SITE PROGRAM RESEARCH BUILDING

SCHEVENING and FASCINATION

CONCORDIA - CONSTANS
well-known for its beaches: half season
SITE
SCHENVENGEN
and FASCINATION

OUTDOOR
THEATER

SITE
SCHENVENGEN
and FASCINATION
groeten uit Scheveningen
Major attractions Scheveningen

Mass tourism:
- Pier
- shopping center Palace Promenade
- Holland Casino
- Sea -Life
- Harbor area events
- Musical Theatre
- Pathe cinema
- (Vitalizee)

- Cultural level:
- Museum Beelden aan Zee
- Increase dune involvement of Scheveninger and tourist
- Increase dune involvement of Scheveninger and tourist
- Interact with the changing environments
- Increase dune involvement of Scheveningen and tourist
Increase dune involvement of Scheveninger and tourist.
Increase dune involvement of Scheveningen and tourist AE LAB 08         //            graduation presentation 16-04-2013               //         Joris Heitkamp                ... Tutors: Jan Engels (A), Tjalling Homans (A), Mauricio Morales Beltran (E)               //               slide      / 144

SITE PROGRAM RESEARCH BUILDING
SCHEVENINGEN OUTDOOR THEATER
SITE SCHEVENINGEN and FASCINATION
Increase dune involvement of Scheveninger and tourist?
PROGRAM
Open Air Theaters in the Netherlands

- 39 theatres associated
- about 75 total in Netherlands
- 270,000 visitors annual and counting (2010) *

- some very successful mixed programs, best of all:

with 100,000 estimated visitors...

*VNO: Vereniging Nederlandse Openluchttheaters

Dutch open air theaters with above 5,000 annual visitors
Focus area

- Parktheater The Hague is understatement for size of the city
Focus area

- Parktheater The Hague is understatement for size of the city
- Scheveningen in the middle of high population density
Focus area

- Parktheater The Hague is understatement for size of the city
- Scheveningen in the middle of high population density
- Within half hour drive of:

**Rotterdam**
- 600,000 inhabitants
- 30 min. drive
- 30 min. public transport

**Zoetermeer**
- 122,000 inhabitants
- 25 min drive

**Leiden**
- 118,000 inhabitants
- 30 min drive

**Delft**
- 100,000 inhabitants
- 20 min. drive
Limitations in Dutch climate

- cancelled performances
- short season
- temporary roof construction
- permanent roof construction
Highest dunes North side Scheveningen
SITE PROGRAM RESEARCH BUILDING
OUTDOOR THEATER SITUATION SITE DESIGN PRINCIPLES
To far away?
To far away?
just one peer: 400 meters!
connexion Scheveningen with dunes
connexion Scheveningen with dunes

- existing paths: poor connexion
connexion Scheveningen with dunes

- existing paths: poor connexion
- conflict situations tram / car / bicycle
connexion Scheveningen with dunes

- existing paths: poor connexion
- conflict situations tram / car / bicycle
- abrupt end boulevard
connexion Scheveningen with dunes

new connection!
remains WOII
remains WOII

Atlantic Wall
remains WOII

Atlantic Wall
- 2685 km
- Spain till Norway
remains WOII

Atlantic Wall
- 2685 km
- Spain till Norway
- Scheveningen becomes Sperrgebiet
- 140,000 people had to abandon their homes
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- stützpunktgruppe Batterie Nord
remains WOII

Atlantic Wall
- 2685 km
- Spain till Norway
- Scheveningen becomes Sperrgebiet
- 140,000 people had to abandon their homes
- stützpunktgruppe Batterie Nord
- well preserved bunkers of 10,273 total built
remains WOII

- regained interest in war period
- bunkers are manucipal monuments, likely to become national monuments *
- ‘bunkerpleg Den Haag’

remains WOII

- regained interest in war period
- bunkers are municipal monuments, likely to become national monuments *
- ‘bunkerpløj Den Haag’

- make history publicly accessible and let the devoted people maintain it by subsidy
- copy success IJmuiden and Noordwijk with similar historical situations: make them publicly accessible!
Focus on beach
- amphitheater 350 seats

Focus on dunes
- cafe/ restaurant year round
- serving museum, cyclists, walkers, own public
RESEARCH
What is Kinetic architecture?

