BAAD

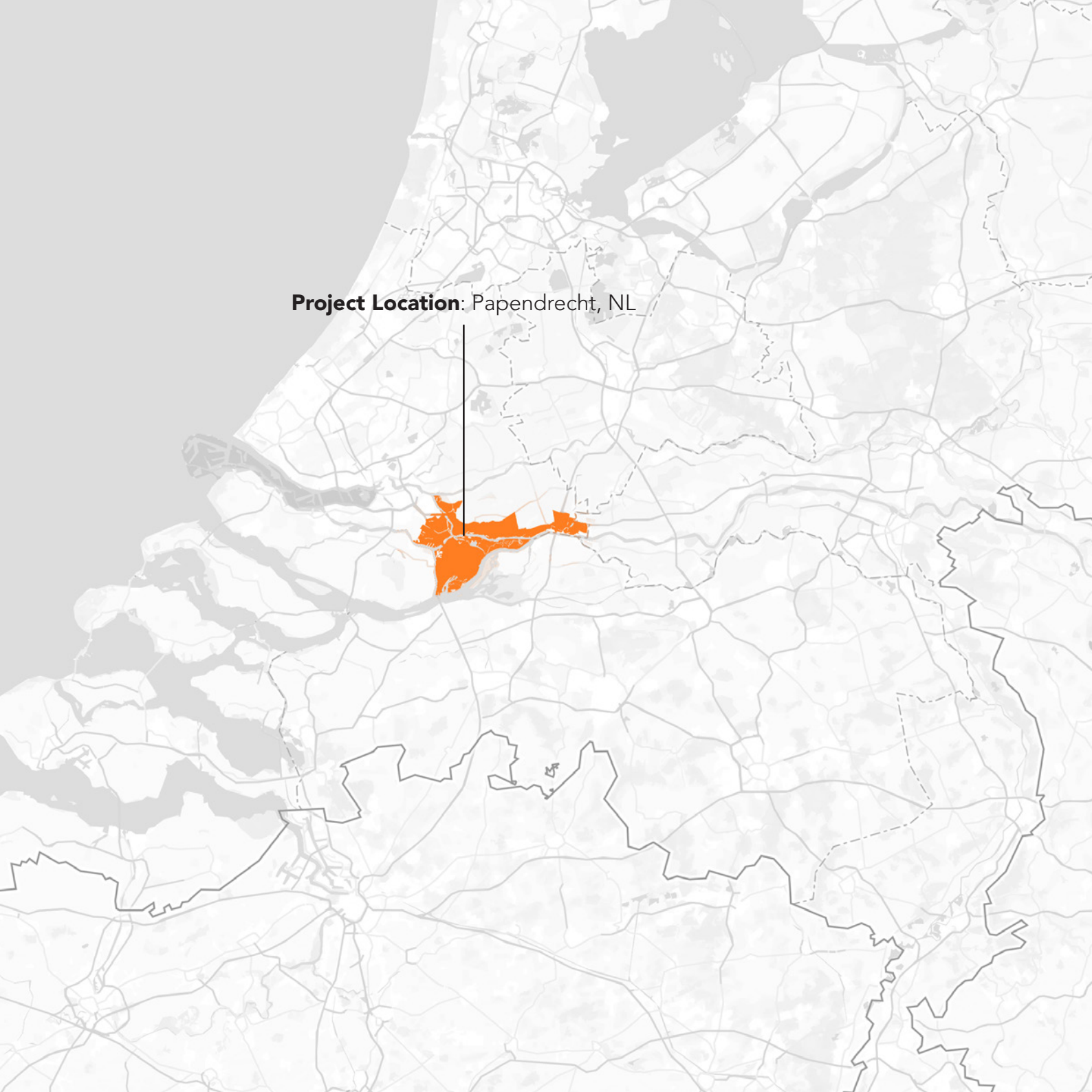
BRIDGE AS ACTIVE DESTINATION

BAAD

MSc Heritage &
Architecture TU Delft
2024/2025

A graduation project
by Kay Knubben

TU Delft


Project Location: Papendrecht, NL

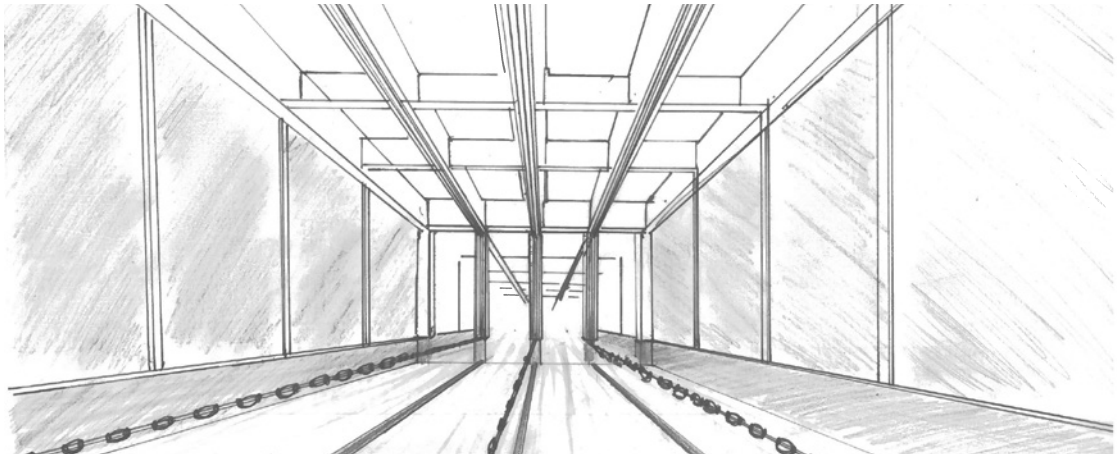
Preface

This book brings together the work, thoughts, and research I developed throughout my graduation year. It reflects a period of exploration, not just into one project, but into my values as an aspiring architect. As I prepare to enter the profession, I believe that architecture must begin with empathy, curiosity, and responsibility.

My ambition is to contribute to a built environment that is meaningful for people and mindful of the future. That means not designing for the now alone, and certainly not designing from a place of assumed authority. I see the architect not as a master planner, but as a careful facilitator, someone who listens, adapts, and builds systems that are resilient, honest, and open to change.

Architecture, like society, is never static. It evolves, and the buildings we create should be able to evolve with it. I believe in a practice grounded in smart and humble design, where clarity, durability, and context guide decisions. Techniques such as circular building strategies, material passports, modular systems, prefabrication, and parametric tools are not goals in themselves, but instruments that help us design with integrity.

In collecting and sharing this work, I hope to express not just a project, but a belief: that thoughtful architecture, rooted in respect for people and place, can create spaces that matter, now and into the future.



Introduction

This book captures the outcome of a conceptual architectural exploration focused on the Papendrechtsebrug and the overlooked public potential of the space beneath it. Through a combination of spatial design, historical reflection, and direct dialogue with the local community, the project proposes a new identity for this infrastructural threshold.

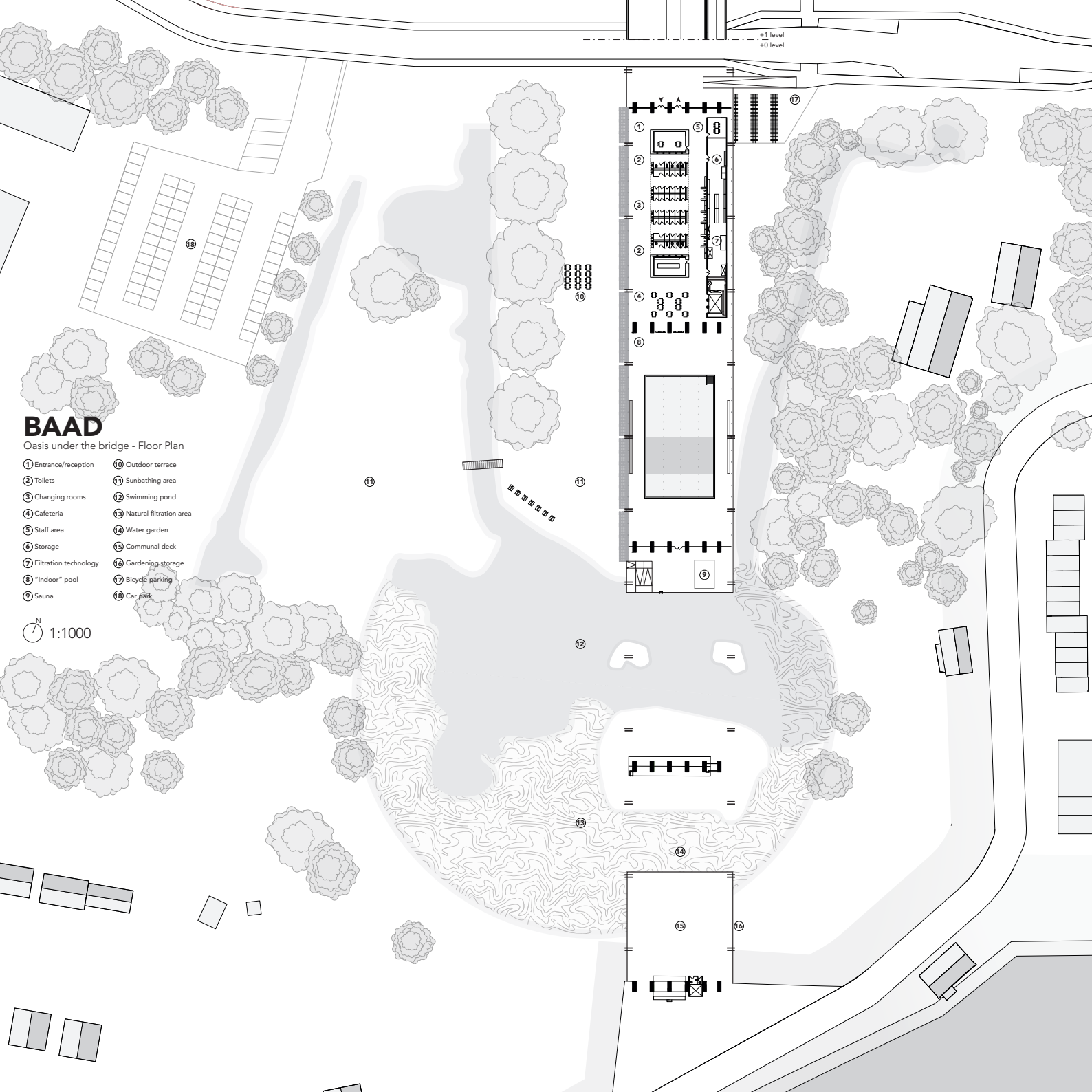
Structured into three main parts, the book begins with the design proposal titled BAAD, an acronym for Bridge As Active Destination. This chapter presents the conceptual vision and spatial strategies of the intervention. The second part reflects on the current spatial experience of the bridge and its surrounding environment through a series of images and observations. The final section offers insights into the historical context of the site, tracing its transformations and the memories still present in the minds of those who live nearby.

The proposal envisions a new kind of public program beneath the Papendrechtsebrug, transforming an often neglected space into a site for social gathering, recreation, and outdoor engagement. BAAD is not merely an addition to the city's infrastructure, but a reinterpretation of how bridges can actively serve a local community.

At its core, the design introduces a natural swimming facility. This includes a 25-meter pool filtered biologically, avoiding the use of chlorine, and an adjacent outdoor pond that supports the natural filtration processes. The glass facade not only frames the views and allows for ventilation. It also serves as an extended self-supporting sound barrier, protecting the surrounding from the noise of traffic above. This acoustic buffer transforms the experience for the community, making it suitable for both relaxation and recreation.

BAAD SWIMMING POOL

A Bridge As Active Destination
architectural proposal



BAAD

Oasis under the bridge - Floor Plan

1. Entrance/reception
2. Toilets
3. Changing rooms
4. Cafeteria
5. Staff area
6. Storage
7. Filtration technology
8. "Indoor" pool
9. Sauna
10. Outdoor terrace
11. Sunbathing area
12. Swimming pond
13. Natural filtration area
14. Water garden
15. Communal deck
16. Gardening storage
17. Bicycle parking
18. Car park

