

NEW URBAN FRONT



*“Public space belongs to all citizens.
Why should the river be an exception?”*

Rotterdam is a water city. It owes its very existence to the harbor that has put it on the map. Economically, the Rotterdam Mainport has become the driver of the Dutch economy for decades, while the mentality of its no-nonsense dockworkers and association with the iconic Maas river echo in the urban memory of its citizens. But with the catastrophic destruction of its city center during World War 2, the modernist reconstruction and subsequent migration of its harbor westward meant that the physical connection with water was lost. Water was not experienced as an urban quality behind the confines of Rotterdam’s dikes and industrial ports along the Maas, neither before nor after the bombing. However, by the end of the 20th century, the post-industrializing of its waterfront -the migration of its harbor out of the center- and the strengthened connection between north and south through the Erasmus bridge, caused the Maas river to suddenly be placed at the heart of the city both physically and symbolically. Rotterdam had gained a new urban front.

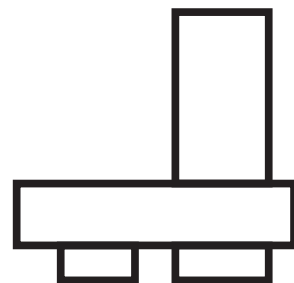
But when looking at the Maas river and its waterfront since the 90’s, one cannot escape the feeling that river and the city should be connected by much more than the nickname Maasstad. Rotterdam and the Maas river are intertwined socially and economically, but not enough urbanistically. The Maas, even today, mainly feels like a highway running through the city center. The waterfront, albeit with recent improvements, has in essence remained the same for the last 100 years: the only difference is there are no industrial functions anymore for which the quays were intended to in the first place.

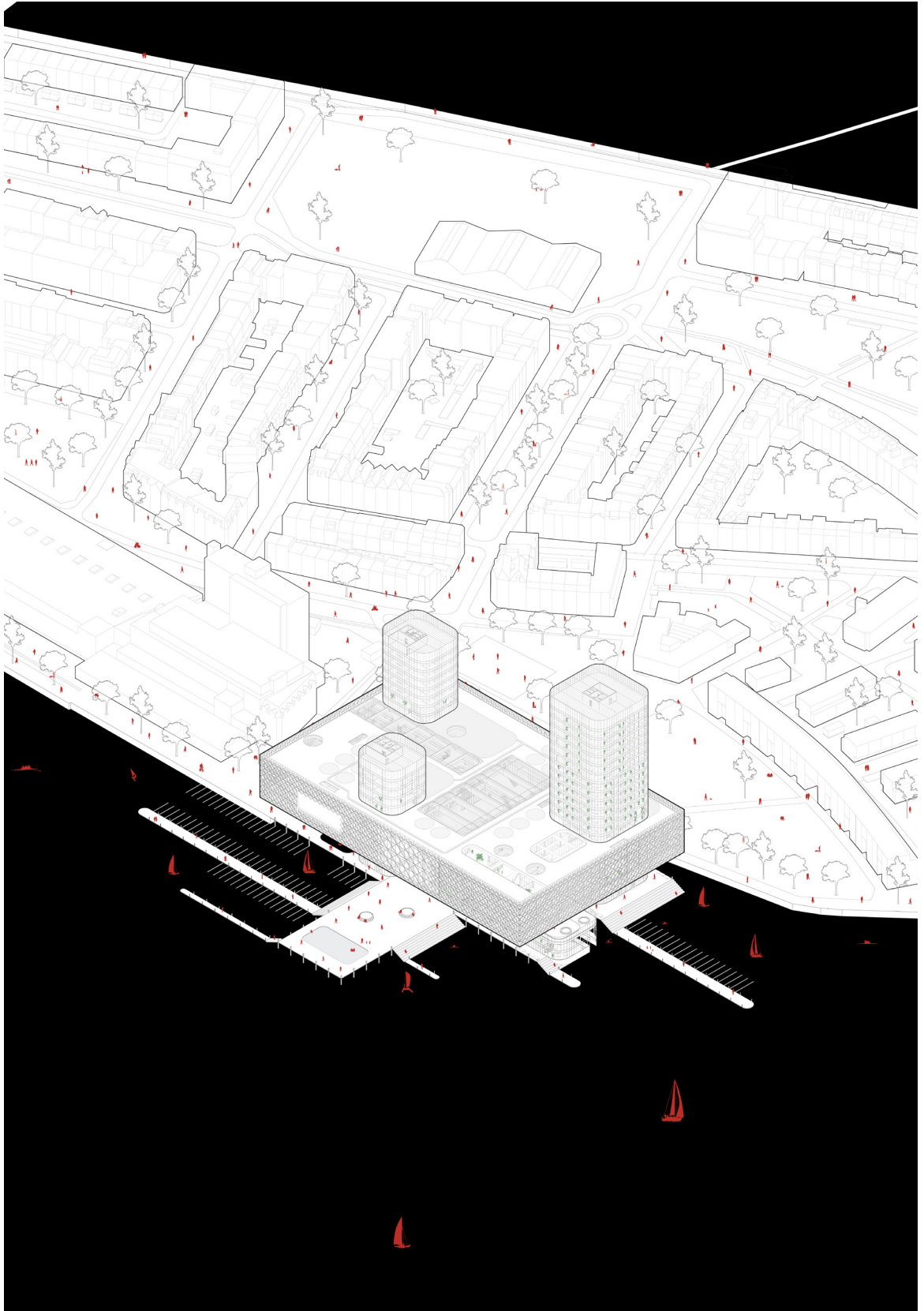
Why could the Maas not be so much more than a place of transit? Why can the Maas not become a permanent destination by itself? A go-to spot for all citizens, where people access and engage with the river just as easily as hopping on a bike or taking the metro? Why should the waterfront of today be the same as that of over 100 years ago?

