?
Interviewee: Yes, exactly. All the plots had to agree with us. We had to coordinate about the public space and the connection with the wall. The only thing we didn't intervene in were the private gardens.
But in the last part, in the centre and Strandkai, which is close to the river and the Riverside, we also did the design for the rooftops. Because with the Elbphilharmonieon the side, you see the rooftops from the platform, so they asked us to create a general design for the rooftops - to connect the landscape down together with the roof.
We also did the squares and the interior courtyards. What is in the courtyards is jumping up to the roof in a more simple version, but we have a kind of unity. When you see the masterplan, you see how everything is done by one hand.

Interviewer: So this intervention on the rooftops, was it the part of this project where you develop public spaces or was it another commission or another competition?
Interviewee: This was a commission which came later, because the first buildings they did it on their own. At the beginning there was no Philharmonie. There was a building, I don't remember the name now, a Dutch office... And then they decided to do the Philharmonie, and the decision to put the main square, the entrance square… suddenly you see from the top —

the public sees everything from above. And then they came with the idea that we should care about the rooftops in this new part of the river.

Interviewer: What kind of infrastructure is there on the rooftops? I guess there are some green elements and how does it work also in terms of drainage systems? Does it connect somehow with the courtyards? How does it work?
Interviewee: It depends on the building. The building on the peak is very high standard apartments. They have some private terraces which are green, and then they have a public zone with a playground, because in the framework plan they had to have a playground for little children. So we did small playgrounds in all the plots. We have a part of green, and unfortunately you always have to take the technic on top — you always have these boxes with technic that you cannot make disappear. But in between we integrated them.
There is also a part which is social housing, and there we have a public terrace, but we had to make it very simple because of the money, because they had a different budget. That's why we did the courtyards inside, trying to have a nice courtyard as well. Because it is very dense, you still have very good views in between, and we tried to do the maximum to give a good design to the courtyards.
The first building on the big site made the main distribution of the flats around the courtyard, and this was very complicated, because all the sleeping rooms went to the courtyard. And if somebody comes in the night, you hear the noise, you hear people talking. This was very complicated, so we tried with the courtyard to introduce a system which can give a little bit of privacy to the sleeping rooms on the same level and to the main entrances. This was how we tried to react on this fact.

Interviewer: Did you have some requirements for green roofs, or I don't know, in which time of the process, which years was this project, the green roof?
Interviewee: I think this one we started maybe four years ago, five years ago. And I think it's extensive green roof, not intensive green. It's an extensive roof because we are very high, exposed to the wind, and the conditions are very strong, very heavy over there. They are fine with the extensive green roof, and then some flower pots. Then we have some plots where we have a little bit more green.

Interviewer: So you said it was very recent, and I know that in the later years for HafenCity they developed some kind of EcoLabel certification system. So I guess this is also one of the requirements for this certification system. Can you tell me something more about it?
Interviewee: In this case, I don't know so much. This is a question I cannot really answer, because for us it was clear — it was the main ideology to introduce more green, green wherever we can. Which is not easy, because you have parking, you have problems for trees. For a tree you need substrate, you need ground, and the ground is heavy. Sometimes you don't have the height. For example, you have the garage, then you need the insulated roof, then you need the green roof layer. Sometimes you have only 10 or 15 centimeters to make something grow. What can grow in 15 centimeters?
So we made small hills to have some zones with a little bit more, but the hills cannot be too steep, because with the next flood they will be taken away. We had to talk about balance. We had several rounds of discussions, sometimes just to move a tree — where is this tree, where can we put it. We really did it by heart, it was a serious approach, to ask: how can we do it?
And always in accordance with HafenCity, because [Frau Schweber, she is the project manager], she kept very much the idea of HafenCity. She always made effort to do another round of planning, to say: okay, let's go on, let's try, let's do it. And all the participants, everybody worked very hard, very insisting, to get to this approach, to get close.

Interviewer: So for the public spaces, since part of them gets flooded, how did it work in choosing the materials and thinking about which materials to implement?

And how did you introduce the drainage logic into the space?
Interviewee: The drainage logic is very simple — it is always towards the water. This gave us a slight inclination; we have around 2% inclination, sometimes 3%, because you need it to bring the water away.
And it's not just the water. With the flood you also have a lot of things coming, for example from the trees, everything gets flooded. So you have to avoid corners where things can collect, to make it easy to clean. You have to use materials which are not folded away, which are heavy and connected. We also have some spaces that go up with the tide, like the floating platforms, which go up and down with the tide.
For the parts that are flooded a lot, we used precast concrete and cobblestones. When you go up, we used granite and concrete tiles. So the more down you go, the more rustic, the more strong the language is. And we also had to consider ice — sometimes you have ice and the pressure of the ice. So you cannot make more than 30 degrees; you have to keep clear parts so the boats do not get blocked by any element. This was very important for the detailed design of the walls and everything.
There were so many parameters we had to fulfill. Sometimes you have a nice drawing, and then specialists from the authority come and say no. In Hamburg they changed the rules for open walkways, for open stairs and handrails. Before, we could do stairs with a certain profile; now you have to make them straight. The handrails and the whole system changed during our planning process. So we had to adapt our planning to these different, very strict rules in Hamburg about public connections and walkways.
Interviewer: I know there is a flood protection ordinance from 2002.
Interviewee: Yes, they made it. But they also have a new one — I don't remember the name now. It is very strict in Hamburg.

Interviewer: So you mentioned the Hamburg Port Authority. Which other institutions did you collaborate with? Which institutions actually influenced the outcomes of your design, and how did that process go?
Interviewee: The first part is that the project manager is HafenCity, because it is a public-private constellation and they are the owner or the developer of the site. But everything also had to be discussed with the mayor of the city, which was *Oberbaudirektor* Walter at the time. And now it is *Oberbaudirektor* Höing, the overall director. But before we had more to do with Herr Walter, and he was very strict, very much behind everything, so everything had to be approved by him.
So first we did the planning process with HafenCity.
The first were the engineers for the heights and the limits. They made the first plan: here is the site limitation, here is the final height. That was the first part. The second was the planning of the public roads, because they gave the height of the public road, which is binding for the investors of the buildings, because you have to accept the road height.
Then we had the framework planning, which was the B-Plan. The B-Plan defines exactly how much free space you have, what you have to do — for example, the trees you have to plant, the playgrounds for children. This is in the plan. Then there is the institution in Hamburg - *Bezirk* - which later takes over the responsibility for the project — the maintenance, the cleaning, everything. So you have the limits between the public part and the private part.
And then you have the Port Authority, which is responsible for the quay walls and the port services. They are the owner of this.
And then what else did we have? We had the engineers for sure, who were calculating. Because here you have no static, there is no construction defined. So whatever they do, they compare with what they had before. For example, if before there was a crane there, they say: okay, before it worked like this, so we can do a maximum like this. That was the way the engineering worked a little bit.
And then we had to deal with the historical part, with the monuments, because we worked in a zone with monuments. We also had to go to associations about the historical boats, because they had to park the historical boats at the floating platform.

And then we worked with the people responsible for mobility and inclusion. For example, when all the plans were ready, there was somebody — I forgot the name now — but he is in a wheelchair. Very clever. You show him the plan and he says: I have a problem there, I have a problem there. For example, he says: there's a bench, but beside the bench I want a space to put a wheelchair, because I go there with somebody who can walk, and I want to sit beside, not in the way where people are walking. So beside every bench we created a reserved space for wheelchairs. With handrails and other details - this was always a kind of control — not mandatory, but for us important. And we changed things if he said:
Over there, or I see a problem over there, because you want later that everybody can walk there. And then sometimes you say there is a hundred, but sometimes people have a problem on the left, sometimes on the right.
And all these things we integrated as well with the cars — when a car drives against a handrail, you need a special force. And all of them were involved with the lights, the illumination we mainly forgot, because they didn't want to have a special illumination, they just wanted to have a functional illumination. So we said: we have 6-meter masts for pedestrians, 12-meter masts for roads, and then higher masts for squares. All the parts had to be illuminated in a functional way, also to avoid spaces where you can get afraid — like fear spaces, how do you call it in English. In HafenCity every space is designed in a way that you can escape. No dead-end parts. Everywhere you have a possibility to escape with a staircase.
If, for example, you are there on your own and a group of people comes and you feel unwell, you are not in a situation where you are blocked. This was always considered, in any corner, mainly with the staircases.
And as well, for example, when we introduced playgrounds or the basketball field, we wanted to give a that kind of feel to the buildings, because we knew there are balconies. So you don't want to have a feeling that there's a burglar in the quartier.