- Embedded
- Dynamic
- Deployable

(Kinetic typologies by Fox and Yeh)
Analysis kinetic architecture

Often
Egg Tower by Richard Moreta Architecture,

Taiwan Tower Conceptual Design / Paolo Cucchi Architects

Windswept installation, Charles Sowers

Wind Facade by Ned Kahn

Egg Tower by Richard Moreta Architecture,
Conclusions
- often retractable roof
- anticipating on rain and sun
- wind avoiding
- two configurations: open and closed
Goals

- anticipate to WIND, sun and rain
- maximize site experience

Site specific wind calculations

WIND PRESSURE CALCULATIONS

wind velocity (m/s)  pressure on surface (kN/m²)  loads on actuator (kN)

<table>
<thead>
<tr>
<th>Product [mechanical actuators]</th>
<th>dimensions (mm)</th>
<th>kN output stroke (mm)</th>
<th>V (mm/s)</th>
<th>references</th>
<th>DUTY CYCLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linak LA 35 (acme)</td>
<td>85, 153, 850</td>
<td>0.011, 1.5, 500</td>
<td>14</td>
<td>outdoor equipment</td>
<td>10% or 2 min cont. with 18 min break.</td>
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<tr>
<td>AIA5 Acme</td>
<td>80, 160, 900</td>
<td>0.012, 3.5, 600</td>
<td>28</td>
<td>indoor (hospital)</td>
<td>25%</td>
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<tr>
<td>Phoenix Mecano LAMBDA</td>
<td>94, 150, 825</td>
<td>0.012, 6, 600</td>
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<td>7</td>
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<td>5-20%</td>
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<tr>
<td>Phoenix Mecano LZ 80</td>
<td>114, 190, 1436</td>
<td>0.031, 12, 1005</td>
<td>6</td>
<td>mainly indoor</td>
<td>10-100%</td>
</tr>
<tr>
<td>Raco Tbc6 acme</td>
<td>138, 294, 1350</td>
<td>0.055, 12, 1000</td>
<td>9</td>
<td>in 3 stages</td>
<td>25%</td>
</tr>
<tr>
<td>Phoenix Mecano SLZ 90</td>
<td>145, 193, 1799</td>
<td>0.050, 24, 1200</td>
<td>10</td>
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Goals
- anticipate to WIND, sun and rain
- maximize site experience

Site specific wind calculations

**Wind Pressure Calculations**

- Wind velocity (m/s)
- Pressure on surface (kN/m²)
- Loads on actuator (kN)

### Industrial Common Elements:

**Actuator Research**
- Hydraulic
- Pneumatic → cushioning
- Electric (spindle)

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**ACTUATOR RESEARCH**
Goals

- anticipate to WIND, sun and rain
- maximize site experience

site specific wind calculations

Structural kinetics will deal with a deployable geometry

1-D bars

DEPLOYABLE STRUCTURE ANALYSIS

folded plates

pantographs for double curvature

double layer pantographs
pantographs for double curvature

tensegrity structures
based on tension of fabric and cables
Conclusions

- often retractable roof
- anticipating on rain and sun
- wind avoiding
- two configurations: open and closed

- pneumatic actuators have damping and inaccuracy

- the more complex the mechanism and geometry, the less rigid and capable of dealing with bigger forces, and perform in more than two positions
Conclusions

- often retractable roof
- anticipating on rain and sun
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- two configurations: open and closed

- pneumatic actuators have damping and inaccuracy

- the more complex the mechanism and geometry, the less rigid and capable of dealing with bigger forces, and perform in more than two positions

- SIMPLE MECHANISM, LITTLE WEIGHT
Using fabrics:
- anticlastic shapes research
- folded membranes
Using fabrics:

- anticlastic shapes research
- folded membranes

Tensile architecture

- basic shapes
- anticlastic surfaces
- membrane is constructive element
- you will need either:
  ~ sufficient curvature
  ~ make ‘waves’ (Sony Center Berlin)
- fabric that can handle folding
- principles of Frei Otto
- PTFE: Sefar Tenara 40% translucency
- fabric that can handle folding
- principles of Frei Otto
- PTFE: Sefar Tenara 40% translucency
- folding principle
BUILDING

BUILDING
BUILT-UP theater + 8400 level - toilets theater - toilets cafe
concrete foundation auditorium
remains ‘Atlanticwall’

stage

concrete foundation auditorium
remains ‘Atlanticwall’
steel trusses
Built-up theater + 1350 level - climatized cafe

gebogen raatliggers

SITE PROGRAM RESEARCH BUILDING CONSTRUCTION BUILT-UP FLOORPLANS AND SECTIONS FRAGMENTS AND DETAILS FACADES
ruimtelijke vakwerkliggers
steel sheeting
hinged profiles
pneumatic actuators
+ 1350 FLOORPLAN

Auditorium
- specs:

  area: 280m²
  13 rows
  350 seats
  outdoor climate
  low temperature seat heating
  generally publicly accessible
  concrete seats, pillows provided

Cafe restaurant:
  250 m²
  all year round
  dune orientated
+ 1350 FLOOR cafe/ restaurant

Auditorium
- specs:
  area: 280m²
  13 rows
  350 seats
  outdoor climate
  low temperature seat heating
  generally publicly accesible
  concrete seats, pillows provided

Cafe restaurant:
  250 m²
  all year round
  dune orientated
Office wing
200m²
theater and restaurant management
includes first bunker