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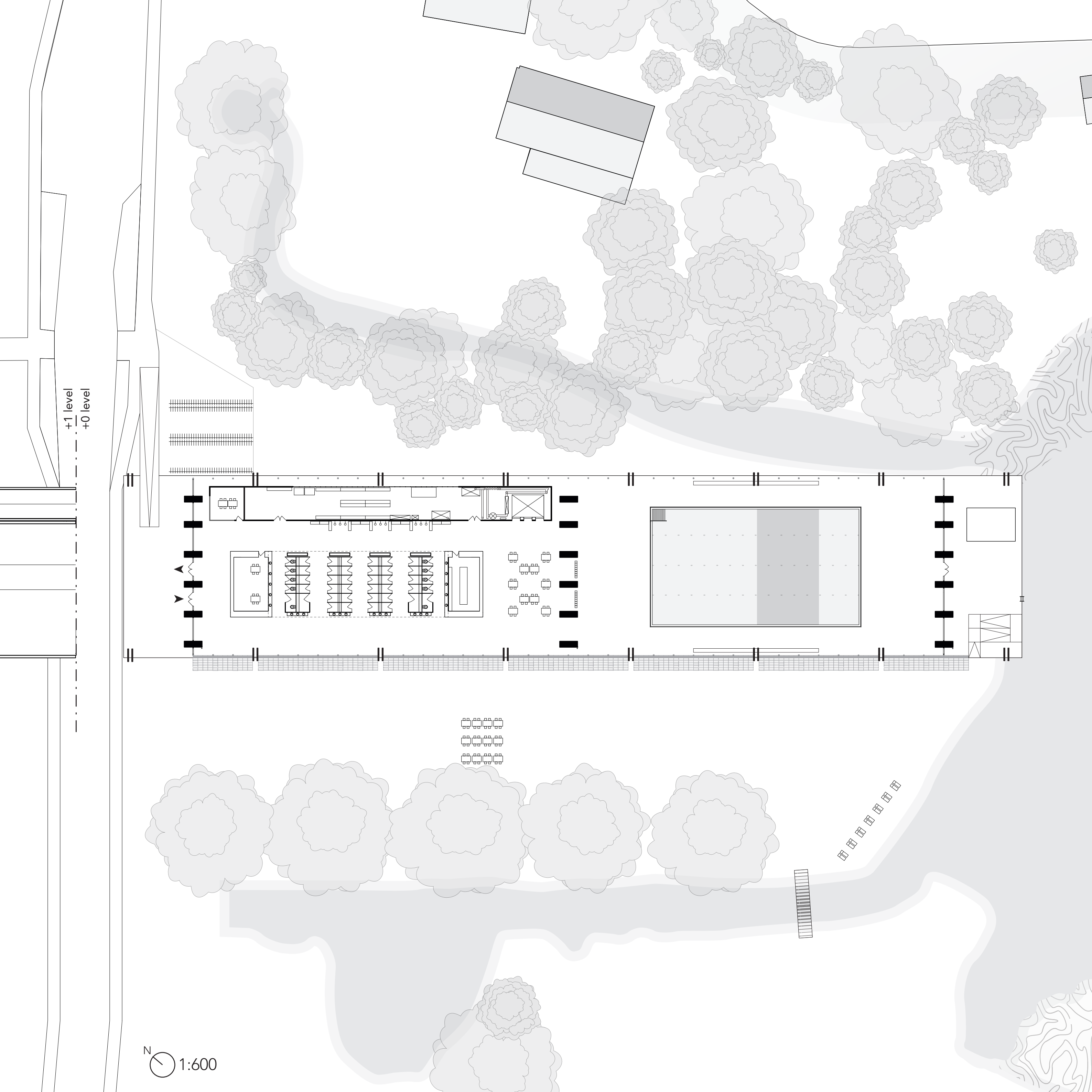
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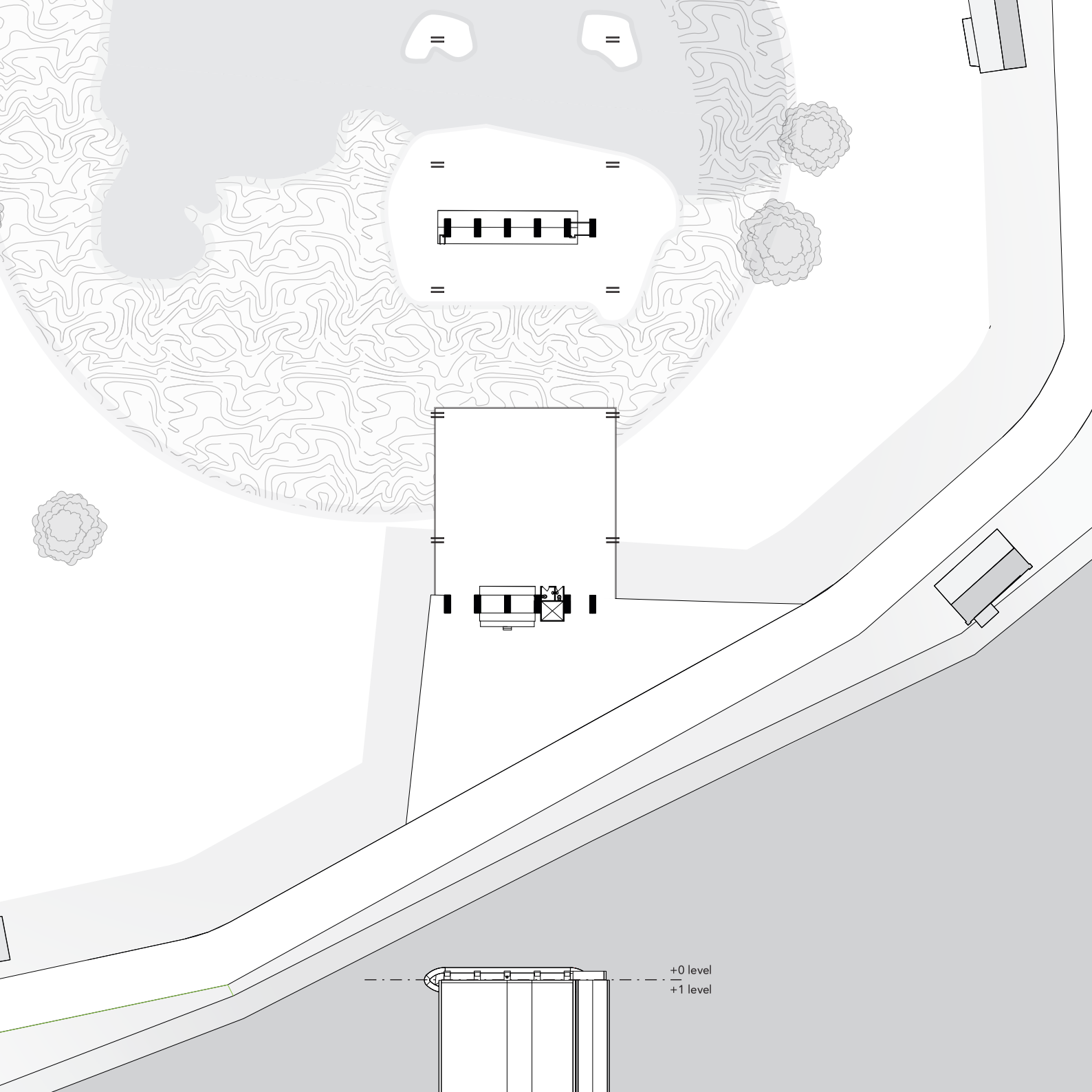
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BAAD
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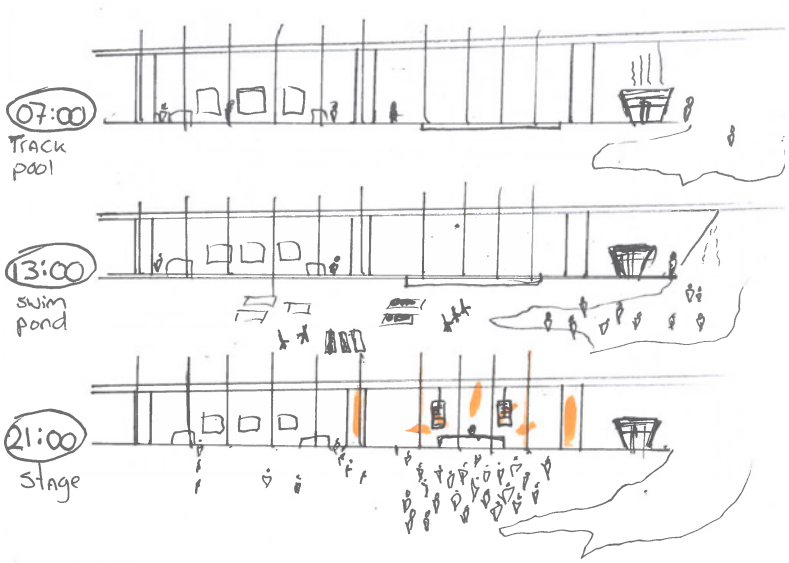


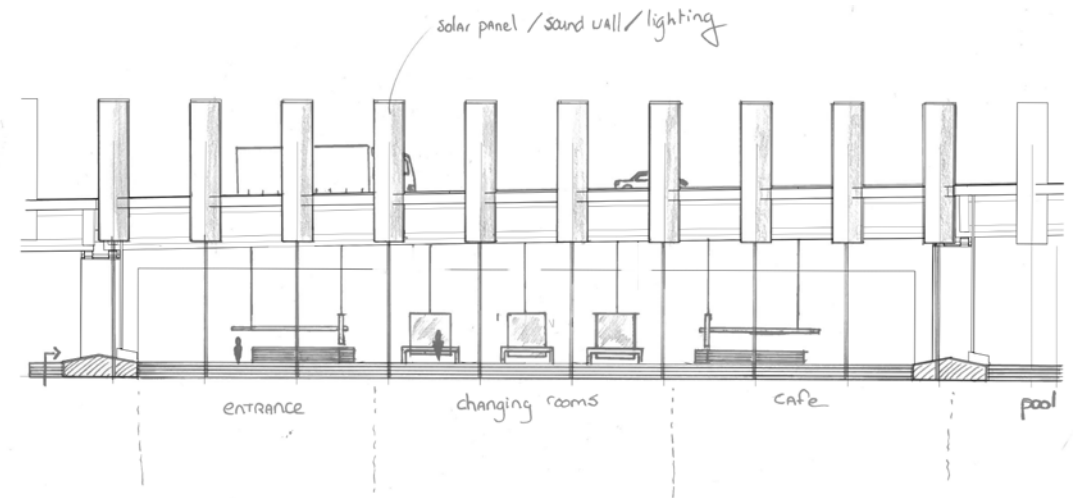
Programme

The design takes the bridge's inherent linearity and reinterprets it as a guiding spatial principle. As visitors move through the building, they are carried along a carefully choreographed sequence of spaces, each aligned with the axis of the bridge and the long sightlines it offers. The experience is deliberately framed, transparency, open passages, and aligned views work together to draw the eye forward, reinforcing a sense of direction and clarity.

This linear arrangement is not only spatial, but programmatic. From entry to changing rooms, and onward to the pool and pond, the design follows the natural flow of how one visits a swimming facility. The transition between indoor and outdoor spaces is smooth and intuitive. Glimpses through the building connect the visitor constantly to the surrounding landscape, while the architecture itself offers orientation and shelter.

The inclusion of key facilities such as reception, lockers, toilets, and a café extends the usability of the structure beyond that of a swimming facility. These amenities provide the necessary infrastructure to host a variety of community events, ranging from outdoor festivals in summer to indoor markets on top of a covered pool in winter.

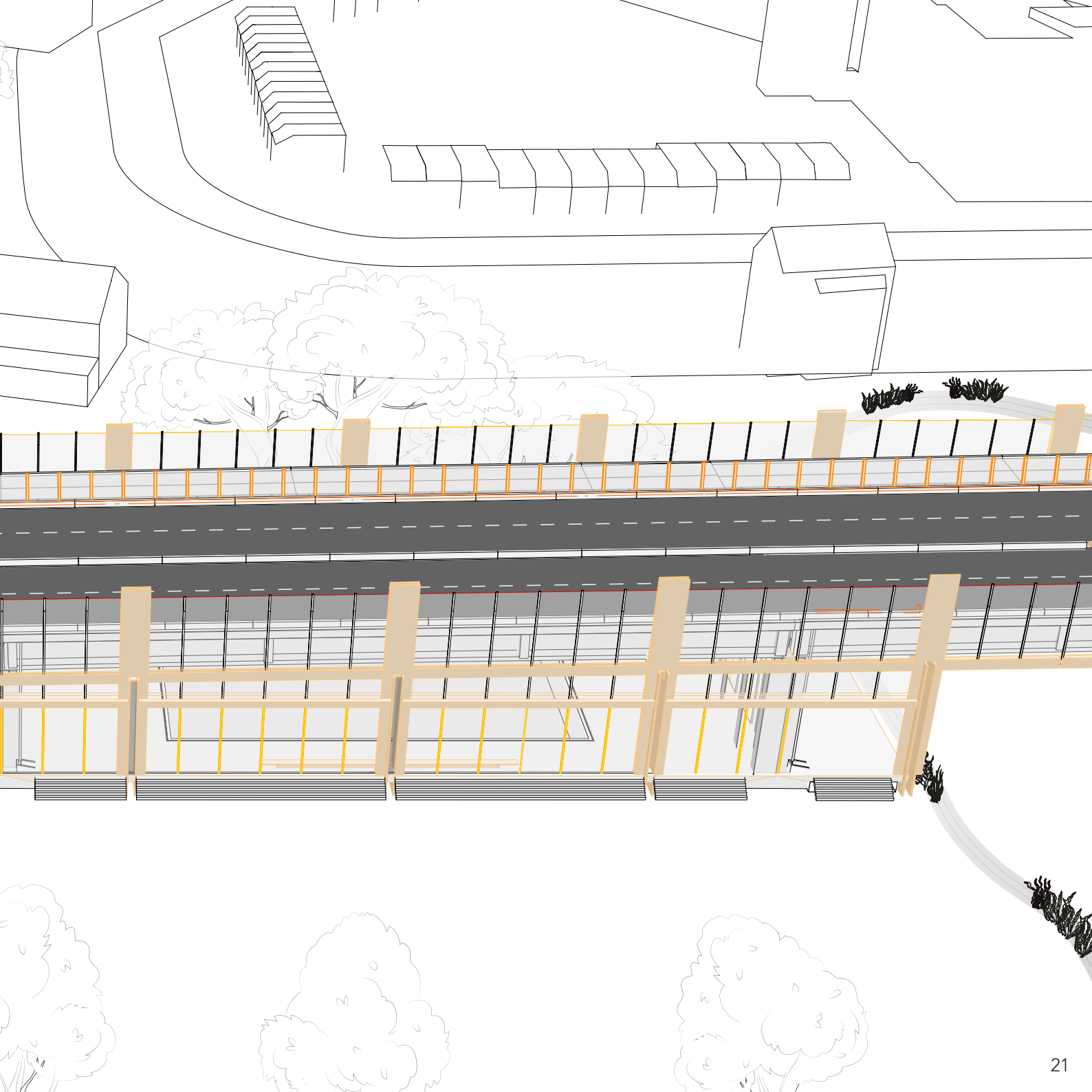
Rather than designing a single-purpose building, the project offers a framework that supports daily use while remaining equipped for special occasions. The café becomes a welcoming anchor point for both swimmers and non-swimmers.