Interviewer: Maybe you meant the Agency for Roads, which is *Landesbetrieb Straßen, Brücken und Gewässer* — maybe it was about the building heights, the LSBG?
Interviewee: Yes, LSBG, yes.

Interviewer: What was their role? They set the heights?
Interviewee: Yes, they gave us the plan, and that plan was mandatory. It was the whole planning, and they defined for Hamburg how much space you need for pedestrians, how much for parking, for the delivery zones the trash — where the trash will be picked up, where you can place it. They did a kind of area management, defining the areas and the connecting heights. Everything was defined by them.
This was not something for discussion — they gave the plan, and we used it. But what we did in our part, which was more private, was to try to erase the limits. We tried to plan the free space from one side to the other, to make it more connected, not to create boundaries, but to reduce the limits.

Interviewer: So do you have like archival, some kind of archive of the documents that they gave you, maybe a mobility study or a study about the flood, that you used as a set of rules for the design?
Interviewee: I don't know. We had a wall completely full with carpets, hundreds of folders, because we talk about a planning process of 25 years. Most of them we archived and we don't have them here in the house. Even to search something there would be very complicated.
It's very… I don't even know if you can find a brief of the competition, because in the brief of the competition there was a lot to find. It's very, very hard. And from the LSBG we had so many meetings, that many things were complicated in the meetings. And then you put a plan, they give you the plan, you put a plan inside your plan. But it's very hard, we have thousands of plans, thousands. This is a typical example.

Yeah, but even this one was modified all the time. No, it was not that they give you once — it was always a kind of planning process where you say it's very hard to say there was this document, and suddenly they give you another document, and then you have to integrate it. So this is very hard to really say, to reduce it.

Interviewer: Do you remember during that process which rule made the biggest impact on your first design concept and then on the ending of the design, how it was actually implemented?
Interviewee: This was the planning budget. We did a planning, they made a budget, and we had to fulfil the budget. This was mandatory. Sometimes we did five, six, seven variants until we reached the budget. That was the most mandatory rule.
We also worked together with WES, the landscape office in Hamburg, because HafenCity demanded from the beginning that we have a local architect. They do this for all the buildings there. In Hamburg you have the design office, and then you have the execution office which makes site supervision and executes the documents. That was WES in Hamburg, and they did the whole planning process together with us.
The engineers were changing, but they were always involved. And I think the success of this project was that all these entities, all the people involved, collaborated very well. It was not about insisting on egos — there was the will to achieve a good result. Sometimes the projects became much better after the input of the experts, because they had know-how for something specific. Then you understand, okay, it is improving because of this input.
It was always very helpful. Sometimes limiting in a way, but I wouldn't call it limiting. It means you search for an alternative. You cannot do this, so you do something else. You search for an alternative, and sometimes it becomes even better.

Interviewer: What were the lessons you learned from designing this public space in HafenCity that you could transfer now to other projects?
Interviewee: This is difficult to say, because every square meter had its own difficulties, its own parameters. In each corner you learn different things. It was a very intensive planning process, so you cannot say there was just one principle we brought to the next project.
The first thing you learn is to respect the limits, because this is always a problem afterwards. When everything is finished and you have one square meter on the limit of somebody else, that will be a problem. So the limits must be very clear.
But what we learned is really that we were able to realize our concept, and the concept was very experimental, and we were able to do it. It was just a question of our continuous working. And we said: you can do everything you want, you can do these ideas. You should not limit yourself in the planning process. You should be experimental, you should propose things. Because then you can achieve very good places, you can achieve very good spaces.
And HafenCity — so many people come from worldwide to see this project, to understand what we did different. Because many cities try to improve something, but not everybody achieves the same result like HafenCity. So what I would say is the most important is to go on like we always do: to make first a good concept, a strong concept, and a very clear language, which is our architectural language. And this helps a lot to solve all the difficulties on the way.

Interviewer: Thank you very much for the interview.

Interview 3: Explorative interview with head of the Spatial Planning Division, Canton of Basel-Stadt, conducted online on 04 October 2023

Interviewer: Can you briefly introduce yourself and your expertise?
Interviewee: I am the head of the Spatial Planning Division of the Canton of Basel Stadt. We are a team of 12 people who are working on spatial planning of our city and Canton, which is all, the whole Canton is only 37 square kilometers. It's very small, and it has about 200,000 inhabitants. And I studied geography. I'm a geographer and he has specialized in spatial spatial planning matters.

Interviewer: What is your role in your institution and the river redevelopment project?
Interviewee: We are talking about the so-called 3Land project, the three-country project, which is located at the border of the three countries, Switzerland, France, and Germany. And the surroundings of this border situation. And that's where the river Rhine is the border first between Switzerland and France for a few 100 meters. And then it's the border between France and Germany. And in this area, we try together with our partners in Germany and in France, to develop urban areas to make them all back-sides. Now it's the backside for France, for Germany. And for Basel, somehow, because it's at the border. And we want to develop it into an urban part of the city of a tri-national city, you might say, that's our aim together with our partners, and my division takes place for the Swiss part for the Basel part in this cooperation.

Interviewer: What sets this project apart from other projects of your prior experience in terms of its objectives and functions in the urban environment?
Interviewee: The specialty of this project is very clearly that it is a partnership over the over borders within three countries, we do often have transport or cooperation projects in spatial plannings with one of our partners around Basel, because, as I mentioned, it's only a small area and the functional city of Basel has been growing over these borders for decades of course, and it has been growing in in direction to our Swiss neighbors to Canton Basel-Landschaft and other cantons and it also growth over the national borders to France and to Germany. And this project - 3Land as a specialty is at the point where these three countries meet and work together within municipalities. Huningue in France and Weil am Rhein in Germany, and it makes it very special. And the fact that the river Rhine is in the center of this area is also a specialty because the Rhine in the city of Basel is a very important open space for the people. In the summertime, everybody goes to the Rhine to walk along to sit in a restaurant, or swim in the Rhine. But once you get to the border, over the border, it's different, you cannot get to the river at any point, at every point. And the Rhine does not have the same function for the people there.

Interviewer: How did the river's proximity affect each stage of the redevelopment project - preparation, planning, execution, and operation, especially when compared to redevelopment initiatives you have worked on, situated away from water bodies?
Interviewee: Or when you have a look at the map of Basel and its surroundings, you can see that there are bridges crossing the Rhine River. Maybe I can show you a map of our city. I can share it just a moment. It's a map of Basel. Here is the border to Basel-Landschaft, which is also part of Switzerland. And in the north, there, there's he is France. And here is Germany. And what I wanted to say is, when you look at the bridges, you have one here, another one here, the next one here, and one here and one here and one here. And then there comes the border. And there's no bridge for a long, long distance. The next one is here, between France and Germany, the so-called Dreiländerbrücke, within three countries. And there's a lack of bridges from here to here. And bridges bring people together over a river. And that's why it is one of the most important goals to build a new bridge between Switzerland and France; on the other side, a bridge for pedestrians, for cyclists, and for tramways is the goal. And that's

what we'll bring together. Also, the people from the three or two countries, so it's very important to make the Rhine crossable. And what already happened is that you have a street for pedestrians and cyclists along the Rhine, on that side, on the left side between Basel and Huningue in France, along the riverside, that's only for 10 years now. And that makes the border crossable at that point, which was not possible before, because we had a harbor here. And we had industry, we still have industry here. But now you can walk or cycle along the riverside, which is very important. And the river also has an ecological function. It is important for biodiversity, it's a path for plants and animals in a corridor where they can move. So we have to be careful not to destroy the possibility for plants and animals to wander along the Rhine. It's very important for ecological function.

Interviewer: Has the river undergone a process of re-naturalization?
Interviewee: There's already something that naturalization has taken place. For example, when this part of the promenade was built on the Basel side, there were possibilities for the beaver to make their nests - it was built there at that promenade, for example.

