Tivoli
Towards a Homogeneous Heterogeneity
Housing onto an existing garage building

Thesis project by
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Further densification within city centres become problematic because land is scarce where it is seldom possible to add new housing.

The thesis explores the possibility in how to apply housing onto an existing garage building, Nordstan P-hus in Gothenburg, Sweden.

The intervention breathes new life onto the existing garage building, enabling a residential neighbourhood to emerge right in the heart of the city.
Thesis question:
How can an existing garage building further densify a city centre with housing?

Problem area and delimitations:
Further densification within city centres become problematic because land is scarce where it is seldom possible to add new housing. The envelope of existing garage buildings then offer the possibility in populating housing to further densify the city centre.

Nordstan P-hus in Gothenburg, Sweden becomes the test bed within this thesis in populating housing onto an existing garage building. The parking spaces of the garage building is mainly used by those who use the neighbouring shopping mall as well as for those who work close by. Still there is an underuse of the garage building when it comes to parking spaces. This in turn enables the opportunity in reconfiguring the buildings usage by adding housing onto it, while preserving the shopping mall on ground level and some of the parking levels above.

Aim and objectives:
The main departure of the thesis is to offer a mixed variety of housing types allowing students, single/couples and families to live coincided within the city centre. The structural logics of the garage building acts as an influential part in the way how housing is placed and arranged.

Methods and process:
The process of the thesis is divided into 2 phases: 1. Information and 2. Design. The first phase focus on gathering information of the existing garage building and framing a conceptual approach. The second phase focus on proposing a design solution in how to apply housing onto the existing garage building.

Results and conclusion:
The design proposal offers a possibility in breathing new life onto the existing garage building, enabling a new residential neighbourhood to emerge right in the heart of the city.
Phase 1 - Analysis

+Site and context
The garage building lays within the heart of Gothenburg city centre facing the waterfront. It sits at the end of a large indoor shopping mall, Nordstan. On its eastern side lies the Central station with its buses and trains. Towards the waterfront lies the opera house as well as a large office block. Above a highway tunnel close by rests a green recreational area under development. Within a near future the city will start to connect with the waterfront area, which previously has been mainly used for industrial purposes. And Nordstan P-hus will have a more frontal image to play, rather than now being the backside of the largest indoor shopping mall within the Northern region.

+Existing garage building - Program
The building mainly houses parking spaces except for the ground floor which mostly contains commercial space connected to the shopping mall. There are 8 parking levels and throughout the year the minimum usage of parking space is 50% which at times reaches 70%. During Christmas maximum usage of parking space is reached.

+Existing garage building - Structure
The garage building consists of a grid of T-shaped pillars that hold up the floor slabs. The floor slab is made of pre-fabricated tt-cassettes. The building is built like a house of cards, where the slabs are placed on the vertical pillar bearings. Within the existing structure, no indoor climate is present, except for the elevator cores, meaning air flows free in and out creating an outdoor zone within the entire garage.

+Concept
The design proposal for populating housing onto the garage building takes its departure from the existing structural layout, the surrounding building heights as well as massing principles for the specific housing types applied.

+Concept - Analogies
The massing of the residential neighbourhood is a fusion between Townhouses, a courtyard block and 2 towers. This is to break up the massing of the housing so to perceive the residential neighbourhood as being a cluster of heterogeneous buildings. The heterogeneity enables variation of housing types to occur as being perceptible, enabling a visual identity of where one lives. Yet there is homogeneity that draws all the separated building volumes together in order to be perceived as a single residential neighbourhood.

The variety of housing types is like the attractions within a Tivoli. Each attraction contain a specific type of thrill and the same should occur with each housing type in terms of identity. Differentiation implicates a housing type’s floor plan layout in order to create varieties of spatial arrangements of apartment units and how they all come together as a volume creating a unique diversity of buildings within the residential neighbourhood.

+Concept - Massing
The massing of the design proposal starts by removing redundant floor slabs within the garage levels in order to preserve the height relationship to neighbouring buildings. Then the housing is added and arranged according to the existing structural system of the pillar grid and cylindrical spiral ramp.

Phase 2 - Design

+Urban
The new residential neighbourhood is perceived as a plateau with towers on top. The plateau respects the surrounding building heights, while the towers relate to surrounding tower heights that are scattered around the city. The massing plays with the dialectics of presenting itself as being a mega block (the presence of the existing building) yet it’s broken up into a cluster of buildings (the new residential neighbourhood).