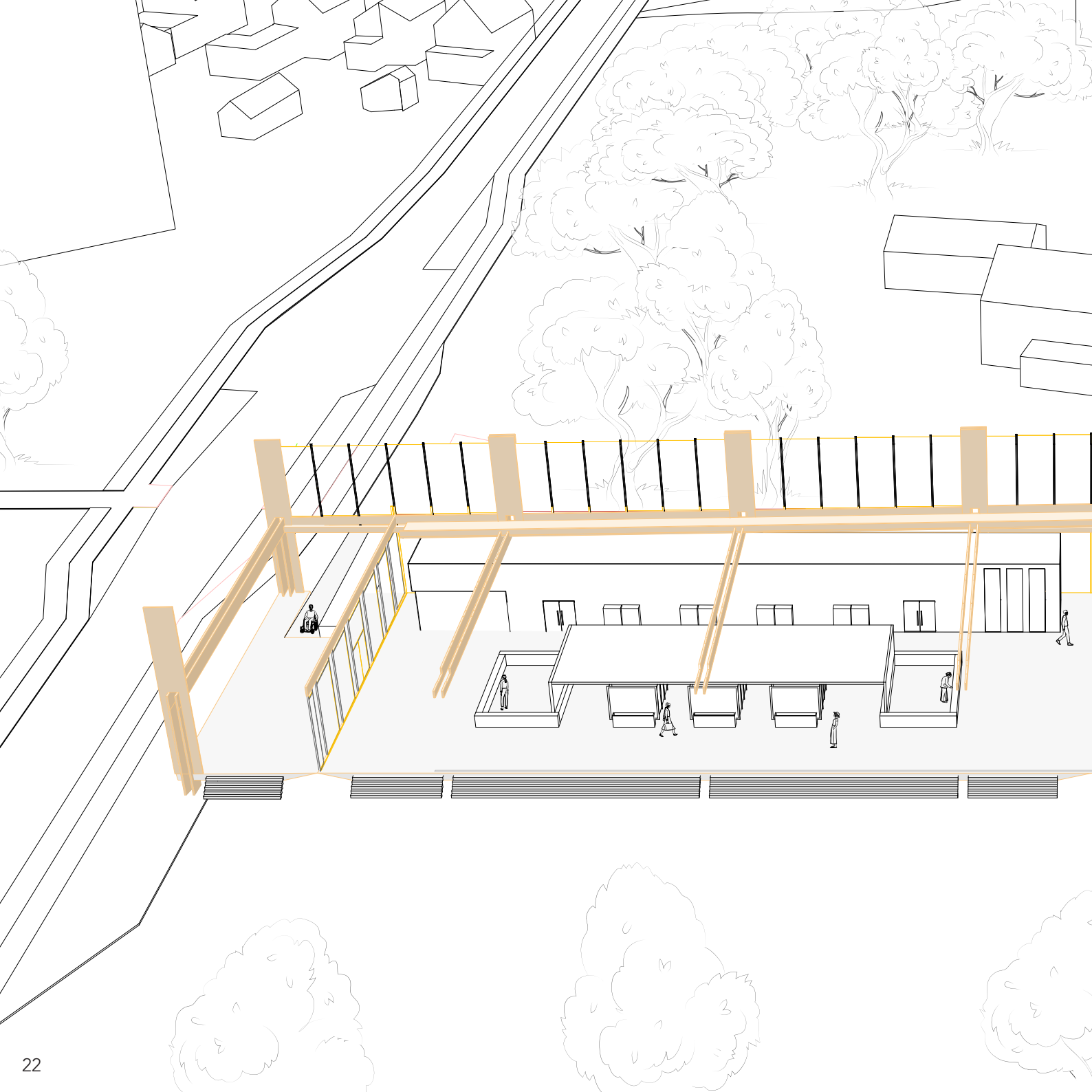


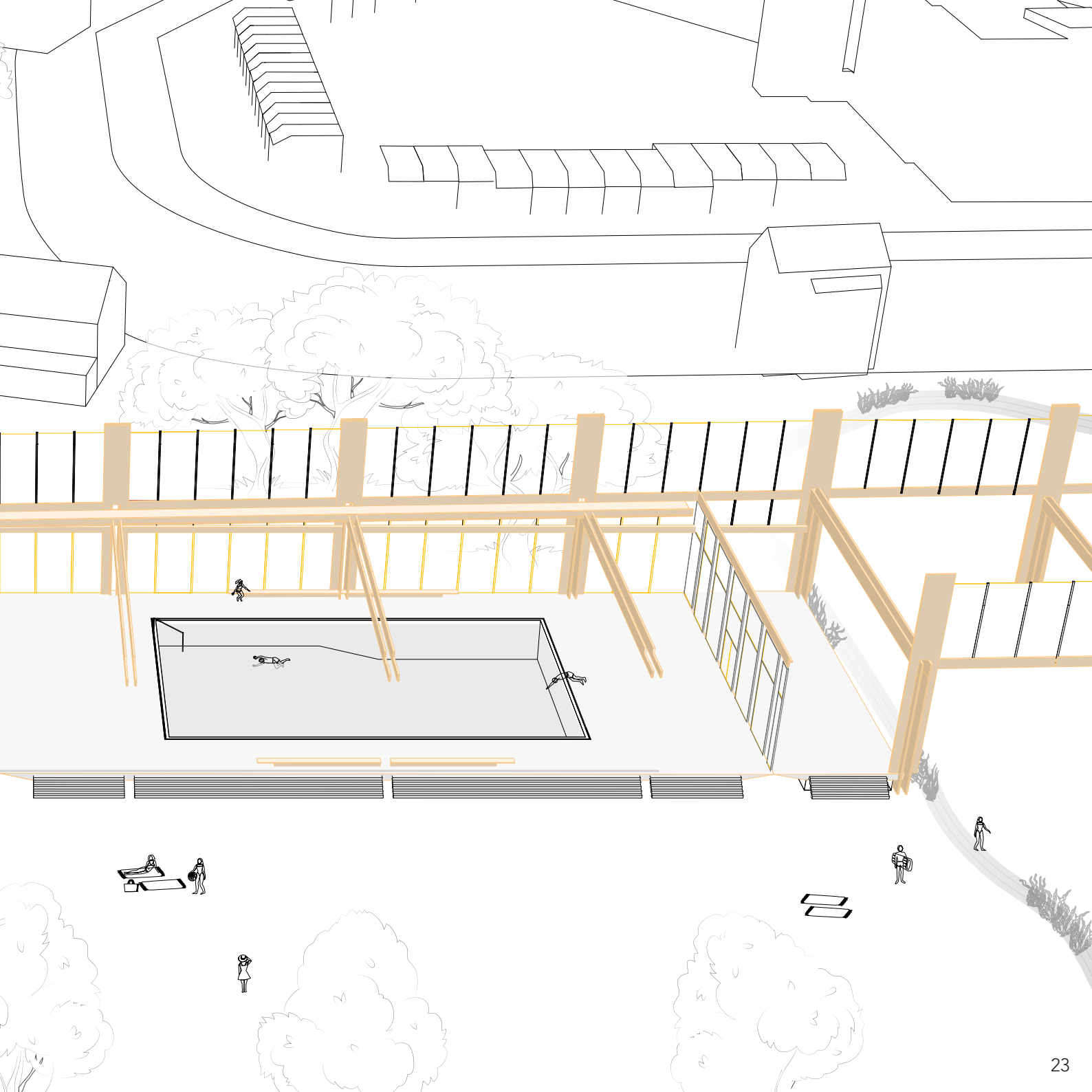
From Infrastructural to Human Scale

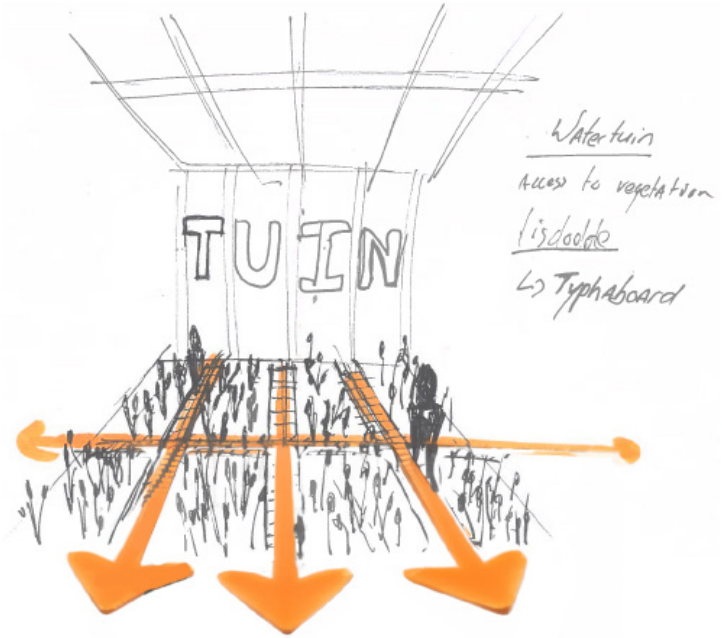
The design of the interior facilities, such as the changing rooms, toilets, and lockers, follows a minimalist approach that brings clarity and calm to the visitor experience. The layout is intuitive and understated, ensuring that the focus remains on the act of swimming and the surrounding natural context. Cleanliness, comfort, and a sense of order are essential in any bathing facility, and in this case, they form a deliberate contrast to the rough concrete surfaces of the bridge above. Through warm material choices, thoughtful dimensioning, and subtle detailing, the design introduces a welcoming, spa-like atmosphere.

The intimate scale of the changing rooms, paired with high-quality finishes, offers users a sense of privacy and ease. The glulaminated timber construction is used not only for its biodegradability and prefabrication potential, but also for its ability to thrive in humid environments. Its tactile warmth and softness stand in stark yet harmonious contrast to the raw infrastructure overhead. The result is a calm architectural language that supports the comfort of daily users while reinforcing the contrast between the manmade and the natural, the infrastructural scale and the human scale.





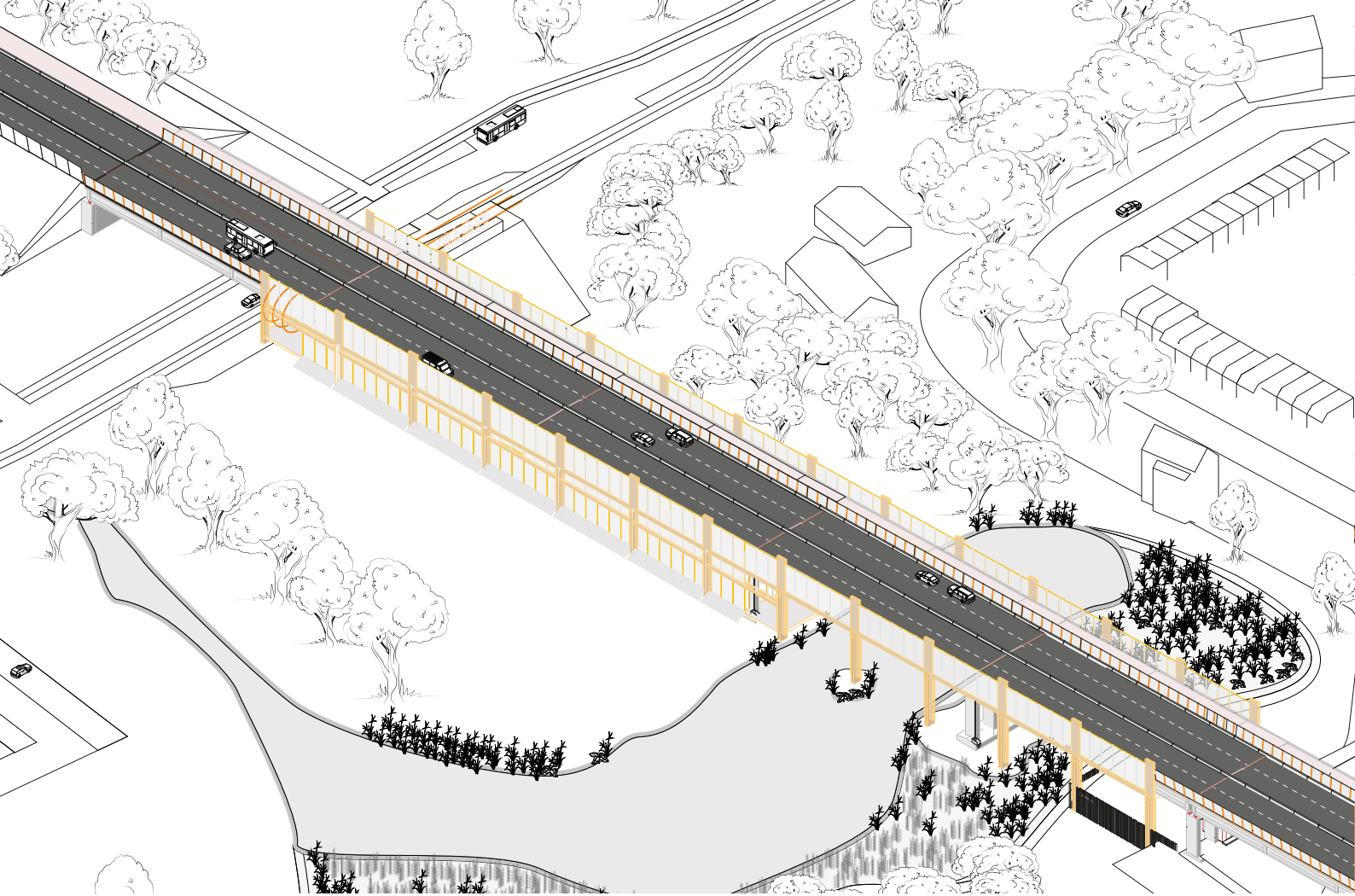




Community Integration and Ownership

The design actively invites community involvement, not merely as a symbolic gesture but as a functional layer embedded within the architecture. The water garden, located alongside the natural pond, is designed as a working landscape where residents can contribute to the maintenance of the regenerative filtration zone. Clear access paths, integrated tool storage beneath the communal deck, and visible filtration components make the process approachable and transparent. Rather than concealing the mechanics of the pool, the project celebrates it, transforming maintenance into an act of stewardship. This practical integration empowers volunteers to take part in the ongoing health of the swimming environment while also fostering a deeper sense of shared ownership over the public space.

