» Living Art Environment

Architectural System Design by learning from the environment

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

Müge Kruşa
1422039 / 4072847

TU Delft

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- Site Analysis
  - * Function Analysis
  - * Materialization
  - * Approach
  - * Existing Lighting
  - * Trees
  - * History
- Colors of Lange Voorhout
- Events of Lange Voorhout
- My Intension






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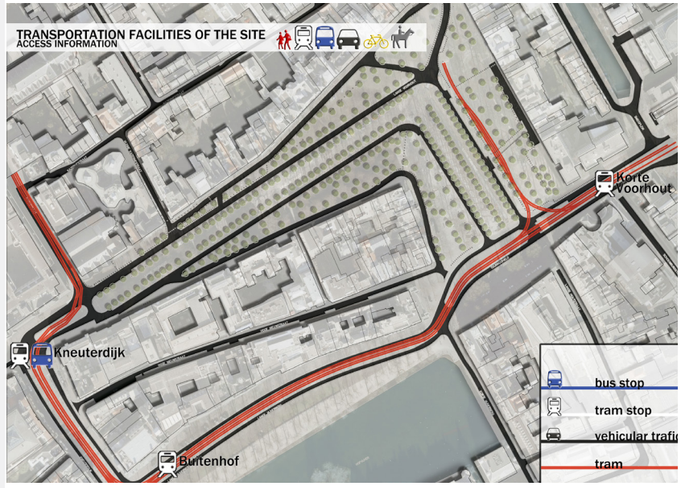

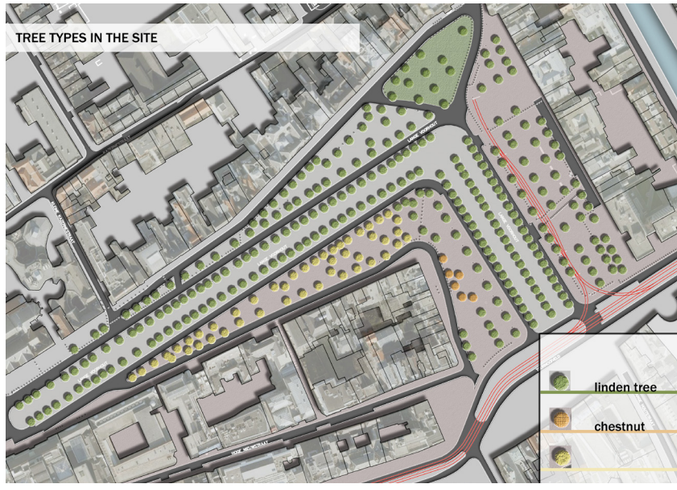

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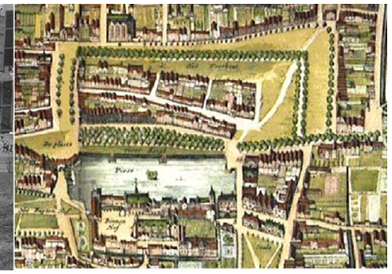
» History of Lange Voorhout



15th Century
The first buildings at the Lange Voorhout appeared around the beginning of the 15th century. The current Monastery church (**Kloosterkerk**) is one of the few buildings that remained of the Monastry that was built in the 15th century.
The Lange Voorhout owes its name to being an offshoot of the Haagse Bos (The Hague Forest). Its characteristic L-shape came into existence by the cultivation of the Lange Vijverberg (1375-1400) and the strip of land between the Hoge Nieuwstraat and the Voorhout (1400-1475).

16th Century
During a stay in The Hague in 1536, Emperor Karel V commanded to plant four rows of linden trees at the Lange Voorhout. These trees still give the Lange Voorhout a stately appearance.

17th Century
In the golden age the Lange Voorhout is the meeting point of the The Hague 'beau monde', where they could saunter. On the request of Prince Maurits an attempt was made to create a city moat of the Lange Voorhout. This failed, probably because the Lange Voorhout is partly located on a sandy hill.

18th Century
In the old days, the Lange Voorhout was full of small homes. In the 18th century a large part of these houses were demolished and replaced by the stately buildings out there right now. Many of these properties are state monuments.

19th Century
From 1811 till 1813 the Lange Voorhout was called the "Cour Napoleon" and the Lange Vijverberg the "Cour de l'Impératrice". Later on it was decided to restore the old names.

20th Century

21st Century
In 2009, the Lange Voorhout has been renovated. Several constructions have been placed, including one to protect the roots of the linden trees. Also, several concrete slabs have been placed to carry the sculptures of the annual exhibition. A shell path covers these constructions, like it used to do in the old days. The golden crowns on the street lanterns indicate the route that the golden carriage of her Majesty Queen Beatrix of the Netherlands rides during "Prinsjesdag". The lighting in the lanterns is controllable and can be aimed at the art objects