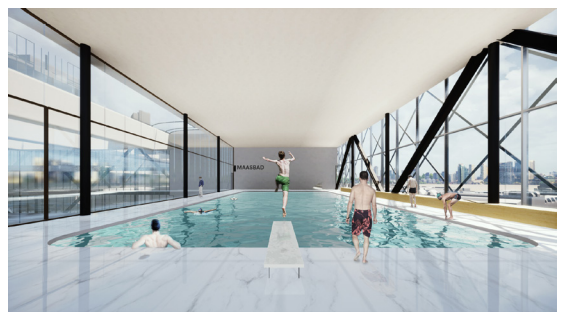
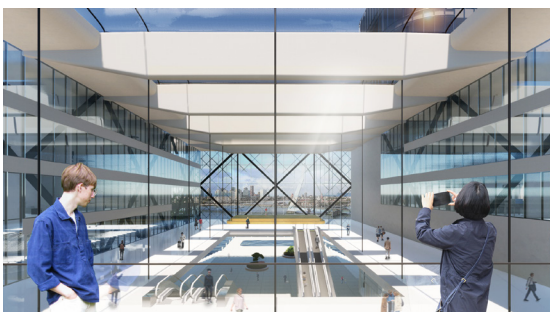
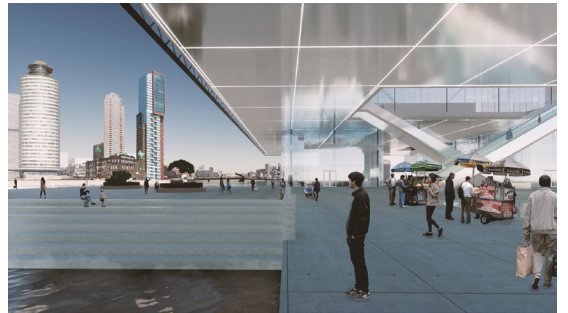
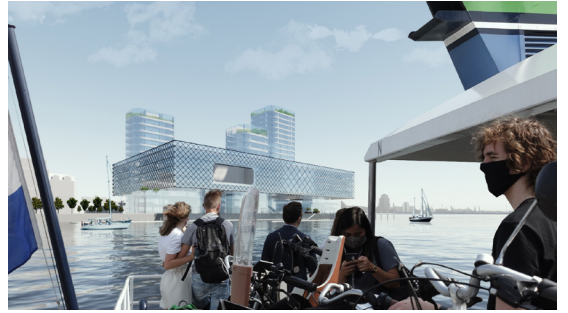
And why could waterfront architecture not add to the quality of the city through urban function, rather than merely fill the pockets of developers with valuable real estate? And could architecture perform to make water the central stage of the city?

That is why New Urban Front explores the research question of “how waterfront densification can contribute to interiorizing the Maas river in the center of Rotterdam?” Proposing a new typology for the main waterfront of Rotterdam, New Urban Front advocates for the loading of urban program to the shores of the river Maas.

The programmatic link between water and architecture that was lost as the industrial functions moved away, is thereby restored. This is done at the historical crossing of the Maas river, linking the Veerhaven to the Linker Veeroever at Katendrecht. This location not only restores a historic axis that ran through the city center from central station to the south, but also sits at the entry point of the Veerhaven harbor that will be densified and transformed in the coming years. The location by such also acts as a ‘lighthouse’ at the entrance to one of the many developing inner harbor areas, emphasizing that not only inner harbors need to be densified, but also the main waterfront of the city. Symbolically opposite Hotel New York, where transatlantic journeys once happened, the site symbolizes a new journey for the waterfront of Rotterdam.







Research Summary

Globally, water and cities have had a mutual relationship since their founding. The invention of agriculture caused the widespread migration of permanent settlements across the globe, which in turn gave rise to technological developments related to water management: from the first waterworks of the Sumerians to the advanced irrigation techniques of today, our sedentary lifestyle has been made possible through our management of water.

But the relation between water and cities is not only an agricultural one: mobility has played a key role in the rise and decline of cities throughout our urban history. Waterways, which provided a vital lifeline to the outside world, were of critical importance for economic development and migration of people and ideas.

It is therefore no wonder that even today, global powerhouse cities in terms of economy and population are mainly waterfront cities. Of the 50 highest GDP and 50 most populous cities, over 75% have a form of physical waterfront, be it a river, lake, or ocean. And although this percentage is expected to decrease due to the growth of non-waterfront areas globally, global waterfront populations will only increase by the year 2100. In fact, water will remain the biggest threat to economies and human lives: over 2 billion people will have to migrate this century due to drought, flooding, and lack of water, while the expected economic damage will be over \$36.8 billion. The issue of waterfronts will therefore remain at the forefront of our urban development for years to come.