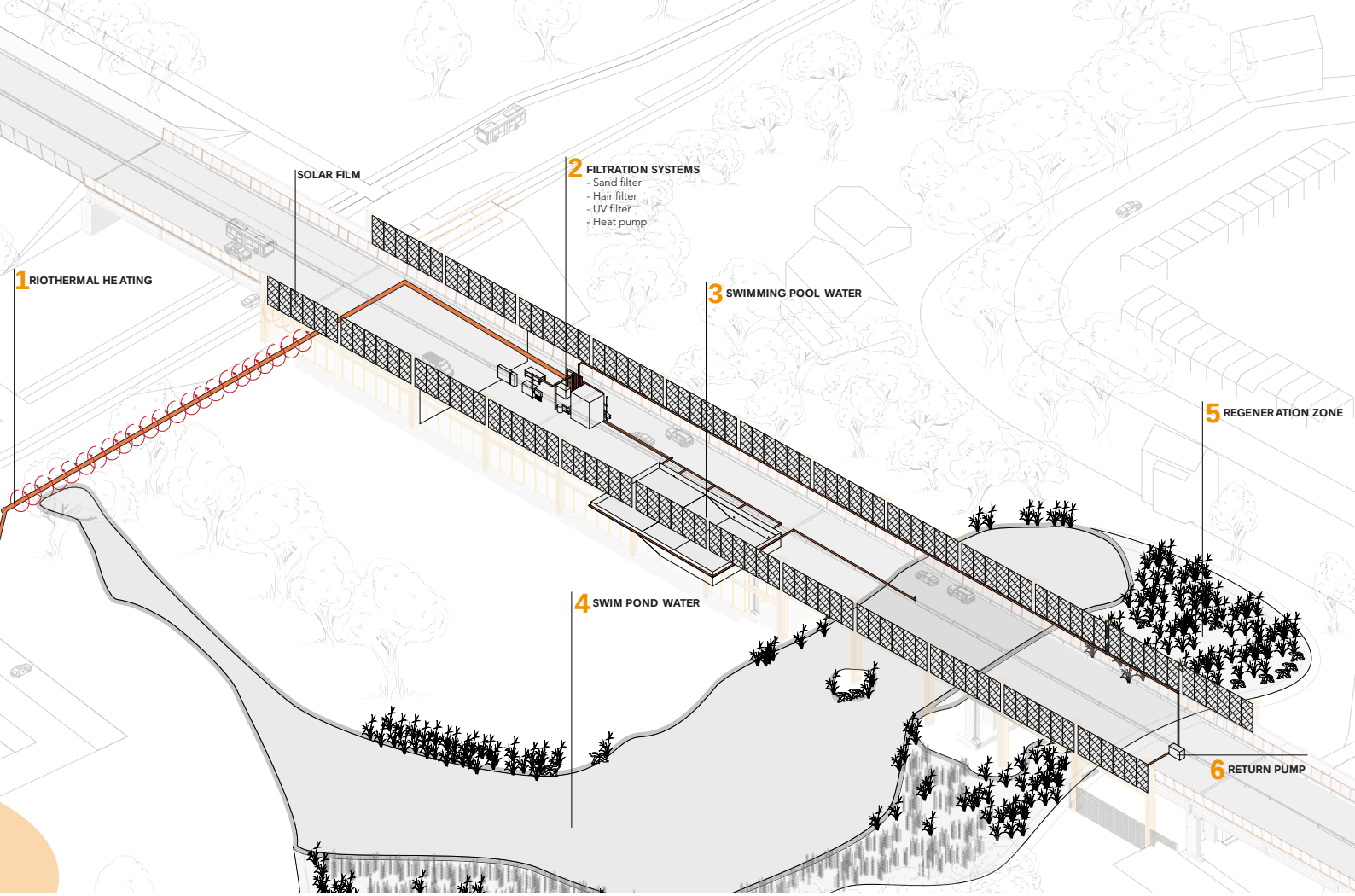
Beyond swimming, the architecture establishes a social infrastructure that supports informal gatherings, neighbourhood events, and seasonal activities. The communal deck extends from the building towards the dyke, designed with basic amenities and lighting to create an inviting platform for open-air cinema nights, public workshops, or shared meals. The café, modest in scale but open in character, serves as a natural anchor for moments of social exchange. Its location and accessibility make it equally functional for a quick coffee after a morning swim or for volunteers gathering before a day of work in the water garden. By combining these elements: deck, café, and functional support spaces, the architecture provides the framework for a living, evolving community hub.



Hybrid Pool Mechanics

The swimming facility operates on a hybrid water system that merges conventional pool mechanics with a regenerative natural cycle. Within the enclosed volume of the building, essential filtration processes such as hair catchers, sand filters, and UV purification are neatly integrated and remain discreetly accessible for maintenance. These mechanical systems manage the cleanliness of the main 25-meter pool, ensuring a high standard of hygiene and comfort for swimmers throughout the year.

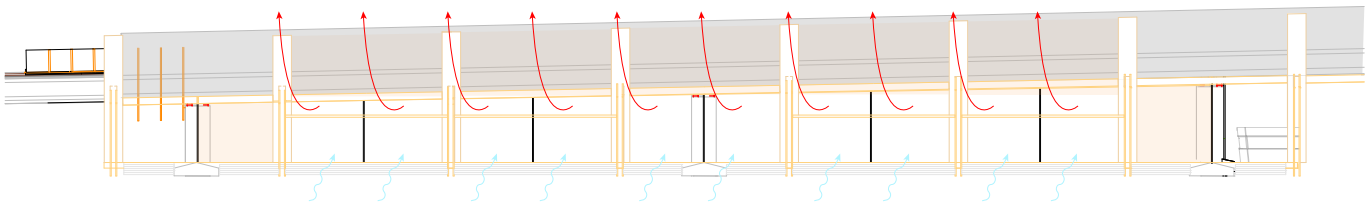
To further reduce energy consumption, the pool's heating is supplied by a riothermal exchange system, developed in collaboration with the neighbo-



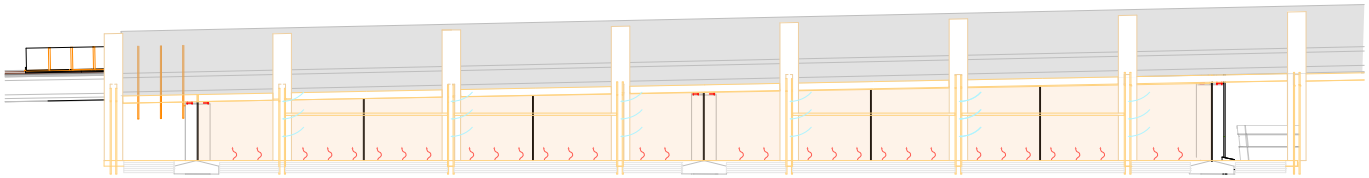
uring water company. This method draws heat from the local water infrastructure, tapping into a constant and sustainable energy source while anchoring the facility even more deeply within its local context. Excess water from the pool is gently directed into the adjacent natural pond, where a slower ecological cycle begins.

Native aquatic plants and biological substrates gradually regenerate the water, which, after sufficient natural filtration, is pumped back into the technical system. This closed-loop between engineered and ecological processes forms a resilient and self-supporting water landscape.

Summer/Spring
scheme



Winter/Autumn
scheme



Blurring Boundaries: The Openable Façade

One of the core architectural gestures of the project is the integration of a fully openable façade that transforms the spatial relationship between inside and outside. When opened, the façade removes any physical or perceptual threshold between the interior swimming hall and the surrounding landscape. The enclosed pool, changing rooms, café, and social spaces extend their functionality outward, serving not only indoor swimmers but also those enjoying the natural pond and the adjacent green space.

This architectural openness is not merely symbolic; it is carefully attuned to the seasonal patterns of use. During the warmer months, the fully retractable façade enables natural ventilation, abundant daylight, and visual continuity between inside and out, creating a passive, comfortable indoor climate that feels distinctly open-air. The result is an experience that captures the atmosphere of outdoor swimming while maintaining the hygiene, structure, and amenities of an indoor facility. As the seasons shift and temperatures drop, the glazed façade, with its generous solar exposure, works in tandem with integrated floor heating to extend the usability of the space well into the colder months. Rather than relying on complex systems, the architecture responds to seasonal change through a clear spatial strategy, offering the openness of the outdoors and the protection of the indoors in a seamless and intuitive manner.

Nighttime Ambience and Spatial Safety

By night, subtle linear lighting highlights the rhythm of the new columns, enhancing orientation and safety under the bridge. This illumination extends to the existing bridge deck above, revealing its distinct concrete texture and transforming the infrastructure into a legible and even atmospheric ceiling. The interplay of light and structure creates a clear and inviting nighttime atmosphere, blending new architecture with the existing bridge in one spatial experience.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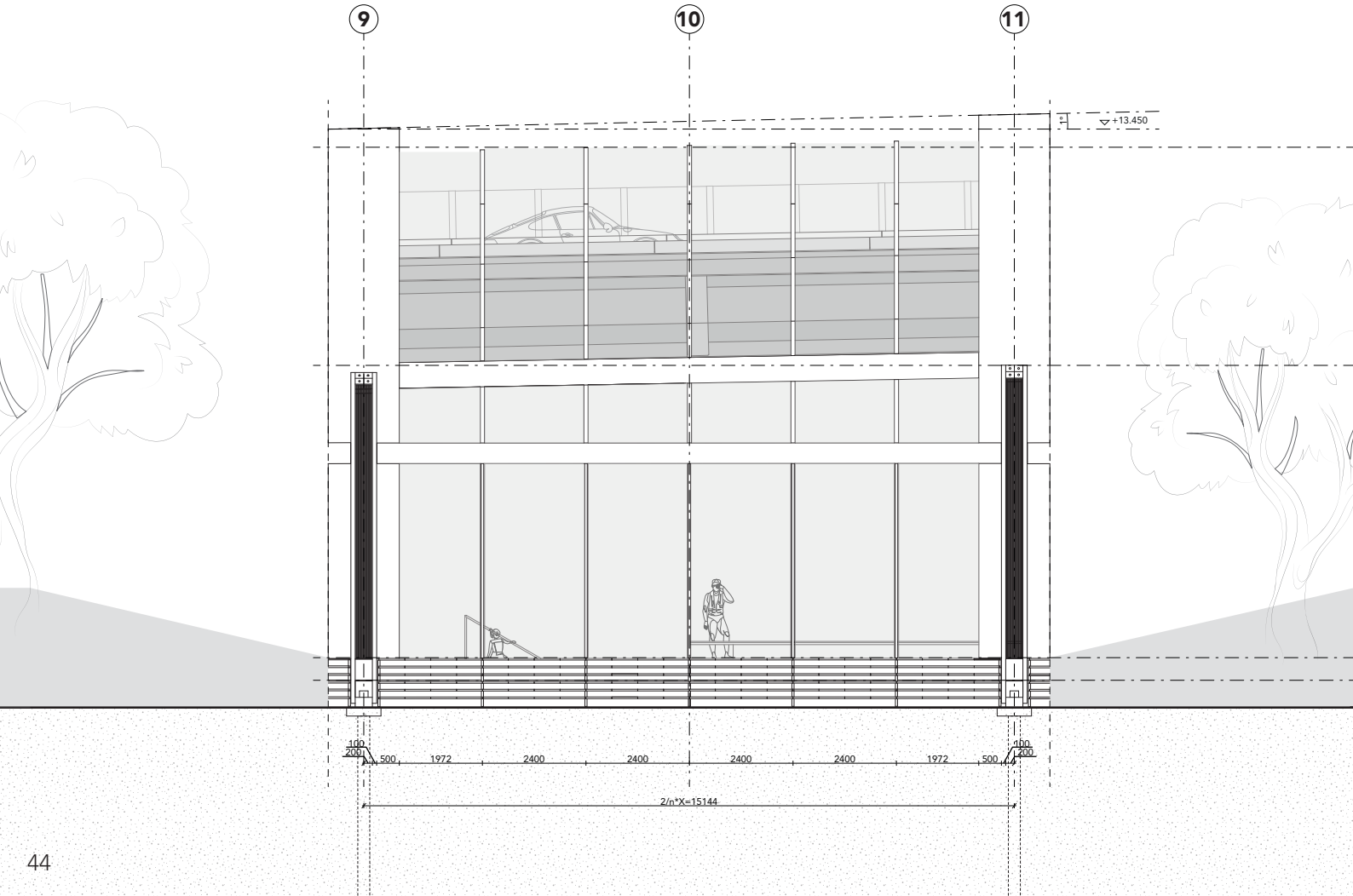
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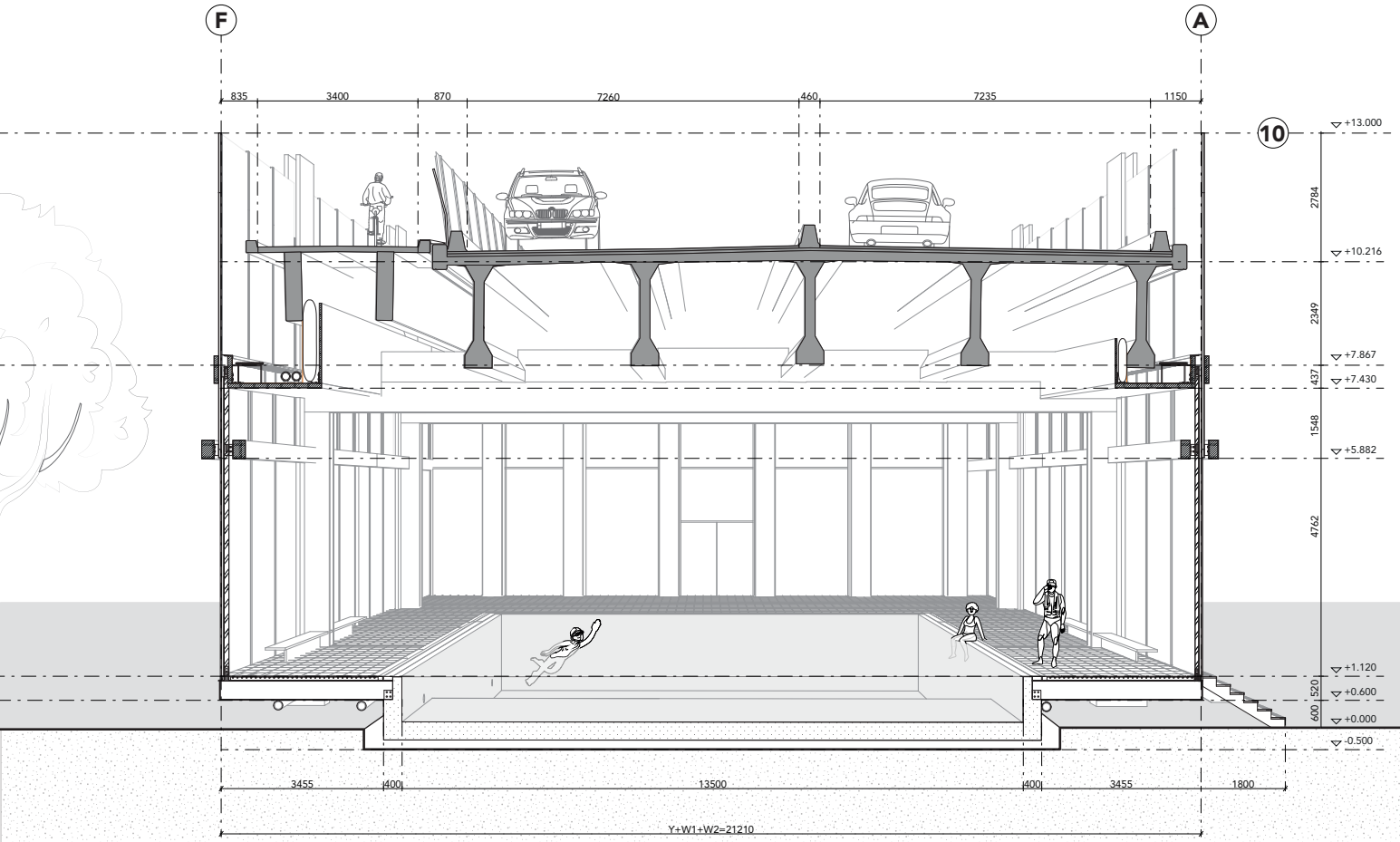
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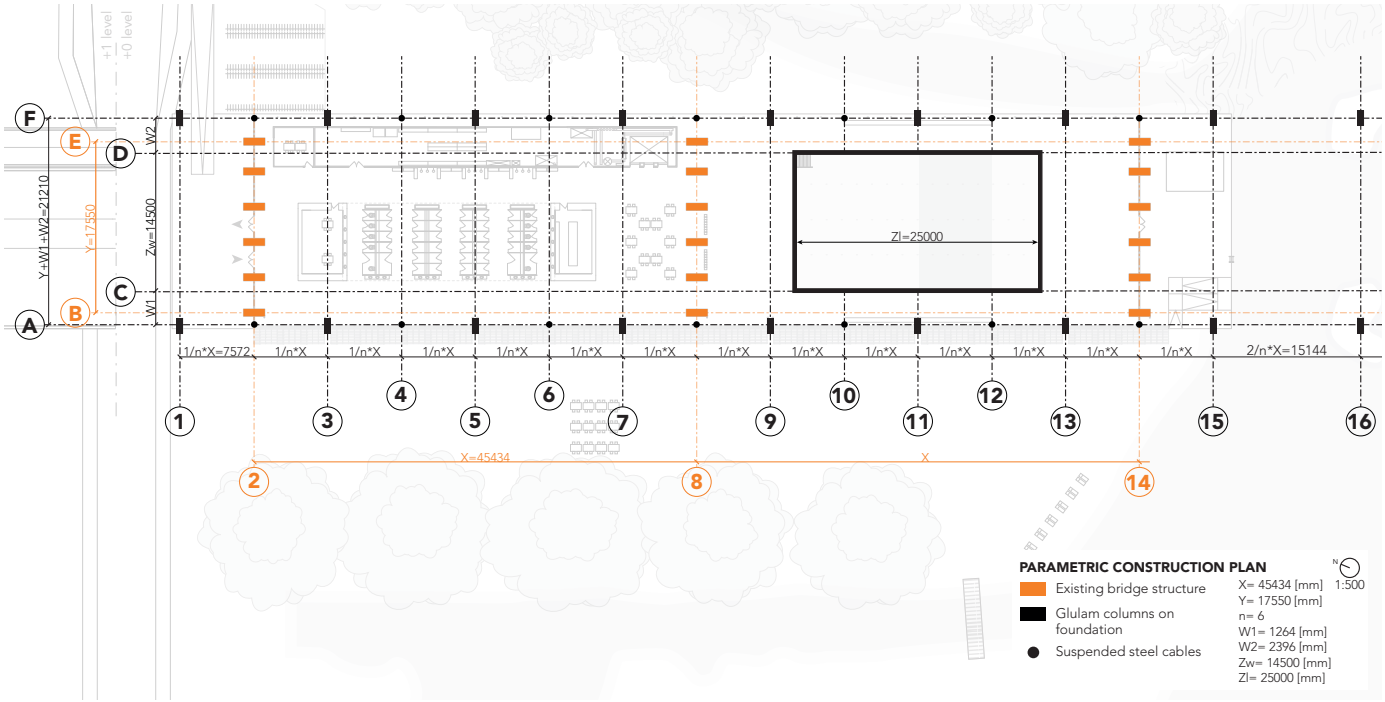
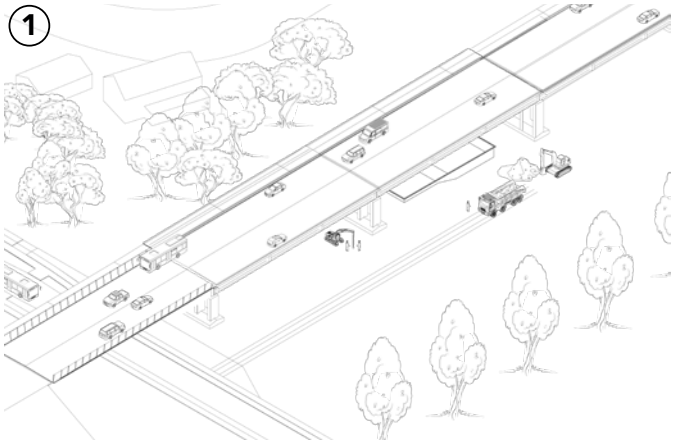


