Crown Town
Rooftop architecture for urban densification and greenification

Final Presentation
1st of July, 2014

Lisa van Schagen
TU Delft Faculty of Architecture
Architectural Engineering graduation studio
Introduction
fascination & problem statement
Content

1. Introduction
   fascination & problem statement

2. Technical research
   urban green, roof technology & generic system design

3. Relevance and context
   Weesperstraat, Amsterdam
Content

1. Introduction
   fascination & problem statement

2. Technical research
   urban green, roof technology & generic system design

3. Relevance and context
   Weesperstraat, Amsterdam

4. Concept
   urban densification and greenification
Content

1. Introduction
   fascination & problem statement

2. Technical research
   urban green, roof technology & generic system design

3. Relevance and context
   Weesperstraat, Amsterdam

4. Concept
   urban densification and greenification

5. Design
   I. programme, elements and routing
   II. structural design
   III. climate design
Introduction
fascination & problem statement

Technical research
urban green, roof technology & generic system design

Relevance and context
Weesperstraat, Amsterdam

Concept
urban densification and greenification

Design
I. programme, elements and routing
II. structural design
III. climate design

Visualisation
artist impressions
unused rooftop landscape: high potential?
roofs are often poorly designed too...
fascination

local food production

roof potential

introduction | technical research | relevance & context | concept | design | visualisation
fascination introduction | technical research | relevance & context | concept | design | visualisation

roof potential

local food production

social space
local food production

roof potential

rooftop architecture

social space

fascination
greenification

Successful transformation of a former high line into a public park
High Line, Manhattan New York
densification

successful densification project
De Karel Doorman, Rotterdam. Ibelings van Tilburg architecten (2012)
Groeikaart Amsterdam (anno 1000 - 2000)
Bron: Amsterdams Historisch Museum
Vinex: monofunctional city expansion
Carnisselande, Barendregt
Vinex: monofunctional city expansion
Carnisselande, Barendregt

successful city parts: multifunctional city centre
Avenue des Champs Élysées, Paris
Amsterdam reaches expansion borders
Photo by: Marco van Middelkoop: Aerophoto Schiphol
Why expand outwards...
... if we can go up?
What about urban green?
2 Technical research
City Roofs 2.0 – Making use of existing roofs to extend the urban green and user functions in the city

L.P.L. van Schagen
Faculty of Architecture, Delft University of Technology, Delft, The Netherlands

ABSTRACT – City growth needs to be addressed within the city borders to preserve surrounding green areas and make use of urban facilities. Next to this, cities suffer from a severe lack of urban green. Existing flat roof surface can provide extra space for expansion of the green space in cities, as well as accommodating new user functions. In order to execute these building transformations several technical and structural aspects need to be taken into account, as well as local legislation. Both roof extensions and urban green will only flourish when applied on a big scale, which is why there’s a need for a generic roof structure to provide for new functions.

BACKGROUND

Lack of green
Not only the Weesperstraat, but cities in general deal with a severe lack of green. Urban green has numerous benefits, some of vital meaning for human health. Others provide climatic or social solutions. The city as dense ‘concrete jungle’ causes an overloaded sewer system, expels urban wildlife and increases human stress levels. Urban green improves urban conditions and helps restoring the balance between citizens and nature.

CITY ROOFS
Making use of existing roof surfaces as renewed building ground can be a helpful tool by expansion within the existing core. The city of Amsterdam contains an unused, flat roof surface by the size of 4,000 soccer fields (Leeuw, 2013). Most Weesperstraat buildings have flat roofs as well, in contrary with most of Amsterdam. The general lack of green in cities can, for the greater part, be solved on the roof as well. Green roofs are quite developed worldwide and have proven to be successful in many ways. A green roof is a way to give back the green surface that the building took away. Green roofs are often chosen for their quality of retaining storm water, but have numerous of other benefits. Not only greening roofs, but multiple ground use in case of rooftop architecture, are sustainable things to do and sharing facilities is sustainable in the first place. Furthermore savings can be done in terms of money, material and energy and the city life will gain quality.