However, not only developed global powerhouses are at waterfronts: less developed cities around our world are founded along water. It is possible to discern three main typologies of waterfront cities: unplanned, industrial, and post-industrial ones. Within the scope of this thesis, the focus will be on post-industrial waterfronts, which is a common typology throughout especially western Europe.

Dutch cities form an interesting case within the scope of this typological framework. With their unique approach to water, Dutch cities can be classified with their own set of waterfront typologies. While some cities lie protected behind their dikes, Dutch urban waterfronts also include canal-cities and cities with riverfronts. The function of such waterfronts used to be very clear: protect from water and enemies (dikes) and allow for trade and industrial activity (canals and riverfronts). Today, this functional division is overarched by the generic need for leisure: all Dutch waterfronts have become an inherent leisure space, an attraction in themselves.

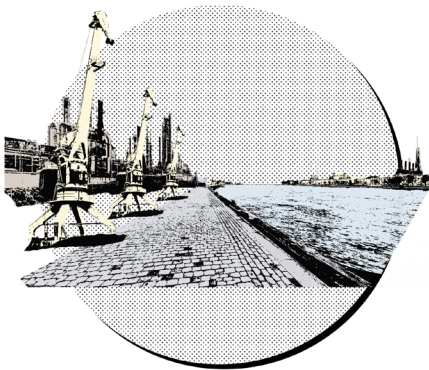
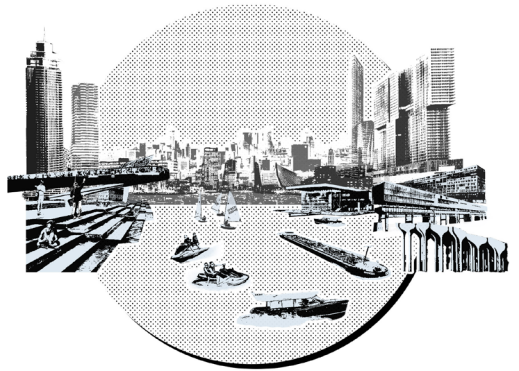

These Dutch waterfronts, whether in original function or not, are shaped by technological developments. This understanding formed the base of the seminar research titled 'Migration of Technologies: Impacting Waterfront Cities'. This paper investigated the impact technological migration had on the built environment of waterfront cities Rotterdam, New York, and Macau. One of the conclusions on Rotterdam was on how connected technological and socio-economic developments were to the built environment of the city. The invention of steam power and subsequent heavy machinery, or the industrialization of the Ruhr area in Germany: just a few examples of technological and socio-economic developments that have decided the waterfront of Rotterdam today.

In short, Rotterdam is not only a water city, but a man-made and technical water city. And this is also immediately visible in the waterfront of Rotterdam: the technical and man-made are everywhere. Dikes, locks, pumping stations, groins and quays shape the waterfront, while any piece of nature is no more than masquerade: carefully man-made to look natural, reducing flood risks and restoring natural biotopes as a by-product.

ROTTERDAM
■■■■■
■■■■■
WATER CITY

**RIVER
SHORE
PROGRAM**

**RIVER
SHORE
PROGRAM**



This technical waterfront also extends far beyond the boundaries of Rotterdam. As the center of a larger regional water network, the city center of Rotterdam lies at the intersection between its expansive harbor to the west and picturesque World Heritage sites such as Kinderdijk and historically important cities such as Dordrecht. Within a radius of 60 minutes by Waterbus, Rotterdam yields a wide water-based experience from the rural to the industrial and post-industrial. The water-based connectivity only reinforces Rotterdam's mainport character.

Upon transiting from the rural to Rotterdam, the waterfront itself is on a journey too. The secondary arteries of the IJssel, Lek, Schie and Rotte rivers are green waterfronts, with dikes and shallows caused by the many groins that keep shipping possible there. The many small beaches and shallow waters are ideal places to swim in summer, while more leisure boats can be spotted than transport ships. When the weather is good, they are Rotterdam's secret Spanish Riviera.

These secondary arteries connect to primary ones such as the Noord, Oude Maas and Beneden Merwede, which have a mixed character. Patches of green waterfronts are mixed with hard, industrial settings such as at the Stormpolder or Alblasserdam. Transport shipping is more prevalent, and leisure activities can only be spotted in small and protected patches. Architecture also starts to play a role here as well: highway bridges, industrial halls and dockyards are interrupted by low-rise dwellings along the waterfront forming a patchwork waterfront.

However, as the many arteries merge into the Nieuwe Maas just outside Rotterdam, the gravity of its high-rise city center starts to take over. Seen from afar, the high-rises act as a beacon or lighthouse, the modern church needle in the medieval landscape. Upon crossing the Brienenoordbrug, a mental and physical barrier is crossed. This sector of the river, 'Maasbruggen', is the first sector where the Port of Rotterdam requires ships to communicate through VTS (Vessel Traffic Services). Leisure boating is nearly non-

existent, although small green patches around Feyenoord and De Esch still allow for people to use the waterfront's beaches and swim. This is mostly illegal: swimming is not allowed in traffic zones, in canals, close to docks, in harbors, along routes of ferries and close to bridges and locks. It is not difficult to guess that practically everywhere starting from the Brienenoord bridge westward is forbidden terrain. This yields an interesting conundrum: as we get closer to the population center, the water becomes less accessible.

