ROTTERDAM IS A WATER CITY...
current waterbus line map

various artificial ports towards the sea
MERWEHAVEN IS TRANSFORMING...
300,000 NEW FLOOR AREA
5,500 NEW DWELLERS...
Our strategy for urban renovation is through two ways, one from land part connect to the cities, another from river part connect to other renovation ports.
Our strategy for urban renovation is through two ways, one from land part connect to the cities, another from river part connect to other renovation ports.
THE POSSIBILITY AND NECESSITY OF A NEW FERRY STATION...
peak time: max 1040p/h
annual app. 300,000 p/y

Merwehaven ---- New Pier

New Pier ---- Merwehaven ---- RDM:
once half an hour during peak times;
daily 26 times in both directions from 7am to 22 pm;
on weekends 15 times daily;
(26*5+15*2)*2=320 times/w;
max 130p*320=41600p/w.

New Pier ---- Merwehaven ---- Erasmusbrug:

once half an hour during peak times;
daily 26 times in both directions from 7am to 22 pm;
on weekends 15 times daily;
(26*5+15*2)*2=320 times/w;
max 130p*320=41600p/w.
New Pier 1 ---- Merwehaven ---- RDM:
once half an hour during peak times;
daily 26 times in both directions from 7am to 22 pm;
on weekends 15 times daily;
\((26*5+15*2)*2=320 \text{ times/w};\)
max 130p*320=41600p/w.

New Pier 2 ---- Merwehaven ---- Erasmusbrug:
once half an hour during peak times;
daily 26 times in both directions from 7am to 22 pm;
on weekends 15 times daily;
\((26*5+15*2)*2=320 \text{ times/w};\)
max 130p*320=41600p/w.

peak time: max 1040p/h
annual app. 300,000 p/y
peak time: max 1040p/h
annual app. 300,000 p/y

Merwehaven ---- New Pier 1
Merwehaven ---- New Pier 2
Merwehaven ---- RDM
Merwehaven ---- Erasmusbrug

New Pier 1 ---- Merwehaven ---- RDM:
- once half an hour during peak times;
- daily 26 times in both directions from 7am to 22 pm;
- on weekends 15 times daily;
- \((26\times5+15\times2)\times2=320\) times/w;
- max 130p\times320=41600p/w.

New Pier 2 ---- Merwehaven ---- Erasmusbrug:
- once half an hour during peak times;
- daily 26 times in both directions from 7am to 22 pm;
- on weekends 15 times daily;
- \((26\times5+15\times2)\times2=320\) times/w;
- max 130p\times320=41600p/w.
A STATION COULD BE...
CONCEPT

i ferry islands at the middle of the water, serving balanced for both of the banks;

ii enough space for waterbuses to get into Merwehaven;

iii a bridge to connect both banks so the whole urban area could be integrated;

iv a flexible bridge capable of letting larger ships go through;

v saving land space;

vi new programme integrated with the ferry station;

vii commercial income for operating the station.
PRESETS
<table>
<thead>
<tr>
<th>Type</th>
<th>Floor Area</th>
<th>Percentage</th>
<th>Agents Number</th>
<th>Separation in Group</th>
<th>Separation with Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>225,500</td>
<td>25.1%</td>
<td>19</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Office</td>
<td>109,500</td>
<td>35.9%</td>
<td>27</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>Commercial</td>
<td>101,900</td>
<td>12.1%</td>
<td>9</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Education</td>
<td>12,000</td>
<td>17.4%</td>
<td>13</td>
<td>200</td>
<td>80</td>
</tr>
</tbody>
</table>

Total: \( \frac{1,098,354\text{m}^2}{120\text{m} \times 120\text{m}} = \text{app.75 agents} \)
offset block boundaries
two basic typologies for building plans according to scales
flow shapes
block height gradual change according to distance from borders
genome = floor area of buildings in each block

fitness = total floor areas
A NEW URBAN PERSPECTIVE...
RESTRICTIONS
ferry line factors:

- a (off bank distance) = 5m (min)
- b (ferry line width) = 10m (min)
- c (boat distance) = 10m (min)
- r (turning radius) = 4 * 28m = app. 120m (min)

boat moving behaviors:

- M1: turning
- M2: rear turning
- M3: literal shifting (manual)
Station Erasmusbrug

1. floating pier/platform
2. waiting hall
3. anchoring space
4. connecting ramp
5. bank

Plan:
- A 5.4m
- B 3.6m
- C 33m
- a +3.0m
- b +1.5m
- c +0.0m
- d -1.0m

Longitudinal section:
ZONING RESTRICTIONS...

largest possible inland cargo ships  width: 9m  usage: construction materials/ cargos
water depth = 12m

branch-like structure rooted below water

floating platform and fixed islands

ship almost the same size as water space in Panama Canal

current floating platform example

height for ship passage
basic branch connection topology

programme agents exploding points selected in point cloud

programme agents forming the basic floor plates

new connections also serving as structures

i  a clear relationship between floor plates and connections

ii  a main connecting topology reaching urban targets on both banks

iii  clearer and shorter public paths

iv  less connections

v  structural potential
branch starting points

branch growing towards central part

branches meeting in both ends of the bridge

generated branch
trail curves simulated by processing

connection curves lifted by waterways

3D point grid

optimal points according to distance from the connection topology
optimal points according to platform position

context > level > distance from banks > connection topology > wind flow

exploding points for agents

optimal points according to wind analysis

surrounding programmes

recursively selected exploding position for each programme
I = platform island  S = station  C = commercial  O = office  E = students’ activity  1a = 50 square metres
processing simulation (normal commercial being with each programmes)

simulation result exported to grasshopper

floor plates generated by metaball
Dijkstra Algorithm
(shortest walk)
people group in different starting points