Interviewer: What difficulties are associated with re-naturalizing rivers, including pollution concerns?
Interviewee: Yeah, what makes it possible to develop this area at the river, which was the first harbor of Basel, was that we had to move the harbor infrastructure from here to somewhere else. So, it was quite expensive, a big investment to transform this harbor into this promenade. And that took place because here, that's the headquarters of Novartis, a very important firm in Basel. And they wanted to build their campus here with an open space, and they wanted to expand to the river. And that was the reason why the harbor had to move away. And we took the chance to build the connection for pedestrians and cyclists, and to do re-naturalization. So it was a big investment, it cost 200 million francs, and it was not so easy. A long process.

Interviewer: Did you include public participation in the process and how?
Interviewee: Yes, of course. Big investments in Basel must always include public participation. Because the parliament must give the money and has to decide on the money. And in Switzerland, we have the possibility that any decision of the parliament can be put to a referendum. So, we always do the participatory stage before so that people know what we want, what the planning wants. And so yeah, that's very important in our planning process.

Interviewer: So, it was done through a referendum.
Interviewee: No. No, in this case, there was no referendum because people agreed to the decision. And that's partly because we did participation before, you know, to inform people about the possibilities and the opportunities of that development.

Interviewer: And were people included in any other way in the process or were they just informed about it and agreed. How was the process going?
Interviewee: I don't know. I don't remember exactly because it was more than 10 years ago. So that's for the bigger project for the 3 Land project. Participation in all three municipalities also took place; we had an exhibition, which toured through the three cities, Huningue, Weil, and Basel, for this spatial concept. And people could make comments on it and discuss the goals of the transition. So that was a big effort to do participation, cross-border with the people.

Interviewer: What about their feedback? Was it used later in the process?
Interviewee: Of course, we don't do participation just as an alibi; we collect the feedback and then try to make the planning better with all the knowledge people bring in, of course.

Interviewer: To what extent were flood resilience and associated risks considered during the preparation of the project? How does this project enhance fluvial flood resilience?
Interviewee: Flood resilience is not a matter in that project. It's simply not. That's for every city; they have to make sure that the development is flood resilient. It's not a trans-border issue.
It's something that is being dealt with in every country separately.
Yes. And it's here in Basel, it's not such a risk - floods, we don't have floods. No, it's not another risky situation because the river is not like in Cologne or in, I don't know, in Rotterdam or somewhere. We don't have that risk that much.

Interviewer: Do you think the riverfront redevelopment project has effectively combined improving the city's image, creating public spaces, establishing ecological and transportation paths along the river, and integrating flood control infrastructure?
Interviewee: Not yet. It's a process that is going on; it's partly achieved. As I told you, here we have a new connection. And we want to build this bridge over the Rhine, which is a very long-term project; it will take at least 20 more years. It's built if it will be built, that's not sure yet. It's not financed yet. So, we're still working on it. It's an ongoing process.

Interviewer: How did digitalization of data and project management play a role in this project? In what manner do you believe digitalization could have positively influenced the overall progression of the project?
Interviewee: It's more of a political and then planning process. I think digitalization, as you mentioned, with digital twins or modeling of processes, that's something which is useful on a very concrete scale. If you build a house, or if you are maybe in a flood situation, then you need big data, and digital means can be very useful or need to be used. But in our case, it's a, on a higher level, it's strategic planning, cooperation. And that's between people, you know, and, of course, we have to use data, we have to know what we're talking about. But it's not a case of modeling something, and for this tour through the three cities I mentioned, we had a physical model of the 3Land area where people could see what this part of our city and the surroundings could look like in maybe 20 or 30 years. But real, you know, not digital. So maybe we could have done that with augmented reality or something that could have been interesting, but that would have been very expensive. And I don't think that it's worth it. For that matter. A physical model of the future city is very, you know, it's touchable. And you can feel it, and you can make your image of how the future could be.

Interviewer: Thank you for the interview!

Interview 4: Explorative interview with 3Land project manager, Trinational Eurodistrict of Basel, conducted online on 02 November 2023

Interviewer: Can you briefly introduce yourself and your expertise? What is your role in your institution and the river redevelopment project?
Interviewee: I am German, but I work for the tri-national Euro district of Basel, which is a French Association. I have been the project manager for the 3Land project for about three and a half years. And it's my first job after university. I have a bachelor's degree in European studies with a focus on German French cooperation, a master's degree in management of clusters and regional networks. And I'm currently pursuing another master's part-time, which is about regional planning. During the last year, during my studies, the key question was always how cross-border cooperation works and how to promote it. So, I don't have this planner or planning perspective; my job is really to promote cooperation.

Interviewer: What sets this project apart from other projects in terms of its objectives and functions in the urban environment?
Interviewee: Our objective is to create cross-border districts in three states. I think it's quite a unique objective. There's a three-national ambition, and we have a certain way of cooperating. We have three countries, two are part of the European Union, and one - Switzerland isn't part of the European Union. This is quite difficult sometimes, too, and I think we're working in a very dense and urban context. So, if I compare to other places, like on the German border, where we also have three countries that cross, we don't have this urban context. So, we have three very different partners. We have the city of Huningue, which is a small French city with about 7000 inhabitants. Then we have Weil am Rhein, the German city, which has about 30,000 inhabitants, and then we have the canton of Basel. It's huge. They have about 180,000; they have a lot of competencies that a small German or French town would never have. So yeah, that's quite different. We were working with three different characteristics. Planning cultures, planning documents. We are working with two different languages. Three different lifestyles.

Interviewer: How did the river's proximity affect each stage of the redevelopment project - preparation, planning, execution, and operation, especially when compared to redevelopment initiatives you have worked on, situated away from water bodies?
Interviewee: The 3Land project is still ongoing, but we divided it into several sub-projects. The Rhine, our river, has a quite special role. It's our natural border between the three countries, but it's also our common denominator. So, it's our point in common and natural space that needs protection. This is the center of the project area and the changes that we are facing in the project area are connected to it. If I think about construction of bridges, of Port structures. And if I compare the three towns, they have acquired a different relation to the to the river. In Basel, they are really living with this river, they are swimming in it, they have riverbanks, where you can really spend time. And especially in summertime, it's really nice. And then we have Weil am Rhein and Huningue and they had another relation to the Rhine, they had these industries. No real link between the city centers and the Rhine, and with our project - 3Land or the sub project *Vis-à-vis* they started to create public spaces on the riverbanks. And I think that changed a lot and in quite a short time. Our talent project started in 2009-2010. They created a new, new public space in 2018. And I think the population really likes it, because in summertime, and in the evening or the weekend to see a lot of people that are trying to spend time outside.

Interviewer: Did you include public participation in the process and how?
Interviewee: We have several sub-projects. Sometimes they only concern two out of the three countries. And then each partner takes care of the implementation of public participation according to the national rules or recommendations. So, it's quite different. If you compare, for example, Switzerland and Germany, they are really careful. They (Swirzerland) always have this danger of referendums, which could stop the whole process. And then in France, it's really top-down decisions. It's difficult sometimes. But in the 3Land project, we also have some space to try a new approach. So, if I think of *Vis-à-Vis*. So, in the project between France and Germany, we have implemented cross-border and bilingual measures. So, on the weekends, there were guided tours in both languages, some kind of outdoor workshop where they had plans for the future parks, and where people could just come, debate about the projects, and just show what they would want. And then there was also a student workshop with French and German pupils or students. And they also discussed with the planners how they would like to spend time on the riverbanks. I think if we speak about public participation, it's really important that people see how their feedback is included. So, for the *Vis-à-Vis*, the side of the recreational areas is really spaced on these workshops that we made.

Interviewer: Was flood resilience considered in any way in the project?
Interviewee: I have to admit that flood resilience is not really a topic that we discuss. I tried to do some research on my own. I just found some information about Basel, and they, in their communication, say that there's really low danger of the Rhine. So, they had the last flood in 1999. It's not that important in our discussions. And I wondered if the hydroelectric power plants that we have under the Rhine -I think they play a role in that. So, they regulate the water that comes to Basel.
For the *Vis-à-vis* project, the park in Weil am Rhein and Huningue, they also constructed a "Rhine balcony". So, they changed the riverbanks, and they said it was possible because there's not that much change.