Similarly, as we get closer to the city center of Rotterdam, the waterfront also changes from a green or industrial to a post-industrial waterfront. Gone are the green embankments or busy quays of industrial wharfs: they are replaced by miles and miles upon quays and embankments whose only purpose seems to be to give a nice place to walk along and park your car. Most of Rotterdam's post-industrial waterfront is for all mobility except ships.

Upon moving deeper into the city, the open and horizontal scale that was experienced in the periphery is replaced by an ever-increasing densification and verticality. Not just the quays have gotten higher: so are the buildings. And this verticalization culminates at the final stop of the Waterbus right in front of De Rotterdam, the most massive building in, well, Rotterdam. This building is the metaphor of Rotterdam's waterfront in general: impressive, grand in scale, but otherwise completely unrelated to the river. It is only when one would sail westward to the harbors that one truly understands that Rotterdam is the maritime capital of Europe.

Part of the shortcomings of the waterfront of Rotterdam are being addressed in the many planning documents that the municipality has set up relating to the Maas. In typical Dutch fashion however, there seems to be mainly decentralization of its planning: there are over fifteen different official documents related to Maas river, while the river itself is governed by a complex network of national and supra-national instances. In addition, large parts of the waterfront are also part of other planning developments in the city:

the high-rise vision for the city center, the redevelopment of Rotterdam South, the transformation of various old ports such as the M4H area and Feijenoord, to name a few. The Maas river's development process can therefore be labeled as ambiguous at best, with a complex set of actors and processes acting simultaneously -and sometimes in opposite directions.

The fruits of municipal measures to improve the waterfront can already be seen in the city center today. In the past decade, the waterfront has been activated through many interventions that emphasize its green and public character and increase its spatial quality. Additionally, the Maas has increasingly become a destination by itself: today, it is the second biggest attraction of The Netherlands with over 3 million annual visitors. Waterfront events, the most notable being the world harbor days and the annual fireworks at the Erasmus bridge, emphasize the public importance of the Maas. Notable is the temporal character of these public events: the Maas' 'publicness' is never permanent, only occasional. The Maas today is still mainly a highway through the center that is closed off to traffic on special occasions.

However, when looking more closely at the plans and executed designs for the waterfront of Rotterdam, there seems to be one essential aspect missing: the architecture. In fact, the waterfront vision is a blatant example of a broken relationship between urban design and architecture. The urban plan has, in essence, focused mainly on the space between property lines and the water edge. The qualities that the public spaces and Maas river should have are in no way reinforced or reflected in a vision for the architectural design of the waterfront. Whatever happens behind the property line can be of no relation to the water at all, nor have the desired representative character or scale for being along the waterfront.

Design Brief

New Urban Front therefore focused on bringing back the programmatic relation between architecture and water in the city center. Moving the water taxi, which is expected to double its passenger rates in the coming 10 years, and adding a waterbus stop will bring back transport-related functions and a 'base level of activity' at the water. A public 'boat-in cinema' and stage will allow for performances and public events to be hosted along the waterfront and viewed from close and across the Maas. Inside, cultural program with multifunctional and flexible halls will ensure adequate event spaces indoors. Public pools, both outdoor and indoor, a marina with a focus on shared boating and multiple water-related landscape features will finally reinforce the relation between water and architecture.

This 'attractive' function along the waterfront is paired with densification to increase liveliness and provide for the financial means to justify the project. A large hotel, offices, workshops, commercial and residential program is paired to densify the waterfront into a fitting lively part of the city center.