commuters, 80% to S 20% to C
ordinary, 80% to C 20% to E
students, 40% to S 20% to C 40% to E
ferry officials, 80% to O 20% to S
connection the centroid of each plate with branch knots and structural points

optimize the topology with shortest walk system

optimize the topology with minimal path algorithm

connection volume generated with widths according to usage
COMPUTATIONAL TOPOLOGY
BASIC VERTICAL SUPPORTINGS
PUT TOGETHER... DECONSTRUCTIVISM?
INNER SKIN LAYER
INSIDE-OUT...
urban plan
site plan reduced from 1:1000
1 ferry platform

plan 0m reduced from 1:200
1 ferry platform
2 commercial
3 waiting
4 station hall

plan +4m reduced from 1:200

5 information
6 tickets
<table>
<thead>
<tr>
<th>7 cafe &amp; fast food</th>
<th>11 multi-func room</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 rest</td>
<td>12 police</td>
</tr>
<tr>
<td>9 togo commercial</td>
<td>13 office</td>
</tr>
<tr>
<td>10 VIP</td>
<td>14 meeting room</td>
</tr>
</tbody>
</table>

plan +7m reduced from 1:200
15 restaurant
16 study room
17 exhibition

plan +12m reduced from 1:200
linear passages and indoors

open indoor spaces

outdoor spaces
section a-a reduced from 1:200

1 commercial
2 togo commercial
3 waiting

4 station hall
5 study room
6 restaurant
7 kitchen

section b-b reduced from 1:200
section c-c reduced from 1:200
7 VIP
8 exhibition
9 control

section d-d reduced from 1:200
south facade reduced from 1:200

north facade reduced from 1:200
east facade reduced from 1:200

west facade reduced from 1:200
NETWORK...
original skin before subdivision
solar radiation analysis on preferred parts
attraction parts for big openings
URBAN COMPLEX IN 21st CENTURY...
basic triangulate grid structure
connection components for skin
strengthened structure on connections
bridge triangulate structure with vertical support
vertical supports with more densed truss, concrete down below
Karamba calculated weak segments of structure, possible for strengthening.

Volume optimized for skin subdivision.
PRINTING SIMULATION WITH SUPPORTMENT MATERIAL
The Hyperbody graduation studio is set to be an endeavor to integrate research with the final design product. The “computational” nature of the whole process serves as both an opportunity and challenge to develop a design methodology out of analyzing the complexity of current social and climatic context and using these presets as “intrigues” to drive the form-finding process, as well as the performance of the project.

This personal project is located in a somehow “extreme” situation: the fact that the surrounding urban context will no longer be existed provides a tricky setup for context research. Moreover, the multi-functional requirements, especially the restricted ones regarding ferry operation, are in the other way around of significant research importance. Consequently, the research process focuses on “creating” an urban context and “illustrating” the inner programme relationship. Computational tools are in crucial status at this stage. It is fair to say this project, at research level, indicates what the Hyperbody graduation studio is searching for in the sense of producing a research outcome to guide the afterwards design, in both urban and architectural level.

Under the main computational methodology frame of the studio, if one would name the “relationship” of personal approach and the studio outline, it is dominant that how one should choose and apply a set of certain computational approach, limiting the programme plates to be only connected by a simple branch typology instead of an uncontrolled connecting system, without losing the initial concept of integrating programme volume with connection, in purpose of constructing an urban network of digital age. So rather than vaguely naming it “relationship”, it is more precise to say that one should be aware of the “limitation” along with the “possibility” within the computational methodology sets in the research process. In other words, out of the sea of computational strategy, one should always be clear of how certain strategies could serve the ultimate architectural goal.

The other reflection is how top-down decisions will affect after the bottom-up computational process. There will always be boundaries when computational outcomes meet real architecture. So at certain stage of the design procedures, specifically after the computational topology is achieved, one needs to make top-down decisions to form the exact space quality. In this project, the computational topology is somehow separated from each other: free-form floor plates, connecting ramps, vertical supports and traffic cores. If the author simply followed this topology without any top-down architectural preference, this project would become a rather unclear pile of individual elements. Regarding the design purpose again, the author takes the top-down approach to integrate all these elements into a continuous form, thus creating an “inside-out” space quality of the whole project, in response to the original concept of programmes as connections. The distinctions of building elements in traditional modernism is retarded by the space continuity, meanwhile without losing the unique characteristics of each segment, which is achieved by previous computational topology. By this approach, the complexity of construction details is also lowered, reflecting Kas Oosterhuis’ quote of “one building, one detail”. This top-down decision serves as a crucial stakeholder for transforming computational language to architectural language, as well as providing an opportunity to revise some parts in the computational topology to put more control onto the architectural design.

Nevertheless, after the top-down modeling process, the computational research tools are once again implemented, but in a more practical level. The structure and skin could be an architectural logic, taking the advantage of computational methodology. Especially for openings in the façade, the computational system could make them follow the inside logic of the digital form, as well as indicating one of the studio’s theme of “climatic ecologies” by controlling the opening sizes according to solar radiation analysis. One could figure out that the whole design process is actually a constant interactive activity among bottom-up analysis and top-down space making. These two keep back feeding each other in a highly-linked digital data exchange.

In practical or social level, this project is definitely an experimental one. However, the purpose of this kind of academic projects is to develop future possibilities of built environment, and research projects could reflect the certain social trend at that time as well as vertically inheriting past wisdoms throughout the history of architecture. If we would call this project “a mat building in digital age”, which exactly indicates the current emerging technology to be influencing the architectural occupation and the whole urban development, meantime referring to the old ideals of integrating urban and architectural scale by designing horizontally spanned building network, we are actually revealing the relationship between this project and wider social context.