Interviewer: Has the river undergone a process of re-naturalization? What difficulties are associated with re-naturalizing rivers, including pollution concerns?
Interviewee: Re-naturalization, of course, with the Rhine, we had this kind of straightening at the beginning of the 19th century. So today it is quite difficult to change the riverbanks, and where we discuss a lot about urbanism and how to develop our riverbanks, but I think the Rhine is still used for transportation, and all these port activities - they are always a priority. So, it's really limited. We are currently pursuing a study on biotope connectivity across bridges. Because in the center of our project area, there will be a bridge for trams, bicycles, and pedestrians. And we are trying to analyze whether we could also include a corridor of five to seven meters with bushes, some type of greenery, to reconnect the two riverbanks of France and Switzerland.

Interviewer: What is the idea behind that though, what kind of flora of I mean fauna will be connected and what kind of corridor is in question, do?
Interviewee: We are just starting with it. In Basel, they have a lot of construction going on - they're changing the port. So, there will be some spaces that will be underwater, and we are trying to get some compensation measures on the bridge because space is really limited. And we are trying to see what works, if it is enough to just have grass around the tram, or if there could be the smallest possibility, or if it would be possible to do something like a really green bridge. So, we were speaking about the Highline in New York. This is a former form of railway infrastructure. And today it is used for pedestrians, and it's quite green. There's also such a thing in Paris. So, the study just started and is quite open. We'll have the results. So, we're talking about greening up the space near the river. Yeah, there is a possibility to open up some ecological corridors. And the study will show, yeah.
And then of course, it's quite an urban context. So, we have port activities or residential areas. We have to see how to connect this corridor.

Interviewer: So, the port structures and these artificial channels are going to be there are efforts to re-naturalize them you would say?
Interviewee: Yes.

Interviewer: How do you think that this project contributes to the city image of Basel and the other towns?
Interviewee: I think it has quite a positive influence. Basel, of course, tried to be innovative, like with the study that I just mentioned. It's a demand that comes from Basel. But the two smaller cities - they're gaining a lot. Especially Huningue, the French town, is becoming quite attractive. So, we have these recreational spaces, parks, and a lot of construction going on the riverbanks, so there's this project leisure space. We have a multinational firm that is interested in building in Huningue, where the population is increasing. It becomes quite attractive. Weil am Rhein, if you translate the city name, it's Weil on the Rhine. And for a long time, there was no "on the Rhine". There was no path, no park, no place where you could really enjoy being at the waterfront. They are trying to open up to the river. That is possible. Also, because of the 3Land, because of the cross-border cooperation. So, this park, *Vis-à-Vis*, on both

sides is visible, and the population can use it. You can take pictures of it, so you can really use it and promote your city's image. In Basel, right now, they want to change the port area. So right now, it is a port area. So, it's difficult to imagine what could be. And it takes some time. It's the German and the French cities that currently...

Interviewer: How much does this project affect connection?
Interviewee: The center of our discussions, new connections over the Rhine. So, of course, it's new bridges, public transport in France and Germany. That works quite well. And cross-border cooperation in general. And then there are more ecological topics. We talked about it too. But if I'm very honest, it's easier to get financial support, maybe for a tramline for bicycle paths, than for this crazy idea of an ecological corridor on a bridge. I think, especially for Huningue, they had a lot of opportunities thanks to the project right now. There's not that much public transport. So, they will profit from the new connections.

Interviewer: In your opinion, I want to know, what do you think were the most prioritized roles and functions of this project? Was it the connection? Was it the city image, the real naturalization, or creating public spaces, we said that the flood resilience was not at its center. So, what about this other function? What are the priorities? What was prioritizing? What do you think was most achieved?
Interviewee: I think it all started in 2005 with the construction of the Novartis campus in Basel, where they could dislocate some part of the port activity from Basel Saint Johann. So, the place where the Novartis campus is today, the current port of Basel, and further away, and I think that was quite the starting point. But Basel pursued. They tried to imagine new ideas for the current port of Basel. And then we have all this economic change, structural change within port activities. So, this is all that concerns port and transportation. And then on the other side, we also have Basel, which is a city that is still growing. And they have a kind of housing shortage. So now they are trying to build a third port, (Basel) because there will be more and more containers that they will take from a boat and put on rail, and stuff like that. So, they have lots of space that opens up, which they won't use on the waterfront. And so yeah, why not use it for housing? Yeah, for workspace, and it's the waterfront, at the water, but also at the border. So, they started with some plans without implying the French and the German side. So, the mayors - the French and the German, mayors were not happy with it. And then they started to work together. Because they are facing common problems that they could deal with together.

Interviewer: What was the main idea of the project? Was it to connect? What did they want to achieve? Did they want to achieve better connection? Did they want to achieve a better image of that part?
Interviewee: It's difficult to say this very first. Then from Switzerland, all the workspaces, all the housing was in Switzerland, and then in France and Germany, you only had these recreational spaces. So, it's more about programming space and finding complementary uses. So that every city gets something of it. Parks and recreational spaces - it's good for the image, but it just costs. It's really, maybe I'm exaggerating, but sometimes it's the point of view of our mayor here. It was really to find a way where everyone can benefit.

Interviewer: Would you say that the German and the French side benefited more from creating public spaces than the Swiss side? Is it more about new functions for the people and creating a better image in that area? What do you think are the different benefits of each site? Specifically, when I'm talking about these functions, like connecting people to the river or creating a better image or better connection?
Interviewee: It's not that much about public space because they already have public space along the river. Right now, we have these public spaces in Germany and France, but I think it's just the first step. Right now, we have this project, *Les Jetées* in France, where they are building five new buildings at the waterfront. They finished two of the buildings, and I think

they're about 100 new apartments. And as I said, the city image was really improved and developed. In Weil am Rhein, there are also some waterfront areas that they want to develop. So, it takes some time, but they are sure that they are going to build new houses because there is a demand for housing in the agglomeration. The connections while they are important, because many work in Basel, and one of our objectives is to create space for the life and work of 20,000 people. And with the current infrastructure, we could not guarantee that they could cross the Rhine or that they could travel rapidly within the project area. So, of course, connections are really necessary.

Interviewer: In which part is the residential area?
Interviewee: There will be residential areas in the three countries, but the first flagship project will be in France - *Les Jetées*.

Interviewer: Thank you for the interview!

Interview 5: Interview with representative from Spatial Planning Division, Canton of Basel-Stadt, conducted online on 30 September 2025

Interviewer: How would you describe your role and tasks in the planning and realization of the riverfront project, the 3Land project?
Interviewee: I have been working on the project for more than 10 years now, with changing roles over time. We were in charge of planning on the Basel area at the riverside—Klybeck and Westquai—which is more specific in the planning. I was also involved more than 10 years ago in the temporary uses. We were like the pioneers of the urban transformation on the site. The temporary uses are still there, but they have changed and needed some initial measures, such as opening the area. There were temporary pathways for pedestrians and some transformation of the public space—very subtle measures, but still significant. I was also involved in the participation processes. There have been many different participation processes with the inhabitants of the area. I have also been working on the trinational project. Now my role is mainly a coordination role in Basel-Stadt, bringing together all the specialists from urban planning, mobility, green spaces, and so on. Since we are in a partnership in the 3Land project across the three cities, but also with other higher-level authorities, I coordinate the Basel part of the partnership and direct them into our trinational group.