Parametric Prefabrication

The project embraces prefabrication as a strategy for circular, efficient, and high-quality construction. By shifting much of the building process to controlled factory environments, components can be produced with greater precision, resulting in tighter joints, faster assembly on site, and significantly reduced material waste. This method supports a lower environmental footprint, both in terms of embodied energy and construction impact.

Central to this process is a parametric design approach. Through digital modelling, each buildingelement, from structure to envelope, is defined within a flexible system of rules and parameters. This enables the design to optimise the use of materials, minimise offcuts, and generate consistent yet adaptable building modules. The parametric system becomes a tool for stewardship, allowing full traceability of materials and ensuring each part fits within a circular lifecycle. Components are not only easier to fabricate, but also to catalogue, disassemble, and potentially reconfigure or reuse in the future. In this way, prefabrication is not simply a logistical solution but a deeply integrated design philosophy supporting sustainable and circular architecture.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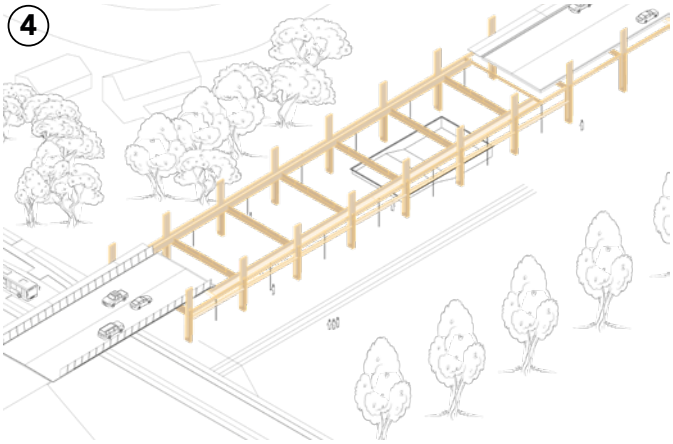
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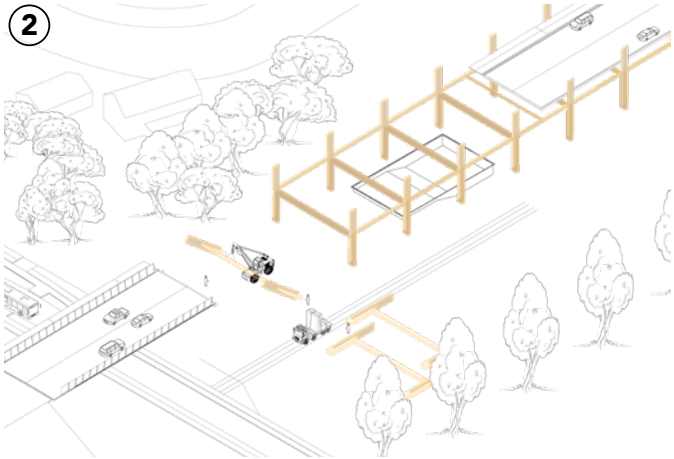
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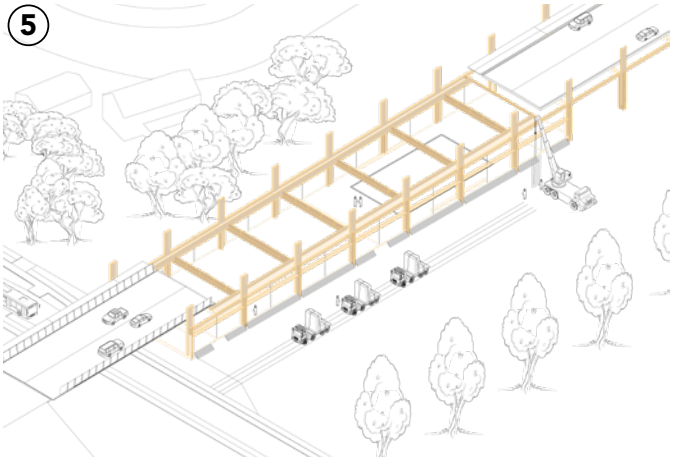
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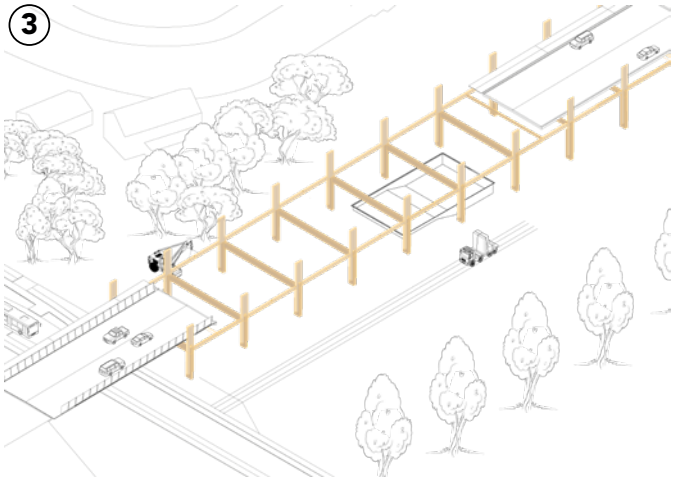
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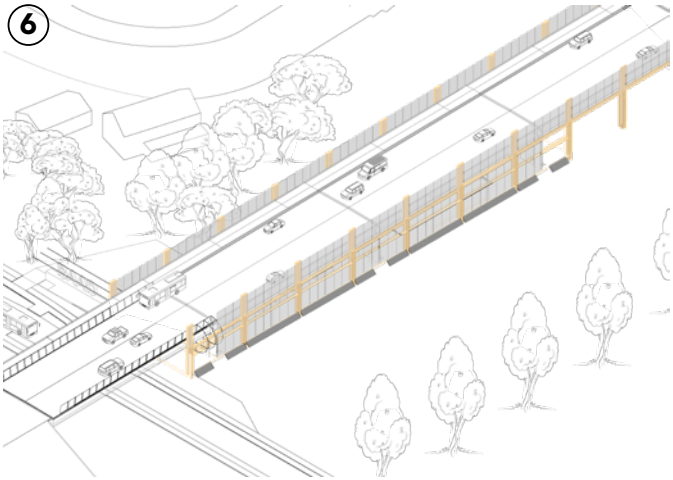
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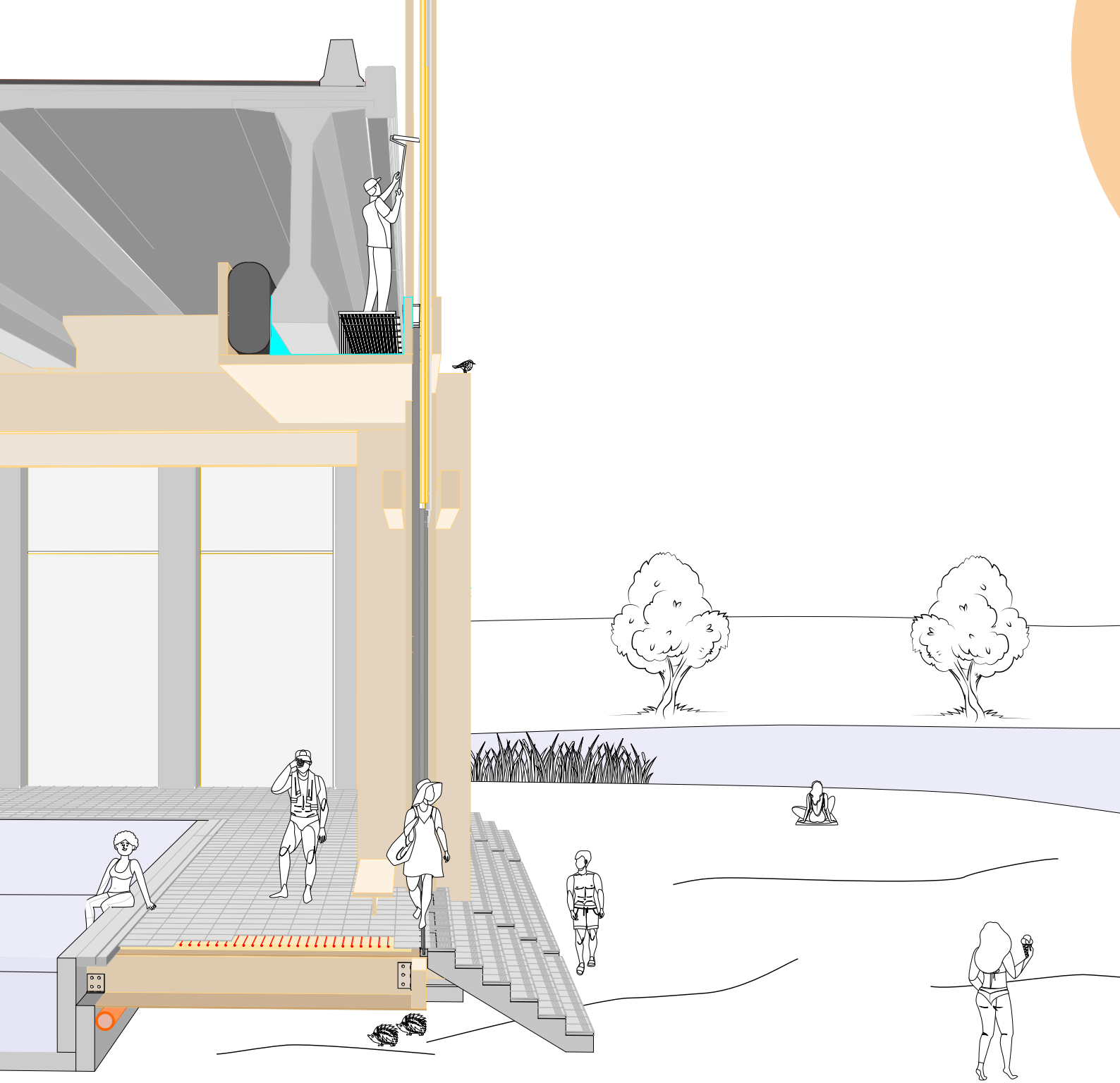
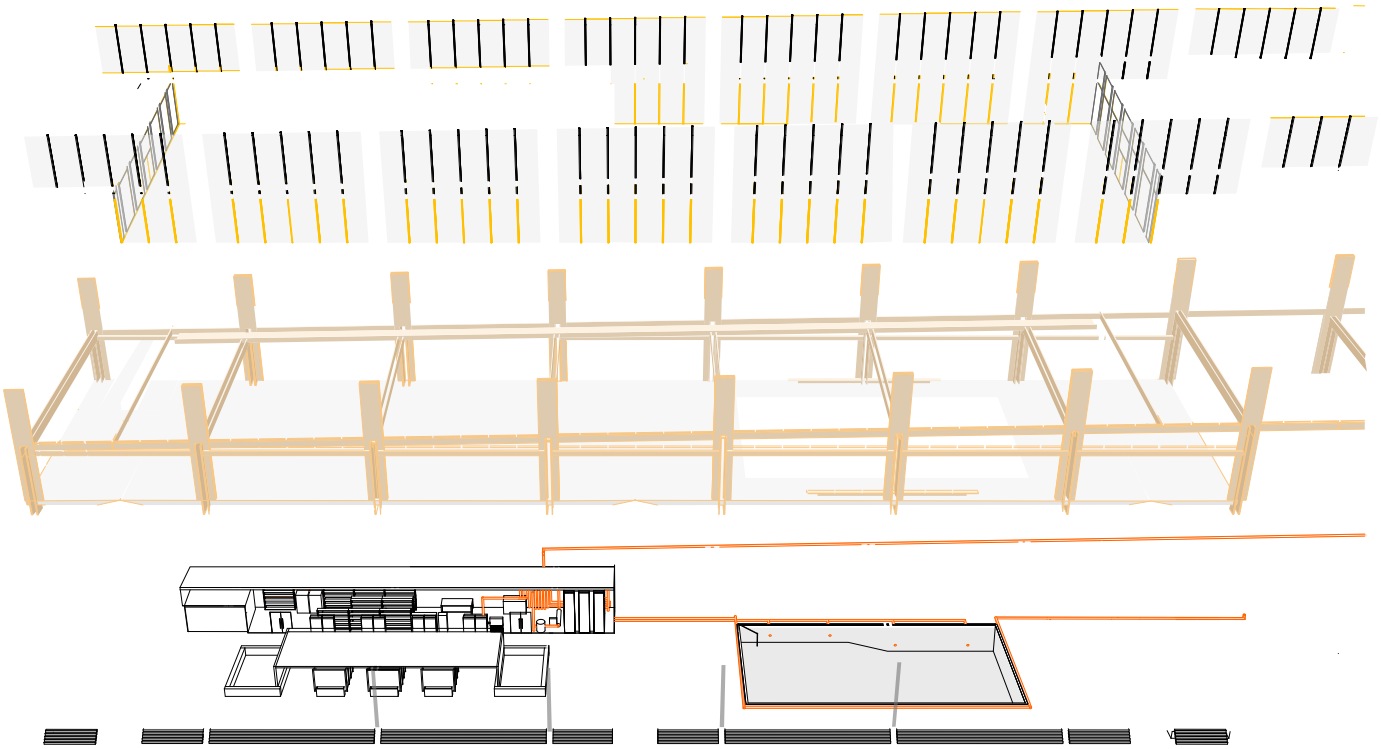