Design Implementation

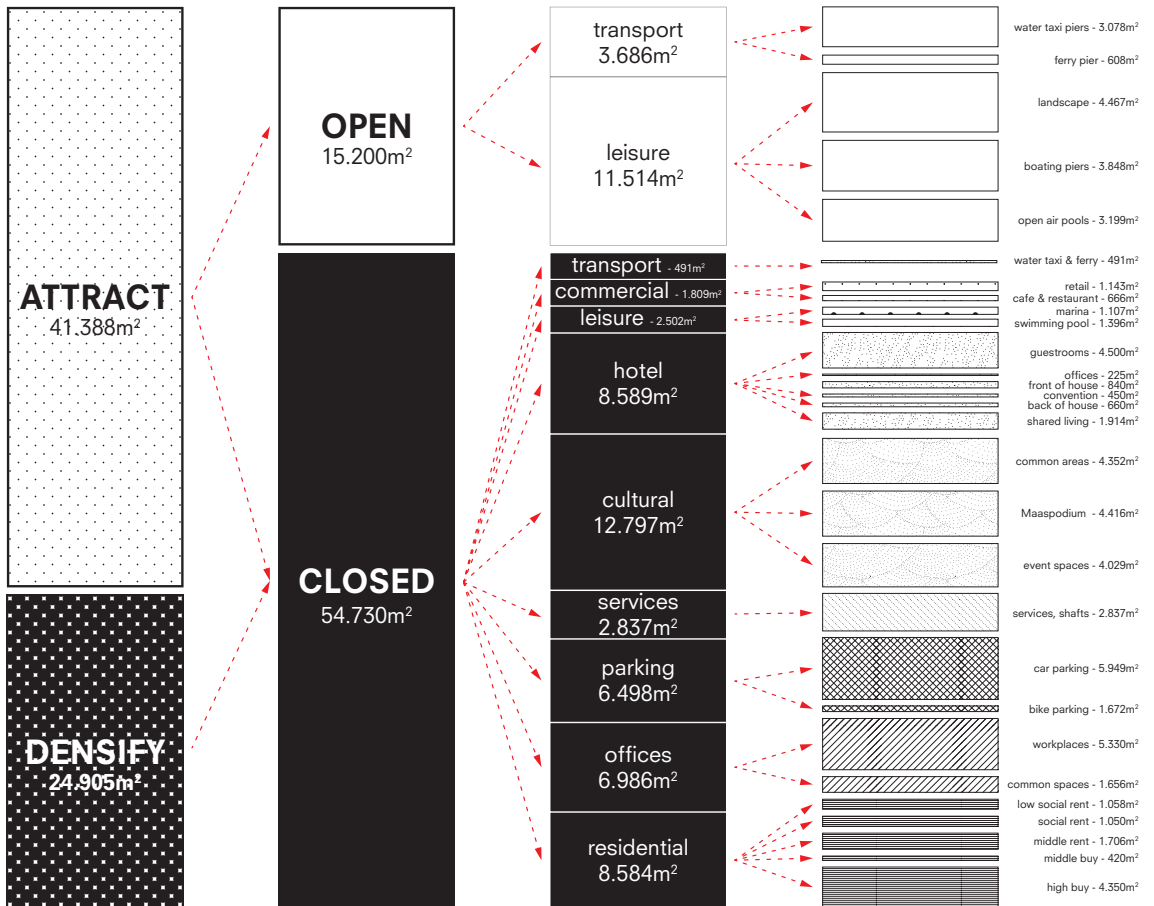
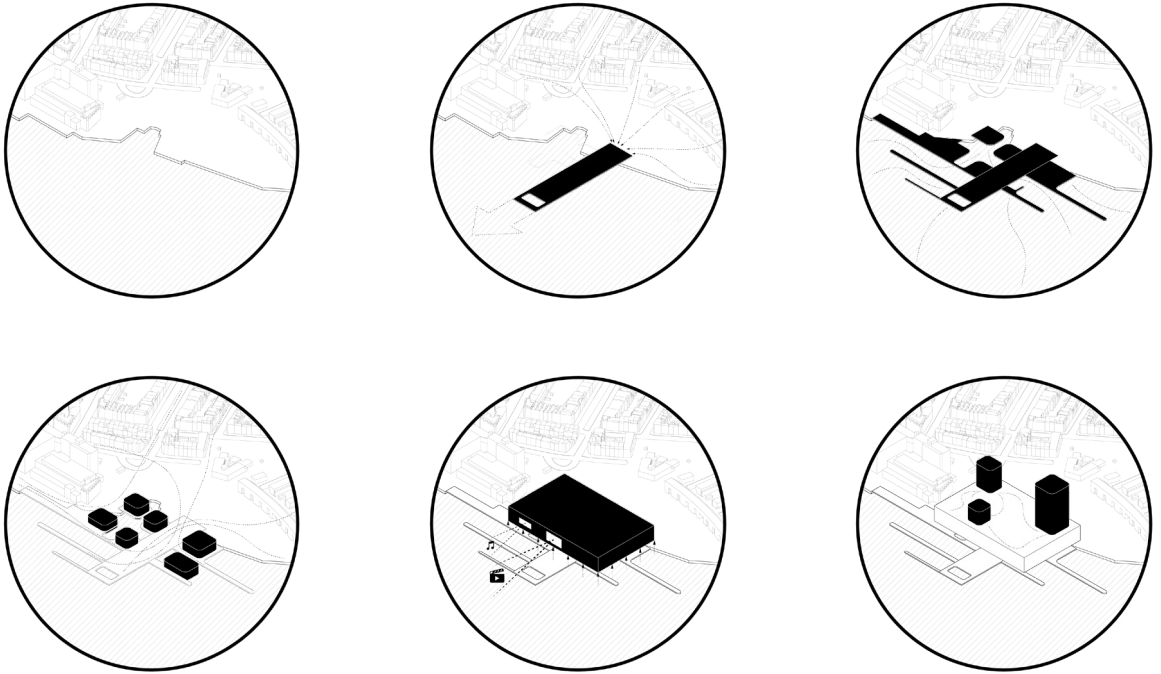
The program comes together in an 'oil rig' massing that combines a sectional base and high-rise towers with a floating, horizontal urban plinth that acts as an urban attractor. The sectional base with its smaller, fragmented volumes allows for maximum surface area to the water, while some of the volumes continue vertically to form towers that -through their varied height- mark the transition from the high-rise zone in Rotterdam to the medium-rise Katendrecht neighborhood. Bridging the height between its surroundings and Kop van Zuid, the design also follows a logical sequence of building volumes that greet incoming ships into Rotterdam from the harbor and North Sea.