Interviewer: Could you walk me through the project, how the project started in Basel, the beginnings?
Interviewee: The 3Land, OK, it started around 2010, I think just before my time. After the first thoughts about the urban development in Basel, the transformation of the harbor and the urban potential that there is at the border of the Rhine. And after these first studies, I think Basel knocked on the doors of their neighbors and tried or asked what are your plans on the areas around this, our shared border? And it turned out that in all the three cities there were transformations happening, or in the planning at least, of these riverside areas. All three cities have a harbor, not they're all different in size, but there is a harbor which are changing and also the industrial sites along the Rhine, they are changing or have changed significantly now in the last 10 years.
And this was the start of this cooperation of trying to take the opportunity of this change in order to grow towards the Rhine. So all the three cities have the opportunity now to grow towards the Rhine and also to open the borders a little bit more to their neighboring cities. The borders, they are open, but there are still very few connections and it's a classical situation that all the many infrastructures that you don't place in the city center, they are placed at the border. And so this, at least, and there are three borders here and so all the infrastructures that nobody wants in their towns, they are put there and it feels like, or I think

the perception of everyone is, this is the end of the city somehow. And we try to shift these perceptions in order to make it a new center of our shared urban space. I think that's the motivation.
And there have been many studies, the Raumkonzept trial on which you probably know from 2015. I think that was an important milestone to have a common picture and also to set an agenda which topics we are going to study further on and I think the main part is mobility with our goal to build a new bridge. And from there it evolved with further studies and also what's important for the process is our tool we have for our cooperation, I don't know the English term, like this cooperation agreement. In which we set an agenda, we set the budget, and it gives us a commitment and it's also like a basis for our cooperation.
And very important for this cooperation is that part of the budget is also the manpower, that there's someone in the Trinational Euro District which is our project management, or they make the project management on the tri-national level. Yes, and very recently the last cooperation agreement is from 2022 which lasted to this year 25 and now we made it longer until 28. And this is mainly because of the mobility topic. There was some agreement or the last success, if you will, was that everyone agreed that we at least continue on planning the bridge, which was already a milestone that everyone said, yes, OK, we will continue to plan on it. It's not definite that everyone says we want it, but at least we try, we plan. And in the process of further planning, we found out that it's really a complicated project, this bridge between, or you know which bridge I'm talking about.

Interviewer: Yes, yes, the one between Switzerland and France.
Interviewee: Yes, exactly, exactly. It's really in the center of the dry land. Also I think it's metaphorically in the center, but also functionally and from the space it's really in the center. It's a bridge which should only be used for public transportation, hopefully a tramway and for pedestrians and bikes, but not for cars.
And it really closes the gap of the existing mobility systems which are all in parallel to the Rhine. There are, I think, all kinds of mobility systems on both sides, but there is no link between these. This bridge and the tramway should close this gap, and since it's the first bridge between Switzerland and France, or at least the first big bridge, there is no role model of how to plan and build a bridge between these two countries. There are many bridges between France and Germany.
And there is a general agreement on how they work together, but there is no such thing between France and Switzerland. It's also an EU border, so it's even more complicated. That's why we first have to really settle all these questions about how we're going to proceed: the legal questions, the questions of the process, which law is going to be applied, what are the steps we have to take. Now the task is to lay out a kind of road map of all the steps of all the authorities involved.
In the end, we think there will be needed a contract between the states of Switzerland and France. That would not only involve Basel and Huningue, the cities, but also the states, which will have to reach an agreement. This will take some time, and now we will do the steps. That's why we know at least until 28 we want to have a good basis, the road map, and the common understanding of the next steps. And maybe, we don't know, maybe already kind of an agreement between the two states.

Interviewer: The date was 2025, like the end date when the bridge should have been already planned or what was the timeline for the bridge?
Interviewee: No. I think a very optimistic timeline, maybe around 2020, was that most of the planning concerning the bridge would be done and we might start with an architectural and infrastructural competition for the bridge. But we learned that it is way more complicated and it is going to take more time.

Interviewer: Could you tell me more about what happened from 2010 until 2015, what were the steps since the initiation of the project?
Interviewee: I was not involved all the time. I started around 2011 or 2012. Yeah, from what I know, I think that's the time when the round concept was made. I joined the team in the middle of doing the round concept and I was there when it was finished. And, is this your question, how the Raumkonzept was established?

Interviewer: Since the project was initiated around 2010, how did it evolve up until the 2015 Raumkonzept?
Interviewee: I think the first step was before the Raumkonzept, it was a kind of a vision. It was called Entwicklungsvision 3Land. It was actually in German, it's called Testplanung. Yeah, it was kind of a test planning, so it was a competition of three teams. And they made the study about the potential and what could the 3Land look like in competition. And then I think in the end they kind of made a synthesis out of these three ideas, which resulted in the Raumkonzept or in the vision. But no, I don't think it was a synthesis, one was chosen as the main vision, which was the work from MVRDV with this huge skyscraper island in Basel and the kind of a diamond urban project in Huningue and another island or a marina-like situation in Germany. It was probably Dutch architecture, it was really large scale. And it provoked, at least in Basel, these pictures of this island with the skyscrapers provoked a lot of resistance and public debate about it, because it was seen as too large in scale and the gentrification of the existing area, which is really an area where many low-income households are situated. And also I think in our neighbor or with the partners, they didn't really adopt this vision or the vision was not what they thought it should look like. But at least I think it was a start to show what's possible, what could be possible. It showed that, I think it really helped shifting this perception from this border area outside of town to what's possible to make it as an urban center. And I think that's really the contribution of this study, and that's maybe also how it was meant. It was never meant as a real architectural study and this is how the houses should look like, or even this is how the urban structures should look like. It was maybe more the purpose to just show the potential and open the heads of all people involved, and I think it helped doing that.
And after this then I think it was the basis for the first agreement, or the first Planungsvereinbarung. It's not an agreement, how you call it, it's a contract kind of.

Interviewer:… there was a letter of intention and then an agreement was signed….
Interviewee: Exactly, exactly. I think the letter of intention was probably before the Entwicklungsvision and then there was this contract.

Interviewer: And what was the role of Basel-Stadt in that process, and when did the other partners, let's say, arrive in the process? The other two countries. At what point?
Interviewee: Before they set up this letter of intention, I think Basel went to the neighbors to ask about their plans and they wanted to establish this cooperation. I think the result of this was this letter of intention. And then afterwards the first study.

Interviewer: So the first letter of intention was in 2011, and then the agreement in 2012, right?
Interviewee: Yes, exactly. The letter of intention was signed in 2011, and then the first contract or convention followed in 2012.

Interviewer: But that was before the MVRDV vision was published?
Interviewee: I'm not sure, but I think so. I would say it was before the vision. The next agreement was in 2016.

Interviewer: That one was based on the 2015 strategy?
Interviewee: Yes, the 2016 agreement was based on the 2015 Raumkonzept.

Interviewer: Did the vision planning already include input from all three countries, even before the letter of intent?
Interviewee: Maybe I was wrong earlier. The test planning was only about Basel, not trinational. It focused on the harbor area in Basel, and the winning team was MVRDV. They made the vision and said it should become a trinational process, opening the view to the neighbors. Basel then presented this test planning to its neighbors and asked how to cooperate. After that came the letter of intent in 2011.

Interviewer: So not before that.
Interviewee: Exactly. Then the sequence was: test planning, letter of intent (2011), first agreement (2012), Raumkonzept (2015), and the next agreement (2016).

Interviewer: Can describe how the 3Land is organized in terms of governance and management of the area. How is Basel-Stadt involved?
Interviewee: Maybe this is the easiest to look at the Planungsvereinbarungen because it's described there. First of all, I mean there are all the partners here, as you can see, the three cities Basel, Weil am Rhein, Huningue, also the city of Saint-Louis, which is touched by the area of the 3Land, but not much. And it's like a project, I don't know what's the term. It's not an official partner, but it's also kind of a collaborator.

Interviewer: Was it included from the beginning or later?
Interviewee: Later, yes.

Interviewer: OK, so every agreement has different, I guess, actors?
Interviewee: Yes, it grew. And there are the German and the French partners, with other levels of hierarchies: Landkreis in Germany, the Saint-Louis Agglomeration, and the Collectivité européenne d'Alsace in France. And the Trinational Eurodistrict Basel, which is our coordination.
Yes, and on the levels every partner sends their delegates to the respective levels. There's a political level, they meet twice a year, and since this agreement they meet together with the strategic level, which are the bosses of the different groups like mobility and urban planning. to live there. It is communication not only towards residents and inhabitants, but also towards politicians.
I think politicians in the Basel area are well aware that it is important to work across borders. There are all sorts of institutions and meeting places for cross-border cooperation. We are not the only one; we are maybe the only spatial planning project, or not even the only one. There are many others—economic, political, cultural, spatial planning projects—across borders. It is part of the DNA of many people living and working here, not only in Basel, but also in France and in Germany. Politicians are very aware how important this is, but still we want to have good communication with them.
And there is the coordination here on top, which is always the Eurodistrict Basel. They prepare all the meetings, they prepare translations, because the meetings are always in two languages. That job of the Eurodistrict is essential. About the cooperation, I would say it is a rather classical approach. On the working level we make the studies, we prepare the strategies, and then we present them to the higher levels. We present findings and strategies, and ask them if they agree to continue in this direction or another. If we see disagreements between partners, we try not to let them be discussed in the big meetings, because those are too big to handle specific disagreements. Sometimes it happens, and that is fine, but usually we try to prepare and resolve them in advance. That is why it is important to have a lot of meetings and talks at this level, so that the results presented upwards are already consolidated.
To make this happen, what's also very important is that we have a good structure, which is rather clear. And it's also important to know each other, to trust each other, and at best to speak the other language, it really helps. And that's a really important part of the project.