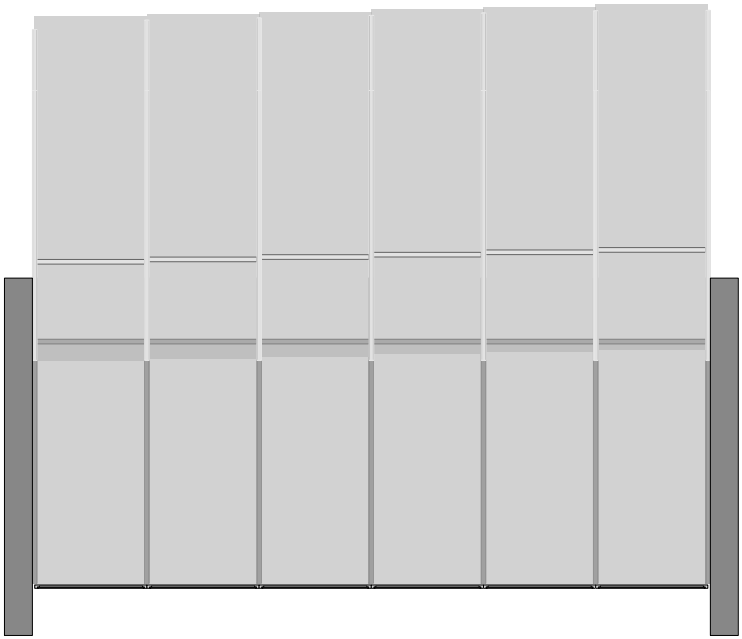


Modularity and Reversibility

The project adopts a layered approach to construction, guided by Stewart Brand's shearing layers concept. By differentiating between structure, skin, services, space plan, and finish, the design enables modularity and future reversibility. Each component is conceived for easy disassembly, guided by a material passport that documents the origin, properties, and future potential of every material used. The repetition in section and façade layout reinforces this principle, allowing not only for efficient material use but also for potential reconfiguration or relocation. In this way, the architecture is designed not just for its first life, but for its next one as well. The façade of the building is designed as a system of repeating, sloped modules that correspond with the incline of the bridge deck overhead. While the slope responds to the site's unique spatial conditions, the modules themselves maintain standardized dimensions. This deliberate separation between geometric adaptation and component standardization allows for efficiency in fabrication and clarity in assembly. Each façade element, comprising aluminium frames, glazing panels, and integrated fixings, is designed with a kit-of-parts logic that can be disassembled, replaced, or repurposed.

