Continuous Workscapes
Hyperbody Studio
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INTRODUCTION
Rotterdam aims to attract high income & skill to the area

Redevelopment as international laboratory for innovative technology

Harbour activities relocating
A central, highly connected node with the potential to influence its surroundings
Vacancy breeds vacancy.
30% of all offices in the Netherlands are vacant

There is a disconnect between their monofunctional use and the changing needs of its surroundings

The spaces within the towers are only vertically connected
Attract startups to stimulate innovation

Proximity breeds collaboration

50% of the startups fail during the first 4 years

Clustered facilities are more efficient and cost effective
Today’s work is not just work
the boundaries between working, living and playing are to be blurred

Spaces in between serve as a facilitator of collaboration

Transparancy and permeability are important
Connected spaces flow into each other, concentrating activity around circulation with varying degrees of activity and privacy.
SPATIAL INTERACTION
THE FUNCTION OBLIQUE

Claude Parent & Paul Virilio The Function of the Oblique
Adaptable
The intervention should serve the changing needs in the innovative technological sector.

Effective workspace
The spatial qualities should promote collaboration, productivity and innovation.

Upgrade the old
The intervention should use, retool and add on to the existing fabric of the Marconi towers and upgrade its monofunctional character.

PROPOSAL
A multifunctional workscape that bridges and interconnects the towers.
1. **Vacant floors** are the starting point for the intervention.

2. **Removing old structure** and floors to make room for the new.

3. **Interjecting new structure** to interconnect the towers and form the basis for future interventions.
**SPACE PLANNING CONCEPT**

*Bridges as circulation.*
The geometry serves as a permeable connection & circulation between the towers.

*Bridges as structure.*
Substitutes & strengthens the existing structure of the towers.

*Bridges facilitation.*
The oblique geometry allows different, varied use of space, enabling interesting interactions.
COMPUTATIONAL STRATEGY
COMPUTATIONAL STRATEGY

1. Spatial Planning
Organising the new program in 3D space with and iterative agent-based modelling process

2. Geometry generation
Geometry is formed by allocating volumes to the agent-based pointcloud

3. Altering geometry
exterior & interior porosities, steps & stairs are informed by use of 3D-mapping
AGENT-BASED MODELLING
FORM FINDING

DISTRIBUTION
PRIVACY

SEPARATION

FUNCTIONAL CONNECTIVITY
SPECIFIC REQUIREMENTS

COHESION

COLLECTIVE ORDER/DIRECTION

ALIGNMENT
Agents take up predetermined space to form initial geometry.

Configurations assessed on flow, sunlight hours & structural potential.
Structure simplified to truss between the cores in order to optimize initial structural viability.
ENVIRONMENTAL OPTIMIZATION
MAXIMIZE SUNLIGHT HRS

Parametrized buffer in allocated space to allow porosities for optimization

Determine potential risk zones for sunlight hours

Configure spatial organisation to optimize sunlight hours on risk zones
Sunlight hours analysis as map for agent based modelling to generate void structure

The voids improve sunlight hours throughout existing building and provide infrastructure for future interventions
13% increase in average sunlight hours
Weave from planar connections to oblique circulation
GEOMETRY GENERATION
COMPLEXITY CIRCLE PACKING

mapping oblique surfaces
(walking angle, circulation,
proximity cores & points of interest)
circlepacking to create variable complexity
varying cellsizes inform the geometry
Cell centre points offset to create a set of enveloping surfaces

Inherent oblique quality to the generated geometry
LANDSCAPE FURNITURE
FACILITATING NEW WAYS OF WORKING

landscape furniture volumes

ergonomically refined

foam seating

The end of sitting - Studio RAAF

Claude Parent
ADDING POROSITY
3D MAPPING ANALYSIS

Initial geometry

3D mapped geometry
- Structural
- Sights & Views
- Sunlight hours

Informed porosities
- Facade openings
STRUCTURAL OPTIMIZATION
STIFFNESS MAPPING

Structure is mapped through a stiffness optimization analysis.
The geometry connects to the cores and transfers loads from the substituted columns.
FUNCTIONAL MAPPING
VIEWS & SIGHTS

Views are mapped by distance and angle alignment

City view angle

$\Delta^\circ$ & d
Individual Cells

$d$
Distance to surface

Viewing angle difference

$\Delta^\circ$

City view angle

Cell view angle

Circulation view angle
The geometry is mapped in sunlight hours informing exterior porosities on daylight entry.
COMBINING 3D MAPPING

Combined mapping
[Views, Solar, Structural]
Varying porosities dependant on combination of mapping, clustersize & effectiveness
THE DESIGN
CIRCULATION
FUTURE ITERATIONS
CITY & TOWER INTERFACE

proposed intervention

future interventions

city interface
Climate is controlled in local, activity based clusters

utilities placed in-between spaces
MATERIALS & FABRICATION
COMPOSITE MATERIALS
OBVERSE QUALITIES

WOOD
Natural
Warm
Tension
Acoustic
Inviting

CONCRETE
Solid
Cool
Compression
Serious

FOAM
Soft
Tactile
Insulating
Acoustic
Playful
Comfort

Cross laminated timber
3D printed concrete
wirecut and milled foam/eps

Interior surfaces
Exterior surfaces
Structural
Landscape furniture
seating
insulation

OBVERSE COMPOSITE MATERIAL WITH TENSILE AND COMPRESSIVE STRENGTHS
MATERIAL MAPPING
UTILIZATION ANALYSIS

top layer

combined material mapping

bottom layer

Case 1: compression-compression

Case 2: tension-tension

Case 3: compression-tension
MATERIAL MAPPING
UTILIZATION ANALYSIS

top layer & bottom layer utilization

combined material mapping
3D PRINTING CONCRETE
SCALABLE POROSITY WORKSHOP

MACRO → MESSO → MICRO

Hyperbody, Tudelft
1. 3D printed concrete
2. cross laminated timber
3. shear connector
4. 100mm insulation + foil
5. rebar
6. steel billet
7. top fixing cleat
8. leveling shim
9. threaded dowel
1. 3D printed concrete
2. cross-laminated timber
3. shear connector
4. 100mm insulation + foil
5. rebar
6. 6mm triple layered glazing
7. setting block
8. silicon adhesive
9. weatherseal
Subdividing into components
ROBOTIC PRODUCTION

- lamination and CNC milling of timber
- embedding connector hardware, rebar & insulation
- printing the concrete
CONSTRUCTION PROCESS

component prefabrication

transport & assembly

demolition & temporary support structure

replacing structural integrity towers

assembly and positioning bridges

connecting bridges & towers
THANK YOU