There are many people in the project who have been working here for a long time, which is good. So we have some stable relations between the partners.

Interviewer: About the Swiss legal frameworks: how are they relevant to this project and how has the 3Land project affected other planning frameworks on the Swiss side?
Interviewee: Guidelines which we all agree on define how to develop our common area. To put it in place and to realize it, that's done on the national level. We cannot establish a trinational legal framework, it doesn't work. So everyone always has to go back home to develop it under their national frameworks.

Interviewer: Which national frameworks actually take part in this area?
Interviewee: Until now, there really didn't much, because from our common concepts like the Raumkonzept, everyone had to translate it back to their national processes and legal frameworks. The planning process is really different in the three countries. And I think that's also a very important principle of the project: everywhere it's always a translation back to the national framework. But now with the bridge, that's maybe the first exception. We have to really work on a new shared legal basis. We have to invent it, or we will see what it will look like. That's the first example of a really new framework.

Interviewer: For the Klybeck-Kleinhüningen area: How did the local development and land-use plans evolve within the 3Land framework? Are there new plans for this redevelopment, and did 3Land influence the agreements or documents used?
Interviewee: Yeah, maybe the easiest I could show you a map. Wait a second, I had it opened before. Here we go. Can you see it?

Interviewer: Yes.
Interviewee: OK, that's the project of the urban development in Klybeck and Kleinhüningen, or it's one of the projects, I must say. It's the transformation of the harbor area, which wasn't at the beginning of the whole 3Land planning. After, for example, the skyscraper island and other planning ideas, there has been a new urban plan, which was presented a month ago. It's really very new.
And the general approach is: there are existing areas here, districts in Klybeck and Kleinhüningen, and the idea is to just grow, at least grow Klybeck to the Rhine, open all the streets, the connections that are already here, and prolong them towards the Rhine to make a new big green space at the center of the area.
And the idea is to just grow, at least grow Klybeck to the Rhine, open all the streets, the connections that are already here, and prolong them towards the Rhine to make a new big green space at the center of the area, and of course the bridge, which is also part of the plans. This is the change, and it's a change: there is no more island. The old pictures of a possible island are gone, and these urban concepts will have to be introduced in the 3Land planning. We must take them into 3Land also. But I don't think that 3Land had a large impact on how the planning changed in Basel.
The biggest impact is really the bridge. The bridge is, of course, part of the urban concept in Basel. We all, at least in Basel, want this bridge. But whether or not this bridge will become reality is not discussed only in Basel. It is a part of the 3Land project.

Interviewer: In the 2015 concept there were three options on how the island or peninsula would be treated. How did the decision come that this concept was the best from the three options?
Interviewee: I think it was because of the large resistance and the public debate about this urban development. The public mostly disagreed with the idea of an island and also with the idea of large skyscrapers. I think this really shifted the planning, and there was also political pressure to change the planning.

Four years ago, there was a new picture, the latest urban concept for this area, which proposed making a green space instead of the island or water here. And it was accepted quite well. But then there was a political initiative, which was agreed on by the parliament in Basel, and which wanted more green spaces and less density in the area. That's why they reworked the urban concept again. This is an answer to the political will, translating that initiative into an urban concept.
I think it is accepted quite well. There is no final parliamentary decision yet, but our government has already said yes, it is a good urban concept, and we will continue in this direction. But there are still next steps to make it legally binding, and that has not happened yet.

Interviewer: What are the next steps to make this kind of concept legally binding in Switzerland?
Interviewee: Since Basel is a canton, like a Bundesland and a city at the same time, we work on different levels and we have planning authority or obligation on different levels. On the level of the canton it is the Richtplanung. And on the level of the city it is called Bebauungsplan, which is the same in Germany, and the Zonenplan, which sets the rules. I think there is also a Zonenplan in Germany, yes. I said Germany because you were there, and it's the only other planning system I know something about.
We work on these two levels, and there is also the federal level of Switzerland. It also has a planning level, these are called Sachpläne. They organize and plan the national infrastructures, or all the national duties are regulated there. Not all national duties, but the spatial questions, and also natural hazards is a topic of the Sachpläne.
Here in this area in Klybeck-Kleinhüningen, we do both of our levels at the same time. Maybe I can show you the picture again, that is easiest. This is the same area, but now we look not only at Klybeck and Westquai, but also at the rest of Klybeck and the two districts of Klybeck and Kleinhüningen. The dotted line is around Klybeck and Kleinhüningen. At the moment we work on the upper level, which is actually a mixture of canton and city. We make a Richtplan for Klybeck and Kleinhüningen called Stadtteilrichtplan. So it is a Richtplan, but only for one part of the city, for a district.
We try to regulate or plan all the upper-level topics like infrastructure and green spaces in this part of the city, because there is so much going to change with the transformation of the port, the urban development at Klybeck and Westquai, and also another project called Klybeck Plus.
Klybeck Plus is a large industrial zone which is going to be transformed and opened. It evolved independently from the harbor development, but at more or less the same time—some years later, but in planning terms it is parallel. If you look at this map, everything except maybe the core area of Klybeck and Kleinhüningen, everything around is going to change. These are really large transformation areas. Not everything is going to change, because we want to continue the city and not make tabula rasa with everything new. It should be an evolution, a continuation of the city. There are a lot of opportunities to bring the city parts more together. Up until now this area of Klybeck Plus had only two or three parallel streets to cross it. The rest was closed, a gated industrial zone. So it is a great opportunity for the city to open and grow together. That is why we make this Richtplan, the upper-level planning, to have an overview of the whole area, to see the linking topics between one project and another, and to see if there are problems or things we have to take into account from one project to the other. The goal is that it becomes a common development of this part of the city, and not just one project after another without an overview.
That is the Richtplanung. It is upper-level, and the measures defined in the Richtplanung are only binding for the planning authorities. They are not binding for private owners. The next step is the Bebauungsplan or Zonenplan. That is where we change the possibilities for buildings. Like in Germany, the normal case is defined in the Zonenplan. There are different zones, and they define how large or tall the buildings are, and everything. There are already zones here, and some zones are going to change, while others will stay the same. For instance,

some industrial zones will probably not change, because there is still industry—maybe not heavy-duty, but working areas that will stay. Other areas will have a change in zoning.
If there are additional measures necessary beyond the zoning, then there will be a Bebauungsplan. These are the measures that are binding for the private owners as well.

Interviewer: Have there been some new Bebauungspläne for that area or not?
Interviewee: Not yet, not yet. We're still on the level of concepts for both the large development areas, Klybeck-Westquai and Klybeck Plus. They're still on the level of concepts. And these are the next steps which are about to begin now or in the next year, the start of the Bebauungsplan. I'm not very sure about Klybeck-Westquai if there's really a need for a Bebauungsplan, maybe yes. But for sure there is a need for several Bebauungspläne in Klybeck Plus, because the goal here is to have a much denser development, also with tall buildings, which requires Bebauungspläne. And also the difference is that the land ownership in Klybeck Plus is with two large development companies, while Klybeck-Westquai is owned by the state. So there are very different expectations about the development.