TECHNICAL ASSIGNMENT
Rooftops are not used or explored to their full extent. They’re a burden to the eye, have climatic disadvantages and run behind on innovation. Existing roofs can be transformed into an extensive or intensive green roof. Green roofs can play an important role in greening cities. In most cases roofs are not designed for this extra load, which limits the possibilities and asks for a smart solution.
importance of urban green
green roofs
importance of urban green
importance of urban green

Green roofs

introduction | technical research | relevance & context | concept | design | visualisation
importance of urban green
importance of urban green
importance of urban green

---

**Introduction**

**Technical Research**

**Relevance & Context**

**Concept**

**Design**

**Visualisation**
importance of urban green
importance of urban green
collaboration with De Dakdokters, Amsterdam
ir. Daan de Leeuw
“Need for a generic green roof system”
“Roofs can greatly contribute to the self-sufficiency of cities”
3 Relevance & Context
Amsterdam location

introduction | technical research | relevance & context | concept | design | visualisation
Wibautas, Weesperstraat
Weesperstraat before and after WWII
Stipo analysis Weesperstraat: disfunctional urban axis
Greenification masterplans for Weesperstraat

De Groene Boulevard inhabitants vision

Lisa's rooftop vision
location

Weesperplein, Weesperstaete building

introduction | technical research | relevance & context | concept | design | visualisation
Weesperplein, Weesperstaete building (1969, renovation 2005)
Het verschijnen van de nieuwe structuurvisie van Amsterdam is een historische gebeurtenis. Een lange termijn perspectief op metropolitaan niveau is ontwikkeld met bijdragen uit alle geledingen van de samenleving: economie, cultuur, sport, wonen, groen, ecologie, verkeer en vervoer, en water. Bijdragen uit de Amsterdamse bevolking kwamen binnen via een speciale website. Bijna achtduizend Amsterdammers bezochten de ‘Vrijstaat Amsterdam’ in de Tolhuistuin. Ook de belangrijkste toekomstprojecten in de buurgemeenten – Almere, Amstelveen, Haarlemmermeer – zijn in het Amsterdamse kaartbeeld verwerkt.

De visie bestaat uit vier ruimtelijke ‘bewegingen’: uitdijend centrumgebied, langgerekt waterfront, gebogen zuidflank en aantrekkelijk metropolitaan landschap. De vier, letterlijk verknipt en in elkaar gevouwen tot één metropolitaan toekomstbeeld, vormen samen een dynamisch spel van ruimtelijke spanningen dat allerminst eenduidig is. De visiekaart is er een van schotsen en breuken, concreet, niet utopisch. Uiteindelijk zijn alle losse stukken met elkaar verzoend in een metropolitaan beeld dat met vertrouwen naar de toekomst kijkt.

1. Need for housing stays high, despite crimp in the Netherlands
2. Number of households decreases more slowly than population
3. City centre is attractive to youngsters and students
4. Needs to create an attractive establishment environment for highly educated people
5. Densification in the core needs to be combined with improvement of the public space
4 Concept
existing building
existing building

using roof as 2nd ‘maaiveld’...
design concept

existing building

using roof as 2nd ‘maaiveld’...

...for adding functions and green
Inhabitants profile

1. young professionals (Structuurvisie 2040)
2. ambitions for using green
3. highly educated people
self-sufficient village
no parasite, but symbiosis
<table>
<thead>
<tr>
<th>concept</th>
<th>design</th>
<th>visualisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE EXTENSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- outlet exiting building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- stability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLIMATE FLOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- installation room roof</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- maintenance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Design
urban plan incl. top view
floor plan roof +2
steel structure + core
vertical transport: elevator shafts
Lignatur floors: wooden hollow-core slabs
great span, lightweight, insulation properties, aesthetics
connecting stairs
enhance interaction between different levels
vegetable- or winter garden
living units
different greentrays
### Programme

<table>
<thead>
<tr>
<th>Programme</th>
<th>Introduction</th>
<th>Technical Research</th>
<th>Relevance &amp; Context</th>
<th>Concept</th>
<th>Design</th>
<th>Visualisation</th>
</tr>
</thead>
</table>

01 **Synergy Unit**
- Wildflowers and solar energy
- Low maintenance
- Substrate layer: 100-120mm
- Weight saturated: 120 kg/m²