Facade-Section-Module
FSM3

FFF(22-28)	6X
FMP	6X
FSP	6X
FUF	7X
FLF	7X
FGF	6X
FUFC	6X
FLFC	6X
FSMU	2X



Facade-Frame-Fitting
FFF22-FFF28

FFF(n)=FFF1+n*50 **1x** 1900

1x 1550

1x 1600

1x 1650

1x 1700

1x 1750

1x 1800

Facade-Upper-Frame
FUF

7x 9800

Facade-Lower-Frame
FLF

7x 4900

Facade-Upper-Frame-Connector
FUFC

6x 2300

Facade-Lower-Frame-Connector
FLFC

6x 2300

Facade-Ground-Frame
FGF

6x 2400

Facade-Second-Panel
FSP

6x 2000 2300

Facade-Main-Panel
FMP

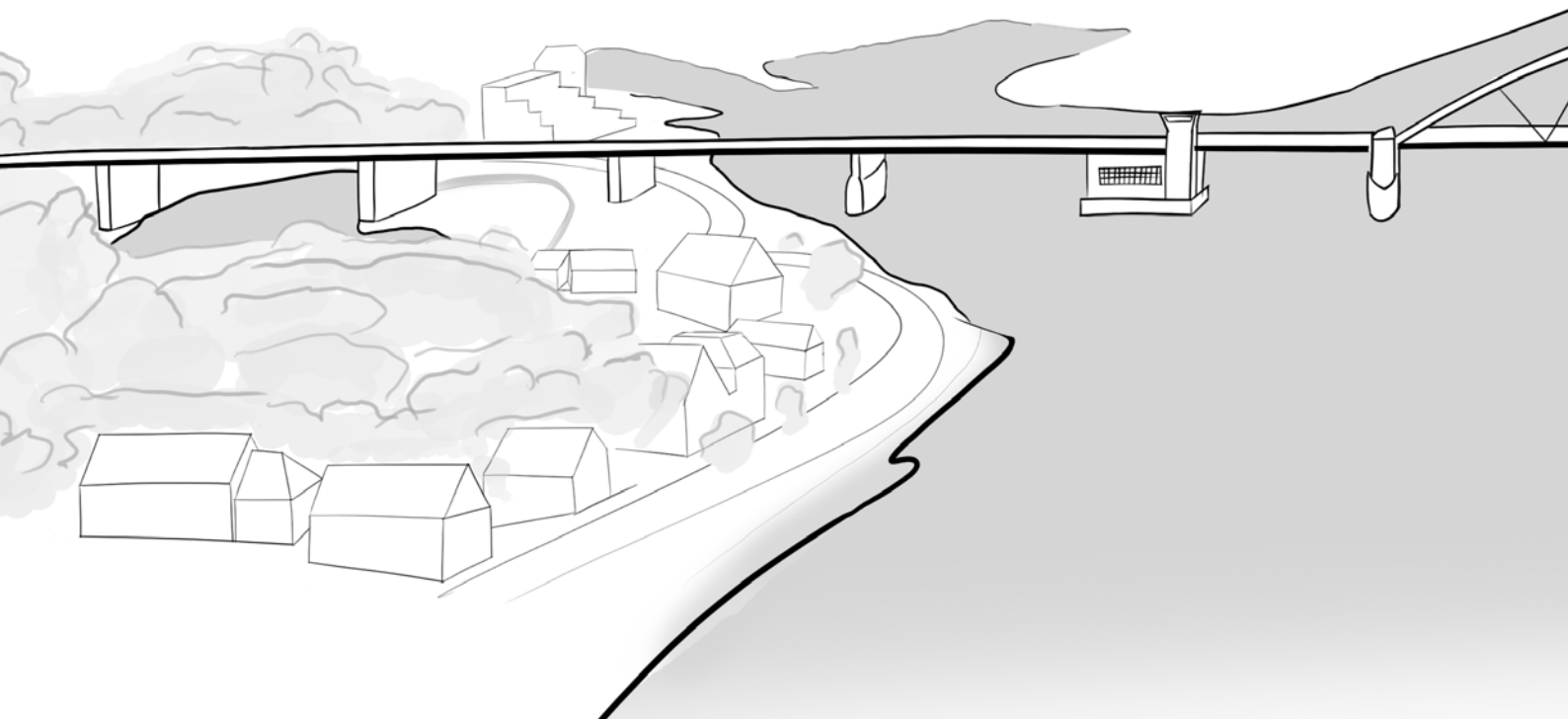
12x 9000 2300

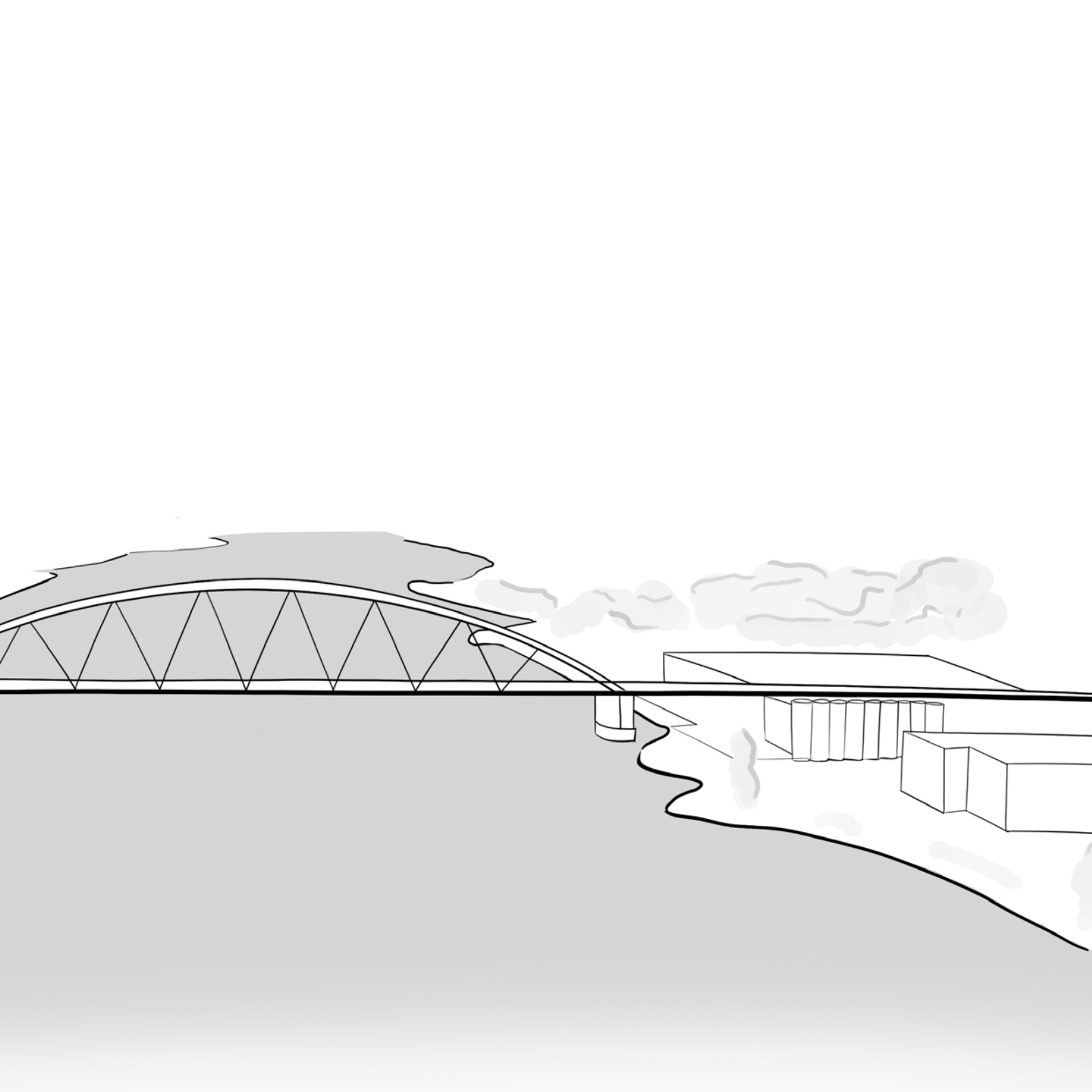
Facade-Side-Motor-Unit
FSMU

2x 7500 600

THE PAPENDRECHTSEBRUG

An overview of the spatial potential





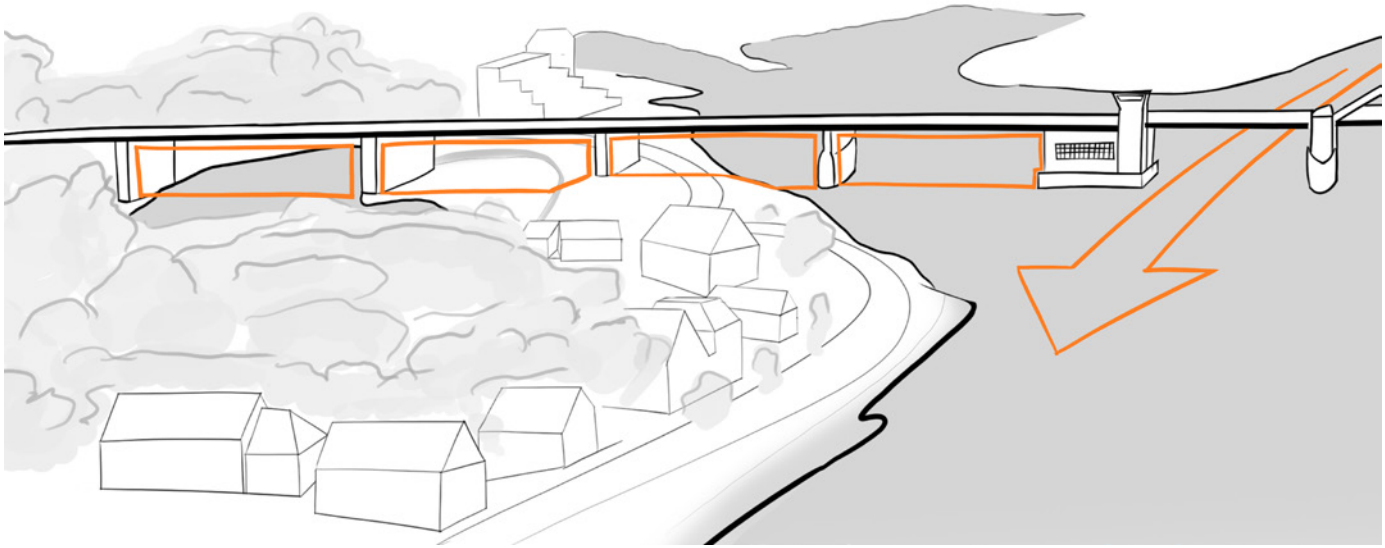

KAFA Duman

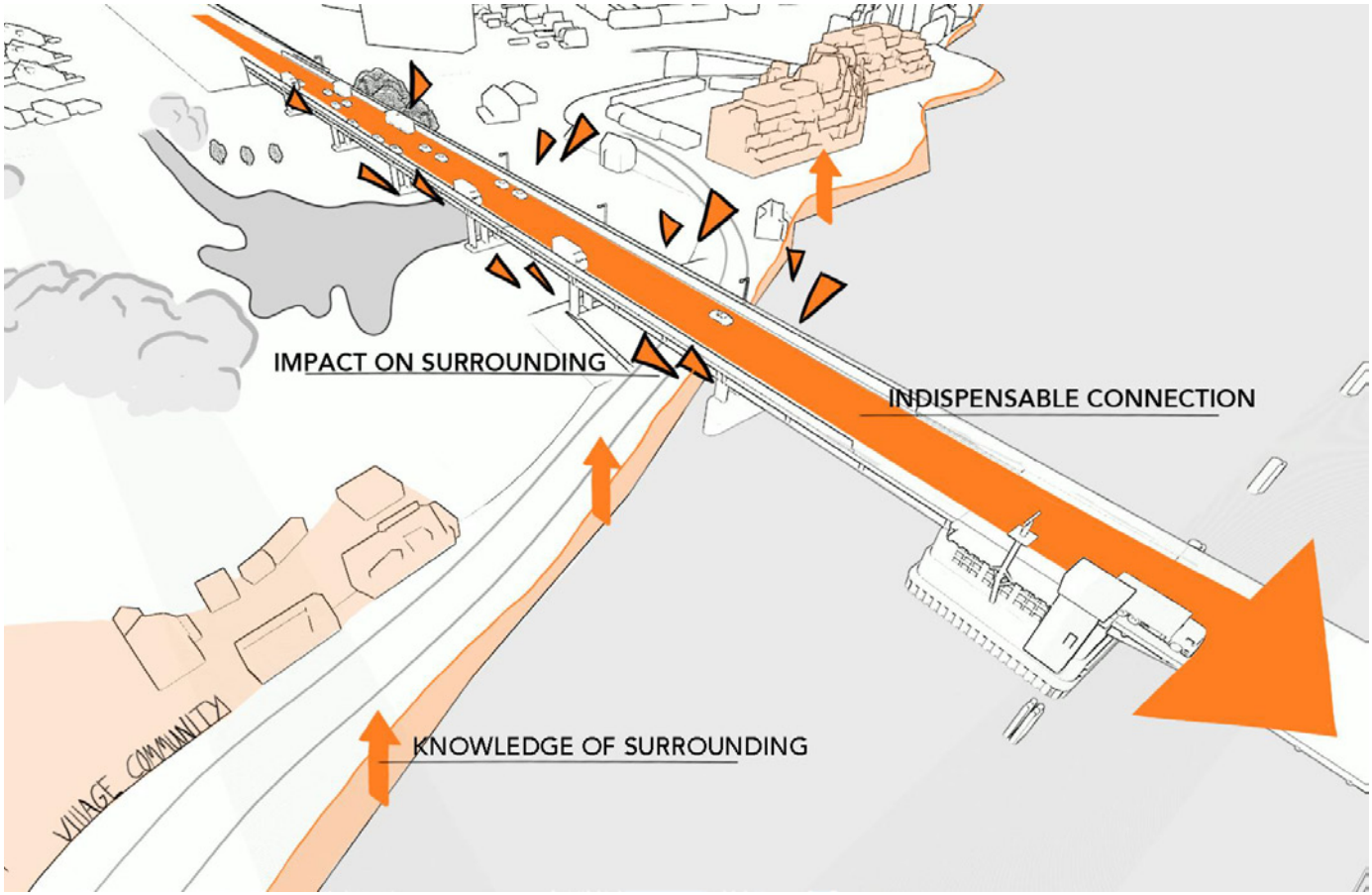
Revealing the Spatial Potential Below the Bridge

The underside of the Papendrechtsebrug offers an unexpectedly rich and compelling spatial experience. Defined by the bold rhythm of its concrete columns and the generous clearance between bridge and ground, the space reads as both monumental and infrastructural. Despite its intended function as a byproduct of the traffic artery above, this residual strip beneath holds architectural qualities that are both rare and valuable in the dense urban landscape: continuity, shelter, and openness. These qualities make it more than a void; they turn it into a space with the potential to house unique public architecture.

This space is neither entirely urban nor entirely infrastructural, and it exists in an in-between zone that makes it open to reinterpretation. The challenge lies not only in its physical characteristics, but also in its cultural reading: seeing the bridge's underside not as a leftover, but as an opportunity. The space beneath the Papendrechtsebrug presents an opportunity to introduce a clearly defined urban function in an area currently dominated by infrastructure. While the bridge efficiently connects two sides of the river for vehicles, it simultaneously creates a physical and social barrier on the ground level. The area below it, though centrally located and generously proportioned, remains largely unused and disconnected from its surroundings.

By introducing a program such as a swimming facility, with changing rooms, a café, a communal deck, and public seating, this disconnected zone can be transformed into a place with clear purpose and daily use. Such an intervention doesn't just fill the void; it reclaims it as a valuable public space. The project demonstrates how an architectural response underneath such a bridge can reweave the fabric of the urban tissue, offering a place to gather, relax, exercise, or meet, where previously there was little reason to wander around.





Insights from the Community

The design of this project has been deeply shaped by conversations with local residents. These dialogues revealed three interwoven themes: the bridge has a profound and daily impact in terms of sound pollution, it is simultaneously indispensable as a connector, and there exists an impressive degree of local expertise and knowledge. Far from being unaware to the area's development, residents demonstrate an intuitive understanding of the environmental and infrastructural dynamics surrounding them. These takeaways have shaped the final concept in several key ways. The façade, for example, functions as an extended sound barrier to reduce noise pollution. All interventions are designed to be constructed and used without disrupting road traffic on the bridge, preserving its indispensable role in regional connectivity. Moreover, the concept integrates community participation, embedding it directly into both the architectural design and the functional programme.

A Reference in Practice

While the transformation of infrastructural space into public space may seem ambitious, it is not entirely new. One particularly relevant example is the Albert Heijn project beneath the A8 highway in Koog aan de Zaan. What was once a, neglected, and unsafe stretch of motorway underside has become an active part of the village fabric. The addition of a grocery store injected new life into the space. The success of that intervention proves that residual spaces can become essential ones.

The proposal under the Papendrechtsebrug builds on this precedent. It introduces a swimming pond, communal garden, café, and public deck, not as temporary pop-ups, but as embedded, architecturally integrated components. Through material precision, thoughtful programming, and community involvement, the bridge's underside can undergo a similar transformation, becoming a shared spatial resource for the surrounding neighbourhood.


KAFA Duman

Location Specific Guidelines

In order to take the architectural, environmental, historical, and other tangible and intangible values into account during the design process, the 6 key values of the value assessment, based on the method of Kuipers and De Jonge (2017), were translated into three main starting points for the concept.

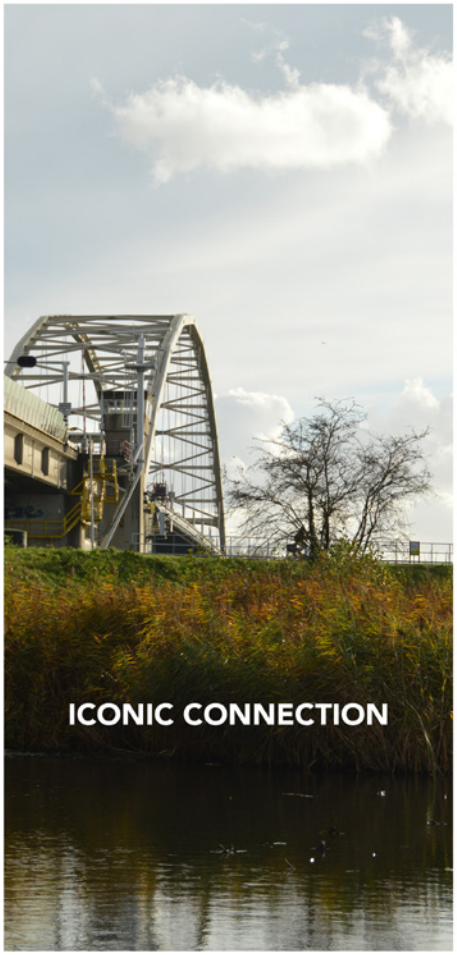
First, the design should aim to make use of the grey infrastructure already present, in other words, to utilise the existing concrete structure. This approach reduces the need for new construction, such as building a new "roof," and takes advantage of the embedded material footprint. Additionally, this guideline ensures that the existing greenery surrounding the underside of the bridge is protected and, where possible, enhanced, supporting both the historical value of features such as the Waal, and the ecological importance of the local microclimate.
The second guideline, termed long lines, was established to preserve and enhance the unique spatial qualities found underneath urban bridges. The repetition, endless sightlines, and wide-open spans are to be maintained in all interventions, and ideally accentuated through architectural framing within the design. The final guideline ensures that the intervention turns the space beneath the bridge into a place for the community. By creating opportunities for gathering and interaction, the concept aims from the outset to provide social value and to counteract the current negative perception of the bridge and its surroundings.

While the multidimensional character of any design makes it difficult to fully capture all existing values, continuously questioning and evaluating design decisions against these core guidelines helped to ground the conceptual narrative and intervention within the site-specific context.


STRETCHED KATHEDRAL


WATER WITHIN REACH


PURITY OF MATERIALS


ICONIC CONNECTION


SURPRISING TRANQUILLITY

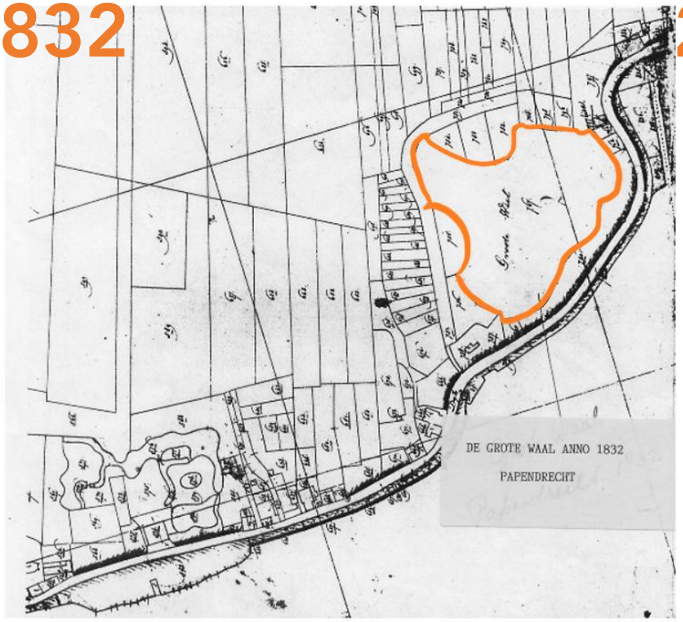

UNGOVERNED FREEDOM

HISTORICAL ANALYSIS

An overview of the past, its memories and the developments

De vrijwilligers v.l.n.r. 1 IJmert vd Griend- (jongen-onbek.) 2 Joost Romijn
3 Kees vd Griend 4 Gerrit Kraal 5 Arie Romijn (jongen onbek.) 6 Jaap Romijn
7 Mees v Dalen 8 Piet Bikker 9 Gijs Bezemer 10 Piet Romijn
Zittend v.l.n.r. 11 Floor Nederlof 12 Jan vd Adel 13 (???) 14 Kees Zegelaar

1832



2024

History of the bridge and site

Exploring the history of the bridge and its surroundings, the Waal, a prominent water body at the site, emerged as a key narrative element to understand how the community has long interacted with this place. Formed naturally through dyke breaches centuries ago, the Waal served as a beloved recreational spot for generations. In winter, it transformed into a skating rink maintained by local volunteers, bringing the community together around seasonal rituals. Long before the bridge existed, the Waal embodied both a literal and symbolic sense of shared space and collective memory.

The construction of the bridge marked a turning point for the Waal and its role in the landscape. While it remained present, the water body was reduced in size and became less accessible. Despite these changes, children continued to play around its banks, keeping the spirit of the place alive. The bridge itself became a vital link in the region's infrastructure. Built in 1967 by Penn & Baudin in Dordrecht, and commissioned by Rijkswaterstaat, it was the first time Papendrecht was directly connected to the city of Dordrecht across the river. Its arrival was met with public celebration, including a large community parade. The improved connection paved the way for substantial urban development, by the end of the 1990s, Papendrecht had more than doubled in size.