Interviewer: In these areas, how are the trinational documents like the Open Space Strategy used somehow in these concepts?
Interviewee: To be honest, I don't think very much, at least in Klybeck Plus. I don't think they were consulted much. But on the level of the whole part of the city, where we make the Stadtteilrichtplan—that's why I'm also involved in this Stadtteilrichtplan—there is also one discipline working there, which is the open space and green space planning. And the 3Land concept was one of the basics for that, of course. Because, as I said before, the job now is to make the re-translation of the trinational concept, or the adaptation for the cities. Building green spaces and new green connections, for instance, is now a task that we also have from this 3Land concept. That's why it became one basic for the further planning.
About Klybeck Plus and also the other urban development areas, maybe the international guidelines or concepts have not been very strictly consulted. But I think they have the same goals. I think there's no contradiction between these intentions, the intentions are really the same. It's probably also because we from Basel's side brought many inputs into the trinational concept, so it already took into account the intentions of the partners, for instance of Basel-Stadt. It was always our goal to make a green promenade along the Rhine, to make connections between the two promenades of the Rhine with a new bridge, and to build more green spaces.
And if that intention went into the 3Land concept, then it is not difficult to readapt it in Basel again. It's this game between the two levels: we bring in our intentions, and then they are automatically already set in our planning.

Interviewer: I know there have been a lot of workshops included for this district, but in the general 3Land project, how is the public included? In developing and even from before, from the start of the project until now, how was the public included?
Interviewee: I think the strongest part was when we presented the 3Land concept in 2015. There was an exhibition which travelled from city to city in 3Land. We were in all three cities and also beyond in other towns. It was not only an exhibition, but always an open platform to get reactions, and we wanted to get reactions. It was also documented, I'm sure there is documentation of this participation process. Besides the exhibition, there were also workshops, which were designed and completed by the team of the IBA. It was the time when the IBA was also active in 2015.
The team of the IBA was involved in the participation process, among other things. They helped us with communication and participation. Afterwards, I think one learning was that it is really difficult to connect with people about such an abstract planning level. They want to know how is this building going to change, or how is this street going to change. That's the level of their daily experience and what they are really interested in. The work we do in 3Land is more interesting for professionals or scientists like you, and that's a good level to have in a

public discussion. But it's not so easy to have a public discussion with the inhabitants of the area.
I think this was one reason. Another reason was that in all three cities there are local projects, and they already have their own participation processes in place, adapted to what is needed or usual in each state or city. The tradition of participation and how planning works is really different in all three cities. For these two reasons, it was decided that participation would be made on the local and national level, rather than on the trinational level. Since then, I don't think we had really a trinational participation. Communication is important, so we try to communicate regularly. For example, this week on Friday there will be a guided tour in 3Land. This month is the Architekturtage in the Oberrhein area, also trinational, and we are just one of the events—if you are interested, you can book a tour.
So, we do lots of things like this to be active, but there is no real participation in my sense.

Interviewer: So, presentation.
Interviewee: Yes, exactly. But in Basel, we had a very intensive participation process about the Stadtteilrichtplan in the last two years.

Interviewer: And what about before, during the process of developing the framework plan from 2015? Since the vision from MVRDV, how did the public get involved in that process of development of the framework plan?
Interviewee: I don't think it was really involved, no. It was after, when it was finished, that it was presented and we wanted to get feedback. I'm not sure if I am completely correct concerning the timing, but I think the loudest protest was during the process of the Raumkonzept around 2013. There was a lot of protest, but only in Basel. Not in Germany or in Huningue. Maybe they didn't take it that seriously in Huningue, Basel-Landschaft, and Weil. It was mostly the business of Basel to deal with that protest. We had extensive meetings with the local people and discussions about their needs. It was not an easy process. I think the real impact of this discussion only showed in 2019, when the new urban concept was presented. Then the feedback was mostly OK.

Interviewer: Yeah, sure, because it's influencing, it's all connected.
Interviewee: Exactly. When we worked on the new urban concept, presented in 2019, we took into account all the reactions and protests. It was with a new team, a new architectural and urban planning team. They had meetings with the authors of the Entwicklungsvision. There were also one or two broad workshops with all the planners who had been part of the earlier planning, so the new urban concept was based on the previous work but went in a new direction.
It was quite helpful not to say "the old planning is bad and we change everything," but instead to discuss with the people who had worked on it before and reflect on their ideas. They packed it all together into the new urban concept, and all the public reactions were part of this thought process. From the perspective of the inhabitants, when they protested in 2012, it took seven years until we showed them a new urban concept. It was a long time.

Interviewer: So that was for the concept of Klybeck-Kleinhüningen from 2019, right?
Interviewee: No, it was actually only Klybeck and Westquai, not the whole part of the district—only the river part.

Interviewer: What was the role of the IBA in the 3Land project? How did they influence the project and at what stage did they enter it?
Interviewee: I don't know exactly about the stage. IBA started in 2010 or 2011, so maybe more or less at the same time as 3Land. I would say they entered probably after the Entwicklungsvision. They were part of the beginning of the Raumkonzept, probably. I don't know if they were even mentioned in the first Planungsvereinbarung.

I think they entered at the early stage, and they had a very important impact. They helped build a platform for cross-border projects, and this platform was really useful for the dialogue process—for the Raumkonzept, which brought together many people and experts of different fields. We could often use the platform, even in terms of meeting rooms. They had scheduled dates where something was presented, or congresses, and we could be part of this broader process. It really helped keep the process going, because we knew there was also a bigger process, and with so many regular meetings you met the people all the time. That was good. Maybe sometimes it was a bit too much, but in the end it is always good to meet often.
They also helped with cultural understanding, because the team was trinational, which was really helpful. On the other hand, 3Land was also helpful for IBA. I think 3Land was the largest IBA project and one of the most visible. It was a win-win situation: both projects became more visible and gained value from being part of each other.
There were also conflicts about roles—who was in charge of what. In the end, the IBA team became the lead for one part of 3Land, the green space study. They started it, but they couldn't finish it. Over the years the connection became stronger, and they really started working for 3Land. I'm not sure if that was the best solution, but 3Land was happy to have extra manpower or womanpower. They had experts in green space planning, which was very helpful, but maybe it was also a bit complicated or messy about roles.
When IBA ended in 2021 or 2022, it was unfortunate because of Corona. They couldn't have a large public closing event, which was really complicated for them. Personally, I missed them, because they were really part of the 3Land process and they helped with this platform. They were quite important.

Interviewer: And you mentioned they were included in some project groups. Did you know exactly which of the subgroups? Are they mentioned there as well?
Interviewee: I'm not sure if they are mentioned in the Planungsvereinbarung. I don't know if it was really formalized or if this was just decided during the process. But yes, the roles are defined in the 2016 agreement. There are roles for the Trinational Eurodistrict Basel and for the IBA. It is written that they take the lead in the Arbeitsgruppe XY, the group about urban and green space.

Interviewer: So they were included with some experts, I guess?
Interviewee: Yes, and also I think they were financed by 3Land. If I remember correctly, this work was paid by 3Land.

Interviewer: And did the IBA exhibition bring some rules that had to be followed, some criteria for the project to be part of the exhibition? Were there some criteria set by the IBA? Because I know there is a process where they nominate projects. Did 3Land have to achieve certain criteria?
Interviewee: Yes, there were. I think it was a two- or three-step certification process. I don't remember the details of the criteria, but I remember we had to write reports or answer questions about the status of the project. It was mainly about how much the project evolved during the IBA process. They tried to measure that, and there were fact sheets we had to put together to answer the questions.
These fact sheets were coordinated by the Trinational Eurodistrict Basel, and we contributed to the answers. At the IBA there was a jury that decided about the certification.

Interviewer: OK, so the project becomes certified in the end?
Interviewee: Yes, with an IBA label. You can discuss the value of this certificate. I think it helped with visibility—it was clear that we were part of the IBA and of the international spirit. But honestly, there was no money, no big attention. Still, it was very clear for everyone that we wanted to be part of it.