02 **Extensive Unit**
- Private or shared use grass
- Low or high maintenance
- Substrate layer: 80mm
- Weight saturated: 88 kg/m²

03 **Intensive Unit/Vegetable Garden**
- Plants and small bushes/vegetable garden
- High maintenance (depending on crops)
- Substrate layer: +200mm
- Weight saturated: 340 kg/m²

04 **Crown Unit**
- Small trees (up to 10m)
- High maintenance (depending on crops)
- Substrate layer: +600mm
- Weight saturated: 865 kg/m²

---

different green trays
extra load bearing capacity of existing building

Weesperstaete building
- 9 stories height
- building year: 1969
- renovation: 2005
- concrete structure

Consulting ir. J.C. Daane, structural specialist

Conclusion: at least two floors can be added without problems and or reinforcement of the existing structure
principal detail  *connecting old and new*

300x300x16 box column (new)

steel base plate

leveling mortar

160mm concrete roof slab

300mm concrete column (existing)

connection bolts
extended I-beam
principal detail primary beam | secondary beam
cross-section AA'
cross-section structural height
cross-section pipes and wiring
Storax valbeveiliging glass
sloped roof edge
Floradrain FD 25-E system filter
extensive green roof substrate 80mm
Lignatur box element (LKE) 240x200mm
Lignatur box element (LKE) 240x200mm with insulation
HE 400B beam
roof covering layer 18mm OSB
roof insulation 1
cavity
roof insulation 2
16mm polycarbonate panel
Lignatur box element (LKE) 240x200mm with insulation
28mm Douglas fir floorboards
vapour barrier
220mm insulation between
18mm OSB
40mm wood-fibre board
4mm rubber
16mm polycarbonate twin wall sheets
Lignatur box element (LKE)
300x200mm with insulation

window sill
11mm gypsum fibreboard
50x50mm battens with
50mm flax insulation between

80x80mm battens with
60mm x 65mm cellulose insulation between

220mm insulation between
18mm OSB
40mm wood-fibre board
100x100mm battens
4mm rubber
16mm polycarbonate twin wall sheets
Lignatur box element (LKE)
300x200mm with insulation

HE 400B beam
HE 180B secondary beam
EXAMPLE UNIT:
1-2 person household
area: ca. 50 m²

numbers for Crown Town:
20 dwellings in total
(1-2 person household)
area: 45-55 m²
inside

- 11 mm gypsum fibreboard
- 50x30 mm battens with 50 mm flex insulation
- vapour barrier
- 18 mm OSB

- 220 mm OSB
- wood window with triple glazing, Ug = 0.7 kWh/m²K
- window adjustment space
- 18 mm OSB
- 40 mm wood-fibre board
- 100x30 battens and cavity
- 18 mm polycarbonate on 4 mm rubber
- unit adjustment space

outside

300x300x16 steel box column

detail C
reference project Walter Unterrainer, passive house (2002)

- highly insulated
- lightweight material
- low maintenance

facade:
1. 16mm polycarbonate panel
2. cavity
3. wood fibre board
4. OSB
5. 220mm insulation
6. OSB, vapour barrier, battens with insulation in between
7. gypsum panel
Passive house principle

01 Envelope provides comfort

02 Ventilation is crucial

03 Surface temperature inside temperature
cascading ventilation principle
counterflow channel heat exchanger in bottom unit
average need for 2-persons household: 3500kWh

passive house: uses up to 4 times less energy than a conventional new building

So, assume 1500kWh. For 20 dwellings this means:

30,000 kWh

average yield solar panels: 80kWh/year, so 375m² is needed

available solar roof space units: +/- 300 m²
greenhouses: 150m²

So, Crown Town can be considered self-sufficient in energy!
6 Visualisation
Thank you

With special thanks to
Ir. Monique Smit
Ir. Maarten Meijs
Ir. Peter Teeuw
Drs. André Mulder
Ir. Hans Daane
De Dakdokters
Ir. Daan de Leeuw
Ir. Friso Klapwijk

Nico & Monique van Schagen
Leon Zondervan
Kees Uytenhout
Marjje Doesburg
Nick van der Zwaag
Cedrick Ingen-Housz
Sam van Til
Remy Heijer
Borris Boschman