Theater artists wing
200 m²
artist dressing rooms
includes lounge in second bunker

Theater backstage/decor
180m²
Office wing
200m²
theater and restaurant management
includes first bunker

Theater artists wing
200 m²
artist dressing rooms
includes lounge in second bunker

Theater backstage/ decor
180m²

Public refreshment
 toilets men: 4, 5 urinoirs, 45m²
toilets women 8, 54m²

Technical installations/ storage
95m²
+ 5000 FLOORPLAN

performance backstage
materials
access to level 8400 (-1)
closed theater situation
closed theater situation
closed theater situation
ANIMATION SLIDING WALLS
SITE PROGRAM RESEARCH BUILDING

SCHEVENING
OUTDOOR
THEATER

86

SITE PROGRAM RESEARCH BUILDING

SCHEVENING
OUTDOOR
THEATER

86
section AA'

CROSS CUTS

site program research building

scheveningen outdoor theater

auditorium

café/restaurant

back stage

backstage

toilets

path

bicycle path

section AA'

slide / 144

Tutors: Jan Engels (A), Tjalling Homans (A), Mauricio Morales Beltran (E)
cafe/ restaurant interior
CROSS CUTS
section DD’
- low temperature floor heating
- natural ventilation inside cold roof construction
- profile detailing
Force calculations
Force calculations
- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge

$F_{\text{wind}}$
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position force flows

\[ F_{\text{wind}} \]
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position
  force flows

- Three positions
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position force flows

- Three positions
- position 1; just open

<table>
<thead>
<tr>
<th>Surface A</th>
<th>Surface B</th>
<th>Total Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>area A (m²)</td>
<td>wind height (m)</td>
<td>wind pressure (kN/m²)</td>
</tr>
<tr>
<td>33</td>
<td>21</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Position 1:
- $F_{wind}$
- $M_A$
- $M_{ACT}$
- $M_B$
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position
  force flows

- Three positions
  - position 1; just open
  - position 2: half open
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position
  force flows

- Three positions
- position 1; just open
- position 2; half open
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position
  force flows
- Three positions
- position 1; just open
- position 2; half open
- position 3; fully open
Force calculations
- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position, flow

- Three positions
  - position 1; just open
  - position 2: half open
  - position 3; fully open
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position

- Three positions
- position 1; just open
- position 2; half open
- position 3; fully open

wind suction

<table>
<thead>
<tr>
<th>POSITION</th>
<th>area A (m²)</th>
<th>wind height (m)</th>
<th>wind pressure (kN/m²)</th>
<th>wind angle on surface (°)</th>
<th>F wind (kN)</th>
<th>l (arm) (m)</th>
<th>Moment B (kNm)</th>
<th>TOTAL MOMENT (kNm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33</td>
<td>21</td>
<td>1.52</td>
<td>65</td>
<td>54.5</td>
<td>4</td>
<td>-182</td>
<td>102</td>
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<tr>
<td>2</td>
<td>29</td>
<td>21</td>
<td>1.52</td>
<td>95</td>
<td>43.5</td>
<td>4</td>
<td>-174</td>
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<tr>
<td>3</td>
<td>20</td>
<td>20.5</td>
<td>1.52</td>
<td>124</td>
<td>25.2</td>
<td>4</td>
<td>-100</td>
<td>125</td>
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</table>
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position force flows

- Three positions
  - position 1: just open
  - position 2: half open
  - position 3: fully open wind suction

2 pneumatic actuators:

- 80 mm piston
- 80kN peak pressure
- 10 bar operating pressure
- 2000 mm stroke
Force calculations

- designed for biggest profile
- 1/3 above hinge
- 2/3 below hinge
- closed position
  force flows

- Three positions

  - position 1; just open
  - position 2: half open
  - position 3; fully open
    wind suction

2 pneumatic actuators:

- 80 mm piston
- 80kN peak pressure
- 10 bar operating pressure
- 2000 mm stroke
- 20 sec loaded opening

- mounted at 2m
- generating 320kN combined

CONVERTED: 9,5 M/S (bft 5)
ANIMATION PNEUMATICS
SITE PROGRAM RESEARCH BUILDING
CONSTRUCTION BUILT-UP FLOORPLANS AND SECTIONS FRAGMENTS AND DETAILS FACADES
ANIMATION POSITIONS
Southwest facade
Southeast facade
southeast perspective view
Northeast facade
from intimite enclosed....
ANIMATION AUDITORIUM AND BEACH
special thanks to:

Overall guidance
Jan Engels
Tjalling Homans

Technical guidance:
Mauricio Morales Beltran

advise hydraulics and pneumatics
Jean-Paul, Metal Work Nederland B.V.

Advisor tensile and membrane constructions
Harmen Werkman, Tentech BV Utrecht

And all friends and family for their support and help!