Interviewer: So my next question is, how have the financing questions shaped the project?
Interviewee: Financing shapes the project in terms of timing. We have very different processes in every country for how we get financing. In Basel, we are the most complicated partner most of the time, because very often, if it is a larger budget, we have to go to parliament, and this takes time.
The agreements up until now are that 50% of the whole budget is paid by Basel-Stadt. We are the biggest player, the biggest partner, and that is why we pay the most. But because of this, our share is the largest, and so we are often the ones who have to go through the complicated process to secure a large budget. Our other partners have much smaller shares, and it is easier for them to organize the money. Very often it is part of their yearly budget—just one position that is renewed year after year. It is not very complicated, for instance, for Weil.
The consequence of this is that we often have to plan very far in advance. When we make a new Planungsvereinbarung with the budget, it is often prepared a long time before, because we know it takes so much time to get confirmation of the money. That is difficult, because often we don't yet have the results of the studies or the planning, and we already have to define our next steps. That is sometimes really difficult. That was also the reason why, for instance, we did not make a new convention, but simply prolonged the existing one—it was the easier way for us.
So, financing shaped the project in terms of timing and in terms of defining the measures. What is also important to acknowledge is the different sizes of our communities and cities. Weil and Huningue have much smaller budgets, and for them it is very important to include funding from other levels or other projects, like Interreg. That has been important in the last periods and will also be important for the coming period to realize large projects.
It does not shape the project in terms of the topics we work on, but it strongly affects timing and process.

Interviewer: What kind of infrastructure are the main priorities for Basel to implement in this project?
Interviewee: It's the bridge. Without doubt, it's the bridge. After that, I would say the pathways along the Rhine. They are already established on the side of France and Switzerland, where there is a pedestrian and bike way along the Rhine. We want to close the gap on the other side. That is also really important, to make the city terrain accessible.
Then I would probably say we have to take care of the cars and the car system, which in Basel, especially in Klybeck and Kleinhüningen, is really overwhelmed. The districts are quite loud and polluted. There is a lot of traffic because of cross-border shopping tourism, and when we talk to people living there, that is one of their main concerns. It is a priority and a problem we want to handle with the Stadtteilrichtplan, with overall planning on the Basel side, and it also includes infrastructure measures.

Interviewer: What about the interim uses of the Klybeck that you mentioned at the beginning? How have they contributed to the project in general? What's your opinion?
Interviewee: I think they helped put the area on the mental map of the people, because before it was a closed industrial zone. You never went there if you didn't live in the neighborhood. I once lived there, and then we went there, but otherwise there was nothing, and it wasn't part of the city. Now it is part of the city, and that's thanks to this opening and the temporary use projects.
It is not only for the people living there, but for the whole town. Everyone knows it now. And also for the people in 3Land, I hear that there are many visitors coming from France as well, for instance.

Interviewer: What about the Durable 3Land certificates? How are they going to influence the future development?
Interviewee: I think it's a bit similar to the other frameworks of 3Land that we discussed before, how they were put in place in the transformation areas. Maybe they were kind of forgotten by some people. One reason is that people leave jobs and new people come who have never heard of these criteria. Then it's the job of those who remain to remind them or show them again.
In Basel there has been a lot of change on the personal level. Many people in charge of the urban transformation areas now were not really involved in the 3Land process. Only one or two of my colleagues and I have been long-term 3Land people. So it's our job to make the adaptation from 3Land to the national level.
The Durable 3Land criteria were probably developed at a time when we thought development would move much quicker. Around 2018 we thought that in the next few years there would be the first competitions for buildings in Basel, but this never happened. It will still take years before areas like Klybeck are really developed. By then the Durable 3Land criteria will be very old and might be out of date, because so much has changed. I am not sure if they will ever be applied, honestly.
But I don't think that is really harmful, because many of the criteria in the catalogue already came from Basel. We managed to put many of Basel-Stadt's goals into the catalogue. In the meantime, much has changed—for example, Basel now has a policy that the city must be carbon neutral by 2037, and other laws and regulations have also changed. So the criteria in the catalogue would not meet the goals we have now. The buildings in Klybeck will probably be built without this catalogue, but I think they will not be worse than if the catalogue had been used.

Interviewer: It was also part of the IBA workshops, right?
Interviewee: Yes. This catalogue has a bit of an unfortunate destiny. It was made, but I think it was never really used. Maybe it is more of a reflection of the intentions of the partners, and it shows how difficult it is to make trinational concepts or guidelines. This one was much more than a concept—it was really a guideline that tried to be binding. As soon as you try to establish something binding on the international level, it gets difficult. It didn't take long until one partner said, "No, I'm not going to be obliged to follow these rules, we have our own national rules and policies."
That's where you reach the limit of what you can do on a transnational level. It is still kind of an informal cooperation, based on everyone's will to cooperate. It's not mandatory.

Interviewer: Thank you.

Interview 6: Interview with a representative of the City of Weil am Rhein (3Land Project), Answers Received in Written Form on 02 October 2025 (translated from German)

How would you describe your role and responsibilities in the planning and realization of the riverfront project?
Answer: In the organizational structure of the project, I was the overall project manager for the City of Weil am Rhein. I was also the link between the political steering committee and the individual technical departments and the communication level.

How would you describe the role and responsibilities of the City of Weil am Rhein within the 3Land Project?

Answer: The City of Weil am Rhein is the planning and financing partner for the overall project. The advantage of the project is the reciprocal communication, not just across the 3Land project.

What were the main motivations and expected benefits for Weil am Rhein from participating in this trinational project?
Answer: Reciprocal support and communication in times when borders are being rebuilt. Not working back-to-back but looking together and jointly for the best solution along the planning perimeter. Joint planning also facilitates the acquisition of funding (see Question No. 8, Rheinpark).

When and how did Weil am Rhein first get involved in the 3Land Project?
a) Did Weil am Rhein already have a role in the test planning with MRVDV, Cabane and Josephy, or only after the signing of the Letter of Intent on 26 September 2011?
Answer: Yes, we were already involved in the planning process and even included in a small part of the test planning.

In what form is Weil am Rhein represented in the governance structure of the 3Land Project, and how is coordination with Basel and Huningue organized in practice?
Answer: Coordination takes place via the Trinational Eurodistrict Basel (TEB). TEB is the project manager for this trinational task. This office is funded by the three partners and by EU financial support. All three partners are represented equally both in the political steering committee and in the technical steering group.

How is Weil am Rhein positioned compared to Basel-Stadt and Huningue in terms of influence, resources, and responsibilities?
Answer: Weil am Rhein and Huningue, however, can contribute significantly fewer financial resources and personnel resources than the Canton of Basel-Stadt. Here, EU funding helps to partially balance this.

How has the spatial concept 3Land (Team LIN, 2015) influenced urban development in Weil am Rhein?
Answer: The spatial concept by LIN, as well as the study by MVRDV, ensured that the district of Friedlingen and especially the riverbank increasingly came into the focus of possible urban development.

How have the Trinational Criteria Catalog and the strategy of the open space and nature conservation concept 3Land (2020) been applied so far in the planning for Weil am Rhein?
Answer: The trinational criteria catalog was a good idea for IBA 2020, but in practice it has not yet been applied. The open space and nature conservation concept is a good planning basis for more in-depth planning.

Which German legal or regulatory framework conditions have influenced implementation, and which planning instruments have been most important for Weil am Rhein in order to align local planning with the trinational vision?
Answer: For developments along the water, a water law permit is required to be allowed to build there. This costs time and ties up procedural effort. A helpful planning instrument was the redevelopment statute for Friedlingen, which made it possible to apply for funding. Other redevelopment areas could also be financed through funding. Furthermore, EU Interreg funding was very helpful, as it allowed us, together with our partner city Huningue, to design the riverbank into the Rheinpark.

Which infrastructures were prioritized for development in Weil am Rhein within the framework of the 3Land Project?
Answer: The expansion and redesign of the Rheinpark. Planning and construction costs: 6 million euros, of which 1 million euros from EU funding and 2.4 million euros from national redevelopment funding.

Were there moments when the position of Weil am Rhein clearly diverged from Basel or Huningue, and how was consensus reached?
Answer: The advantage of trinational planning is that it almost always involves binational circumstances (e.g., with bridges). The third partner can then step in as a moderator. If no consensus is reached, then the national circumstances apply.

How were the citizens of Weil am Rhein involved in the process? Did public participation in Germany influence the trinational vision?
Answer: Trinational participation is difficult due to the two languages. At the national level, the citizens of Weil am Rhein were intensively involved in the planning process of the Rheinpark. The planning "Vis à Vis" with Huningue was deepened with pupils of the bilingual secondary school (German/French).

What main priorities does Weil am Rhein see for the next phases of implementing the 3Land Project?
Answer: North of the Rheinpark, additional areas owned by the city are to be developed urbanistically in the coming years.