+Building
The building constitutes of a vertical layering of program where the residential area sits on top of the base. On ground level it mainly hosts the existing shopping mall with its commercial spaces, plus entrance points for the housing inhabitants as well as for the parking. 4 levels of parking space sits above ground level. Above the parking levels rests the residential neighbourhood consisting of a variety of housing types (townhouses, an apartment block and two towers) arranged according to the underlying structural system.

The townhouses and the apartment block within the plateau are arranged according to the pillar grid while the high rise towers are placed within the cylindrical spiral ramp. The main housing volume within the plateau is an S-shaped apartment block framing the base of the building with 2 courtyard gardens, where one is opened towards residing street alley on the southern side and the second courtyard garden opens up towards the waterfront area. An internal street (communal hall) that lays within the S-shaped block connects both ends of the residential neighbourhood and containing communal areas such as laundry room/storage, offices/ateliers gym/running track etc. the program of the communal hall are arranged according to need of direct sunlight. So the winter garden is placed next to the façade on the southern of the communal hall, while laundry rooms and storage may be placed in darker areas.

+Housing
A large variety of housing types are offered to the inhabitants. The inhabitants may live either more small scale in townhouses with their own sky streets, or within the courtyard gardens, or in a row house with large terraces, or cantilevered out above the streets to review the street life below, or live high up in the towers with views towards the city and beyond.

+Housing - Block
A variety of housing types come together to form the apartment block. The block consists of courtyard apartments that reside within the courtyard gardens. The apartments that lay on top are the pitched roof row houses with large terraces. There are also two low rise towers with apartments within them.

+Housing - Townhouse
Above the apartment block lies the townhouses which are accessed via streets in the sky. The town houses give the impression of living in an actual house with private outdoor entrances and backyard gardens.

+Housing - Cantilever
Cantilevered apartment units extend out above the streets where it’s mainly hold up through the residing structural pillars. They mainly consist of studios for students.

+Housing - Towers
The two high rise towers differentiate themselves from one another through either being circular, called the Pineapple or quadrant, called the Biscuit. The variegated floor plan layouts results in the unique shape of each tower given them an iconic identity within the city.
Bus terminal
Train station
Tram/busstop
Ferry
5min walk

Site - Context
Usage of parking space

30-50% Parking space = 1500 Sqm
3 levels - May be replaced by housing

50-70% Parking space = 4000sqm
4 levels - To be remained as parking space

Typical plan size:
Length approx 130m + Width 80m
10,615 Sqm

Floor 1
Entrance/exit garage + commercial space

Floor 2-6:
Garage - approx. 320 parking lots per floor

Floor 7-8:
Garage - approx. 240 parking lots per floor

Data of existing building

Total P. space - approx. 2030
Floor 2-6: approx. 320 P per floor
Floor 7-8: approx. 240 P per floor

Building height 24m
Existing structure

The main structure is made of pre-fabricated concrete elements. It is engineered based on a pillar slab system, where the slabs are made of pre-fabricated ft-cassettes (cc 1200 millimetres). The building is built like a house of cards, where the slabs are placed on the vertical pillar bearings. In the existing structure, no indoor climate is present, except for the elevator cores, meaning air flows free in and out creating an outdoor zone within the entire garage.
Typical floorplan from original construction drawing, dated 1973.
Typical floorplan axonometry showing structural principles pillar grid.
Concept

The rooftop of the garage building is large enough to house an entire elevated residential neighbourhood, giving the impression of a hovering city much like the movie “Howl’s moving castle”. The vertical setback of the elevated residential neighbourhood allows to create a distance from the busy streets around the site.
Housing types

In order to create a residential neighbourhood, a mixture of housing types is needed to produce a diversity of apartment units ranging from towers with panorama views, towards blocks framing garden courtyards, towards more individual houses with private entrances and terraces.

Typical British Townhouse: Barbican, London

Townhouse

Block framing a garden courtyard

Tower with panorama view

Townhouse with private entrance and terrace

Barbican, London
Ground condition

If placing one type of housing on to the garage rooftop there becomes a danger of monotony. Monotony is still achieved within a 2D ground condition in that they do not interact with each other. Within a 3D ground condition the visual appearance of a small town start to emerge.
The homogeneity of heterogenous volumes

Though the main departure is to produce a heterogeneity of housing types it is important to gain a sense of homogeneity as well. This is firstly due to that if pure heterogeneity is allowed a cacophony of unrelated objects emerges in such extent that would pollute the identity of a coherent visual appearance of the residential neighbourhood. The housing types should come together much like a Lamborghini engine. At once the engine parts all formally differentiate but enables a clear reading of each parts specific function, yet coherent as a homogeneous entity giving the reading of its purpose as an engine.