A central "red carpet" public pier extends towards the Erasmus bridge with an open-air pool at its end. Smaller piers flank this main axis with commercial functions and offices, alongside the entrances to higher levels.

The volumes at ground floor have rounded corners that not only respond to literally standing on water, but also reduce wind disturbance and give the overall ground floor a more fluid and dynamic spatial experience. This is reinforced by the reflective glazing of the structurally glazed curtain walls and mirror-clad ceiling -the fifth façade at the bottom of the raised plinth. This ceiling follows the structural grid of 8.40x8.40m, with lights following the main gridlines allowing for various degrees of illumination as required.

This raised plinth houses the cultural and hotel program and is accessed through a pair of escalators paired in a semi-enclosed cocoon clad in mirrors. Rather than being an enclosed experience, the open character of the escalators reinforces the public character of the spaces it tries to connect. Taking the escalators, one is greeted above with views over the Erasmus bridge and south of Rotterdam in a raised urban plaza with public pool and spa center. This multifunctional space acts as an elevated stoa, allowing for events to be held within a semi-enclosed public space: the more enclosed version of the experience below, which is that of a semi-open stoa under the raised plinth. Towards the south, the public plaza gets elevated in two steps, forming a public terrace and culminating in a swimming pool that has an incredible view over Katendrecht and the harbor of Rotterdam.

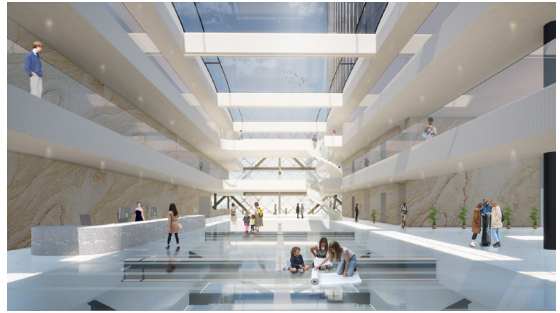
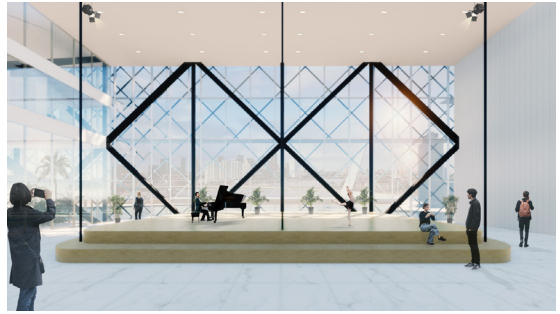
Intersecting this north-south oriented public plaza is a longitudinal axis within the raised plinth that connects the cultural center to the hotel. This axis generates a visual connection between the two spaces horizontally, while two large voids at the ends of this axis create the vertical relation between the ground and raised functions. In the hotel, this void acts as a large wind-shielded but open terrace, while in the cultural center it manifests itself as a dramatic glass floor at the center of the foyer.

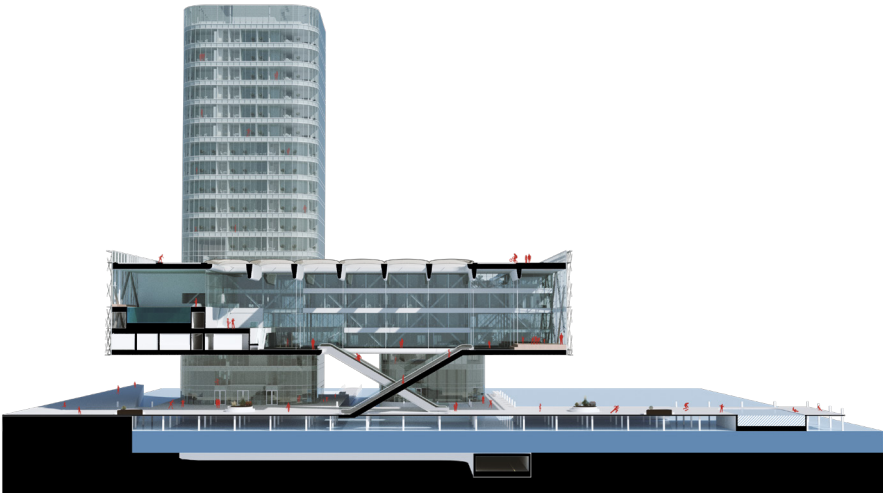


The roof of this raised plinth forms a new communal ground plane of activities for the towers above. This communal space with excellent views over Rotterdam enables residents and office workers alike to enjoy their respective parts on top of the city, allowing for gatherings, a walk during lunchtime or urban farming. Acting as a shortcut between the towers, this communal rooftop is another layer of densification that is added on top of the ground floor and public plaza level: the single-layered waterfront is transformed to a multi-layered one.

The towers themselves house a variety of residential options and generic offices. All towers are topped by communal greenhouses that contain hydroponics (vertical farming) units to increase food production in the city center and reduce food mileage. The greenhouses are also an integrated part of the climate strategy however: the exhaust air with high CO₂ levels is ideal for plants to thrive, while the heat of the greenhouses is paired with a seasonal ice buffer to heat the indoor pool. In winter, the generated ice is used to convert the outdoor pool at ground level into a public ice-skating rink: experience with water can also be in its solid form.