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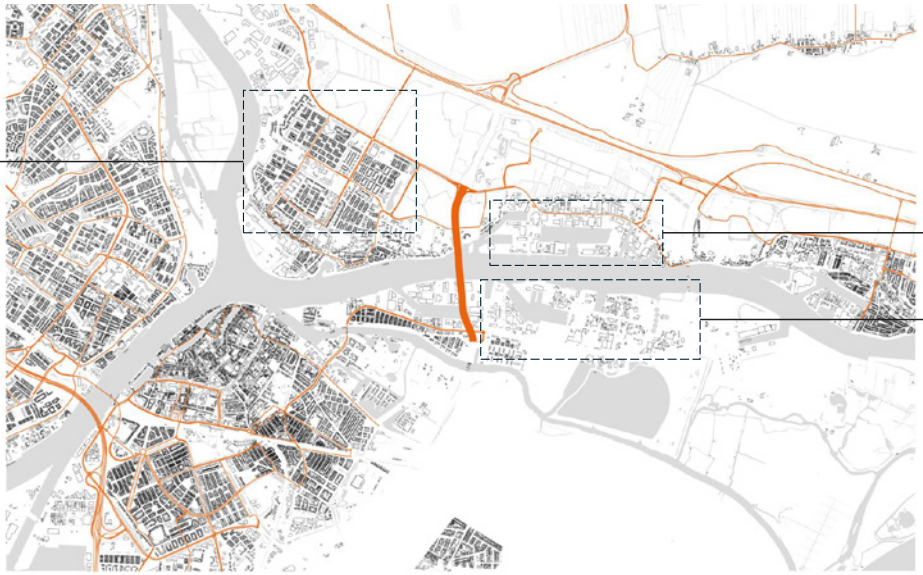
1960



1:25000

1970


'Expansion 2'
Papendrecht
Extension of N3
completed by 1993
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1990


'Expansion 3'
Papendrecht
Expansion Dubbeldam
Creation Stadspolders
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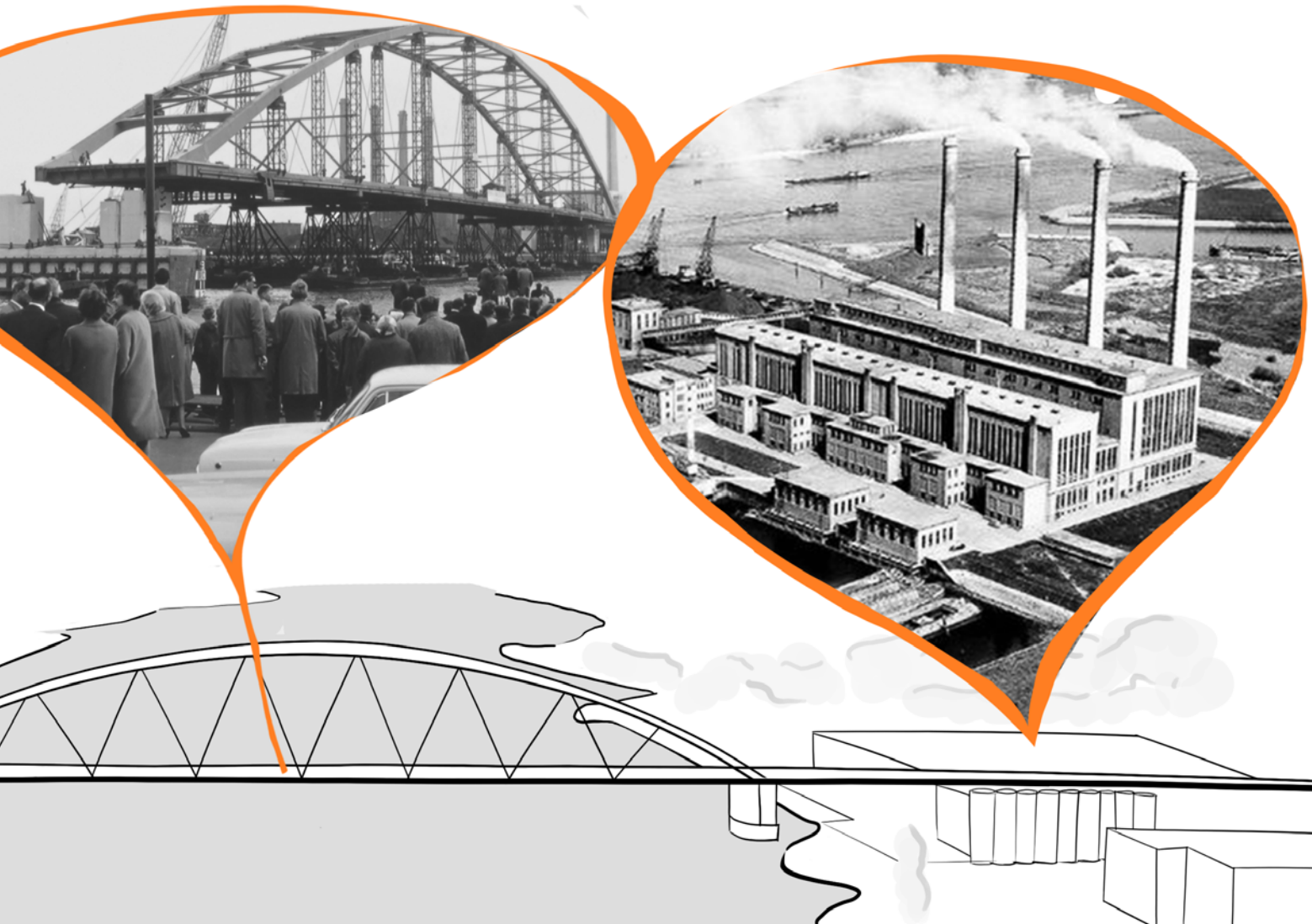
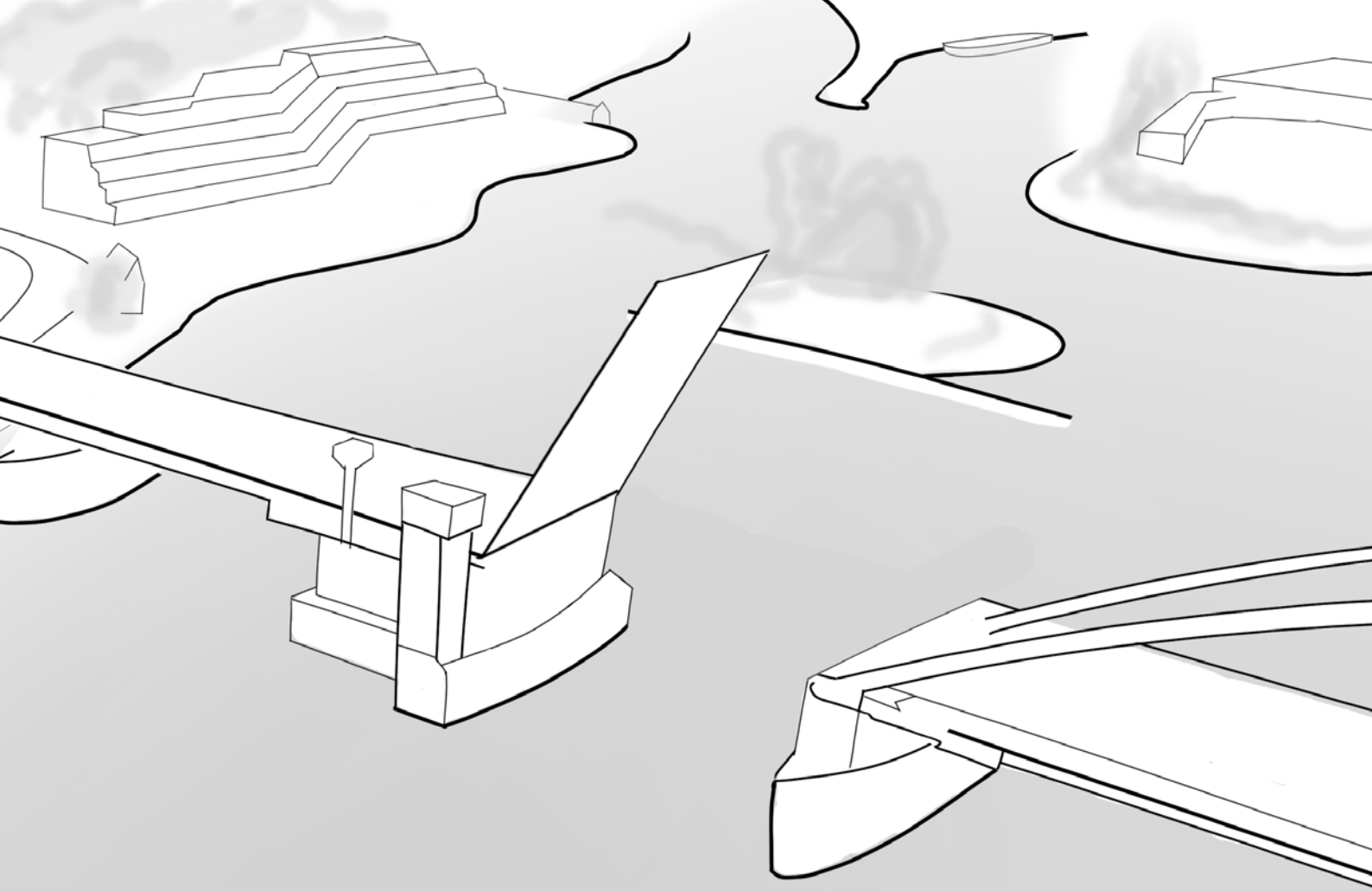
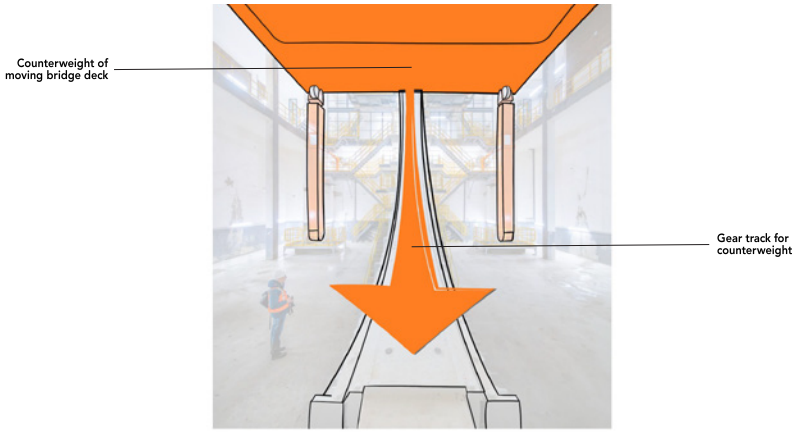
2023







The Architecture and Engineering of the Bridge

Originally completed in 1967, the bridge is part of a broader typology of post-war Dutch movable bridges, designed by ir. W.J. van der Eb with technical precision to accommodate both road traffic and inland waterway navigation. Its most notable engineering component is the bascule mechanism, housed in a large chamber partially submerged beneath the river surface. While once celebrated as a symbol of mechanical ingenuity, many of these bascule systems across the Netherlands are now reaching the end of their technical lifespan. Rijkswaterstaat is currently in the process of renovating these mechanisms nationwide, including those in the Papendrechtsebrug.

Despite the historic and technical value of the bascule chamber, conversations with Rijkswaterstaat made clear that this space offers no architectural potential for public reuse. On the contrary, the technical upgrades will likely demand more operational room, reducing any remaining spatial margins within the chamber. However, the architectural interest of the Papendrechtsebrug extends far beyond its moving parts. The bridge creates a unique spatial condition at its landings, where the four-lane highway meets the riverbanks. The underside of the structure reveals a rhythm of heavy concrete columns, repetitive bays, and long-span overhead beams. These spaces, often dismissed as residual, hold immense architectural potential. Over the years, a separate bicycle lane has been added to the bridge, increasing its functional diversity and reinforcing its role as a key connector in the regional mobility network.

Together, the engineering logic and infrastructural layering have produced an underside condition that is both monumental and strangely underutilized. It is precisely in these overlooked zones that a new architectural narrative can unfold. By engaging in dialogue with both Rijkswaterstaat and the local community, a clearer story of place began to take shape, one in which the transformation of the bridge's underside emerges as a meaningful intervention for both public use and institutional stewardship.

References & Acknowledgements

This book and design proposal were developed as part of an academic graduation project in Architecture at the TU Delft (2025). Several theories, methods, and references have informed the process and are briefly acknowledged below.

Theoretical References

• Kuipers, M., & De Jonge, W. (2017) – Value-based design and the value matrix. Used as a framework to evaluate the architectural, environmental, and historical values of the site.

• Brand, S. (1994) – How Buildings Learn: What Happens After They're Built. The concept of shearing layers has informed the modular and reversible approach to the architectural proposal.

Institutional Collaboration

• Rijkswaterstaat – Valuable insights and boundary conditions were gathered through an interview conducted during the research phase. Their perspective has helped frame the limits and potential of the existing infrastructure.

Architectural References

• Albert Heijn A8 Koog aan de Zaan – A case study in urban reuse of infrastructure, cited as inspiration for successful integration of public program underneath highway structures.

Project Context

The historical and spatial narrative surrounding the Papendrechtsebrug has been gathered through archival research, on-site analysis, and multiple informal conversations with local residents of Papendrecht. Their expertise, memories, and reflections were crucial in understanding the site's meaning.

Image Credits

All visuals in this publication are the author's own work, unless otherwise stated below:

- Page 55 – Kramer, 2003
- Page 65 – Beeldarchief Rijkswaterstaat, 1967
- Page 66
  - Beeldbank Oud Papendrecht, 1929
  - Beeldbank Oud Papendrecht, 1939
- Page 67 – van Blokland-Visser, 1832
- Page 68 – Regionale Beeldbank Dordrecht, 1967
- Page 69 – Regionale Beeldbank Dordrecht, 1968–1977
- Pages 72–73 – Own work, incorporating imagery from Regionale Beeldbank Dordrecht, n.d.
- Page 75 – Own work, incorporating image from Beeldarchief Rijkswaterstaat, n.d.

Text editing and revision assistance

ChatGPT, developed by OpenAI, used for language refinement and editorial support.

A bridge, a place, a destination.

This book documents a graduation project that reimagines the overlooked underside of the Papendrechtsebrug in the Netherlands, not as a leftover, but as a catalyst for community, ecology, and spatial renewal. With a focus on circular strategies, prefabrication, and social value, the design transforms the void beneath infrastructure into a meaningful public place. More than a project, it reflects a belief in honest, humble architecture that listens to its context and adapts to time. Through architectural drawings, research, and narrative, it invites readers into a vision for a built environment that's both ambitious and grounded.