Much like in a Tivoli with a multitude of attraction types, each housing type (tower, block and townhouse) should all have varieties in order to allow for a perceivable identity to emerge within the residential neighbourhood.

Each housing type should differentiate itself like within the variety of rollercoasters contained in a Tivoli. Differentiation implicates a housing type’s floor plan layout in order to create varieties of spatial arrangements of apartments and how they all come together as a volume creating a unique diversity of buildings within the residential neighbourhood.

Tivoli

Liseberg, Gothenburg

Balder
Kanonen
Nickelpigan

Tower
Block
Townhouse

Heterogenous parts
Homogenous engine
Lamborghini engine
Massing in relation to pillar grid structure

The massing of the apartment units are arranged and placed so according to the logics of the structural pillar grid.

Additional structure

Existing structure

Additional volume

Tower volumes in relation to pillar grid structure

11

Strategy - Structural massing B

Existing pillar grid structure

3 pillar system

4 pillar system

6 pillar system

Cantilevered apartment units in relation to pillar grid structure
Site adjustments:
- Removal of 3 levels of floor slabs and replaced by housing mass.
- Housing mass arranged according to structural pillar grid & spiral ramp.
- Block & townhouse adjusted to height of surrounding buildings.
- Shopping mall and 4 levels of parking garage left intact.

Implementation of a residential neighborhood onto the existing garage building.
Massing diagram in its purest form

- Tower
- Plateau
  - Block
  - Townhouses
  - Base
  - Adjoining building

The plateau volume relates to surrounding building heights +/- 25m
Towers - 20399sqm = 45.9%
Townhouses - 2421sqm = 5.4%
Courtyard gardens - Eden
Communal hall - 4716sqm = 10.6%
- Wintergarden
- Relax zones
- Office/atelier
- Gym
- Laundry room
- Storage space
Rocks - 3750sqm - 8.4%
Pitched roof - 3235sqm = 7.2%
Courtyard & Shard - 4450sqm = 10.1%
Cantilever - 5469sqm - 12.3%

Total floor area within housing volume - 44412sqm = 100%
Axonometric section - 1:500

Apartments
Enclosed communal areas
Courtyard garden
Parking garage
Commercial space
Delivery area for shopping mall
The housing block frames the courtyard garden while opening up on one side towards its surroundings.

Level 5 - Courtyard garden

- Wintergarden
- Relax
- Office
- Atelier
- Laundry room
- Storage

Program is placed according to need of sunlight. If a program needs more light then it is placed in proximity to the envelope. If a program needs less light then it is placed in areas with minimum direct sunlight.

Level 5 - Communal hall

Communal hall for housing inhabitants

Wintergarden is placed on the southern side of the communal hall to maximize direct sunlight.

Level 5 - Communal hall

Wintergarden is placed on the southern side of the communal hall to maximize direct sunlight.
The layout of the massing is influenced by the existing parking garage structure. The plateau is influenced by the orthogonal pillar grid while the towers sit on top of the spiral ramp cylinders. Massing volumes are arranged along the underlying structural system of the garage building. Structural forces move down from the housing volume that come together to funnel through the existing pillar grid structure.
Toes

The cantilevered apartment units are hovered above the street and entered through the parking garage levels.

Level 0 - Shopping mall
Level 2 - Garage
Level 3 - Garage
Level 4 - Garage
Level 6 - Housing
Level 5 - Housing
Level 1 - Garage

Entrance situation - Street alley
Townhouse - sky street
Toes

Cantilevered apartment units in relation to parking garage.

Level 2 - Cantilevered apartment units in relation to parking garage.

Cantilevered apartment units - Leaf

Typical cantilevered apartment unit - Toe studio 27sqm

Storage
Bathroom
Hall/kitchenette
Livingroom

Sample - Cantilevered housing F

1:50
Townhouses are entered through the sky street via lift up to level 8.

Penthouse accessed via lift up to level 11.
Floorplan layouts within various levels of Pineapple tower

Level 19
- 1 apartment
  a1 - 163sqm

Level 14
- 4 apartments
  a1.a2 - 129sqm
  a3.a4 - 129sqm

Level 11
- 3 apartments
  a1.a2 - 99sqm
  a3 - 156sqm

Pineapple volume
14 story high from level 8
Total 4604 sqm
Biscuit volume
32 story high from level 5
Total 15927 sqm

Structural system for Biscuit tower
Inner ring
Outer ring
Core

Tower - Biscuit

Upper level floorplan
Level 32-37
Mid level floorplan
Level 15-31
Lower level floorplan
Level 5-15

Apartment 4rok - 108sqm 1:100

Sample of floorplan - 432sqm
View from courtyard garden
View from parking garage