The façade surrounding the plinth is designed parametrically and covered in PV panels that are cut to size in one direction and encased in a rectangular aluminum frame. The shading percentage of this fixed shading is designed to range from 9% to 21% by the varying width of the solar panels. The total façade is then parametrically graded to increase the closed percentage at the south, east, and west facades. At four spots this solar-based gradient is punctured by additional openness: at the location where the two public axes in the raised plinth meet the façade, the thickness of the solar panels is reduced to allow for a clearer view outside. In the case of the main north-south public axis, there is even a change in the underlying grid size to become more open. This gradient therefore becomes a manifestation of program, views out and solar optimization on the façade.





Building Technology

For the towers, a more transparent approach is selected. The masses below the plinth enjoy clear glazing, but also high amounts of shading by the raised plinth. Ideal for the often cooling-driven office and commercial program. The towers above continue the same transparent look but contain a multi-layered shading approach to keep the sun out. The glazing has a lower SHGC, while most of the residences have indoor balconies that act as a buffer space to the temperature and noise outside. Indoor operable shades block the rays of the sun, while parallel-opening windows allow for minimal openings to ventilate the houses naturally.

Heating and cooling is provided through a centralized water-source heat pump that uses the Maas as a heat sink. This was, all-year high COP's are guaranteed. This heat and cool is provided to both floor heating and cooling, as well as climate ceilings. For the public program, additionally the air itself can be post-heated or cooled. By integrating electrically operable parallel-opening windows in all parts of the building, natural ventilation can be integrated into the mechanical systems' operation. The system will therefore prioritize passive methods such as shading and natural ventilation through its mechanically operated windows and roof openings. CO₂ and temperature-control means that mechanical systems only kick in when necessary.

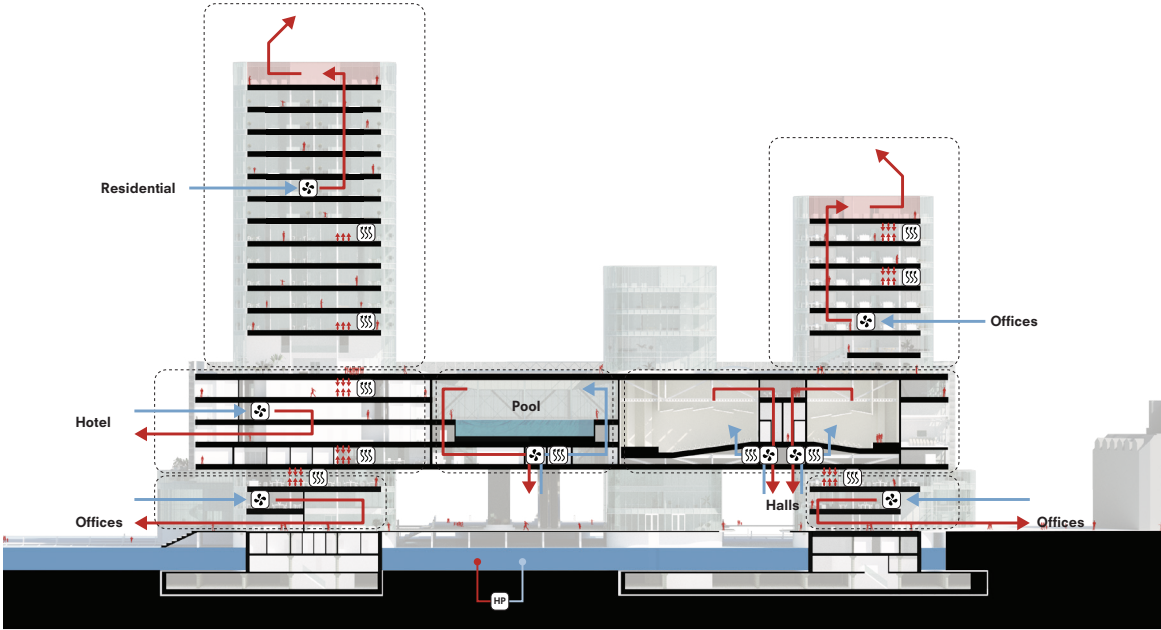
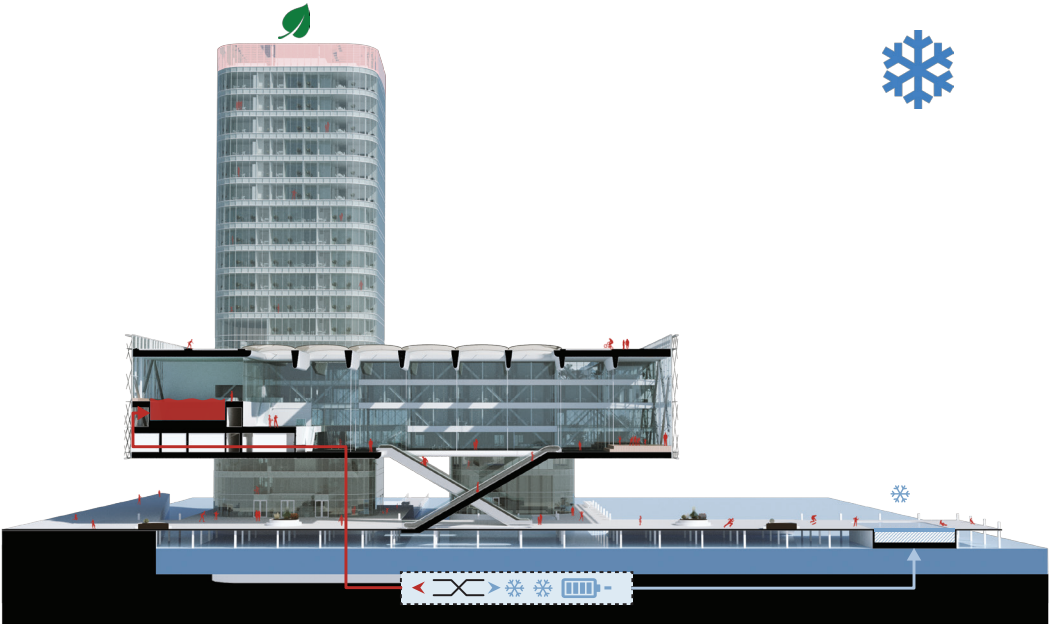
The façade and the interior materialization focus on industrial construction methods and lightness. The structural system consists of a steel braced frame system, while the floors are built from CLT slabs. The floor buildup is fully dry and demountable, including clickable natural stone tiles and carpet tiles that are used in the public areas of the design. The underlying layers of gypsum fiber panels and rockwool contain floor heating and cooling, which is also mounted in a dry manner and is therefore both easily accessible for maintenance as well as reuse.

Similarly, the façade of all parts of the design consists of aluminum unitized curtain walls

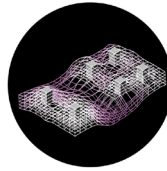
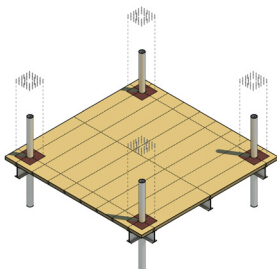
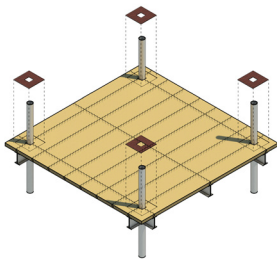
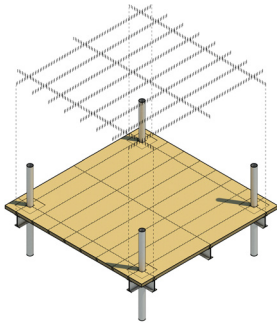
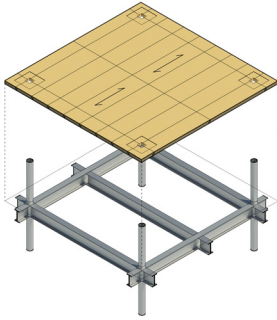
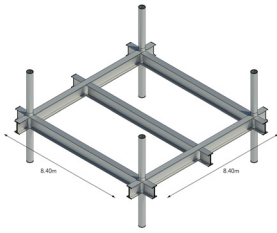
that can be mounted with high speed and are prefabricated. The parallel-opening windows are integrated into these elements, which have external mullion caps at the raised plinth and are structurally glazed at the other building volumes for a clearer look. All parts are triple glazed for maximum thermal performance. In the case of the raised plinth, the unitized façade also carries catwalks and the diamond-shaped PV shading using carbon fiber reinforced brackets that protrude from the elements. The catwalks allow for easy access to the PV systems as well as the glazing for maintenance or cleaning, reducing operating costs considerably.

Conclusion

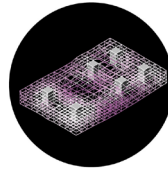
When combined, New Urban Front is a new typology for the waterfront of Rotterdam. Essentially an anti-typology, New Urban Front cuts transversally across various typologies that currently dominate the waterfront. It is not a tower, yet it has a profound verticality. It is not a horizontal 'groundscraper', yet its footprint is massive by merit of its raised plinth. It is a distinctly singular composition, yet the fragmented base and towers make it feel as part of a bigger complex. Density is very high, yet the various levels in the design create distinct public and private spaces. In essence, that is what the waterfront of Rotterdam requires: layers of urban density that create a transversal typology for the New Urban Front of Rotterdam.



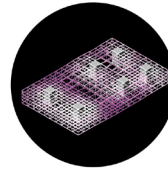
Mech. vent. (heat rec., CO₂) HP Heat pump (Maas) Heating



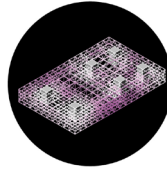
-1227mm
Vierendeel



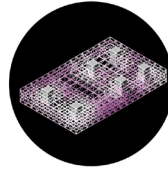
-371mm
Facade Truss



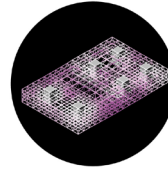
-308mm
Plaza Reinforcement



-187mm
Facade Reinforcement



-111mm
Cores + Braced Frame



-59mm
Cores + Braced Frame