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» Colors of Lange Voorhout

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» Events of Lange Voorhout



Antique Market

Escher in the Palace


Book Market

De Posthorn


Prinsjesdag

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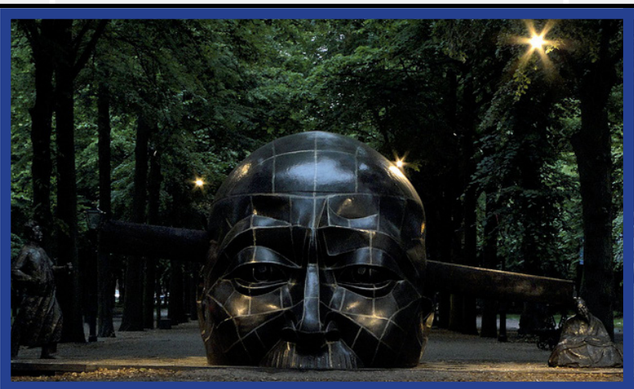
Hotel Des Indes

Exhibition



Pulchi Studio

Queens Day

Diligentia

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» My intension

Site has an impressive **natural beauty** with important **historical buildings** and **events**. So lighting and pavilions should have been attached with **minimum touch** to the site. In order to do that, **less complex** geometry and elements should have been used.

- Computation Theory
- Collective Animal Behaviour
  * Swarm Behavior
- Research Questions & Hypotheses

Computation is a procedure of calculating; hence computational design is about calculating, determining design **by mathematical and logical methods.** (Terzidis, 2006) [1]

These mathematical methods could be the methods that designer defined or the methods adapted from different principles. In this project and my thesis, I would like to examine one of these medium that as an architect I found inspiring; "Collective Animal Behavior" from biological computation.

Biologically inspired computing has been adapted to many fields, especially to computer science that is considered as a significant part of scientific and engineering activities. While computer technology has been used to analyse biology, biological ideas have inspired new questions of computer science. (Lamm&Unger, 2011)[2]

[1] Terzidis,K. (2006). Algorithmic Architecture. Oxford: Elsevier Ltd.
[2] Lamm,E. & Unger,R. (version date 2011). Biological Computation. London: CRC Press, Taylor & Francis Group.

- Computation Theory
- Collective Animal Behaviour
  * Swarm Behavior
- Research Questions & Hypotheses

Designer defined methods have their own mathematics and rules to answer well-defined situations. On the other hand biological computation has its own complete rules but only applicable to nature. On this project and in my thesis, I have tried to translate this language to architecture by the mean of relation between spaces, structural parts, building elements, and installations like light.

If the spaces (rooms or functions) and users can be seen as individuals in the nature, it is possible to adapt the rules of collective animal behaviour to an architectural space by the concept of self-organization. (Sumpter, 2005)[3]

If this organization is defined as a flow between spaces, we can consider spaces as agents and the behavior we should translate is swarm behavior (Oosterhuis, 2006)[4] . On the other hand if the designer dealing with a structural system including horizontal and vertical elements than the behavior supposed to be more hierarchical that we can analyse horse and some other mammal colonies.

[5] Sumpter,D.J.T. (2005), The Principles of Collective Animal Behavior, Oxford: Department of Zoology.(retrieved from www.ncbi.nlm.nih.gov on 10/26/2011)
[4] Oosterhuis, K. (2006), 2006 Swarm Architecture II, retrieved from www.oosterhuis.nl on 10/26/2011.

- Computation Theory
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» Swarm Behaviour
in architecture

"The swarm intelligence presupposes a large user base which is actively involved in development."

Hence, it creates an ideal open source system (for my design) that leads to share the knowledge between different disciplines, instead of a system that is closed and based on strict hierarchy and competition.
While closed source system creates competition and fragmentation, open source system leads to cooperation, conforms to the network logic . As a result, while swarm intelligence with large group of users and developers creates an open source system, also creates a living environment. (Kaspori,2005) [6]

[6] Kaspori Dennis, What People Want, 2005, Part 3, Panel 5 "Towards an open-source architectural practice", pp329-330 retrieved from http://www.springerlink.com/content/j5771g4156278506/ at 10.30.2010.

- Computation Theory
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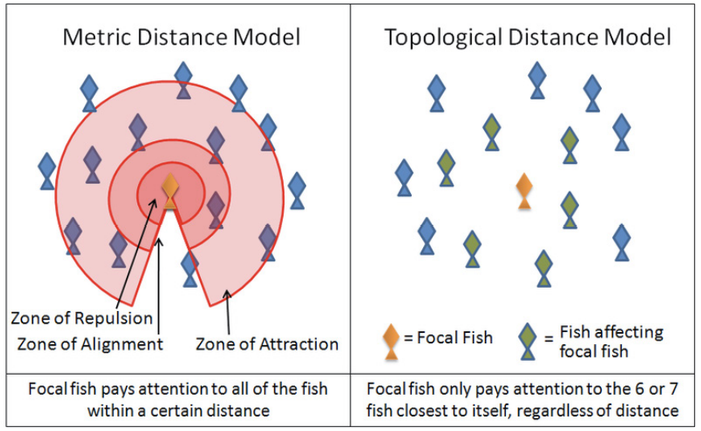
» Swarm Behaviour

- Rules:
- 1. Move in the same direction as your neighbor
- 2. Remain close to your neighbors
- 3. Avoid collisions with your neighbors



- Computation Theory
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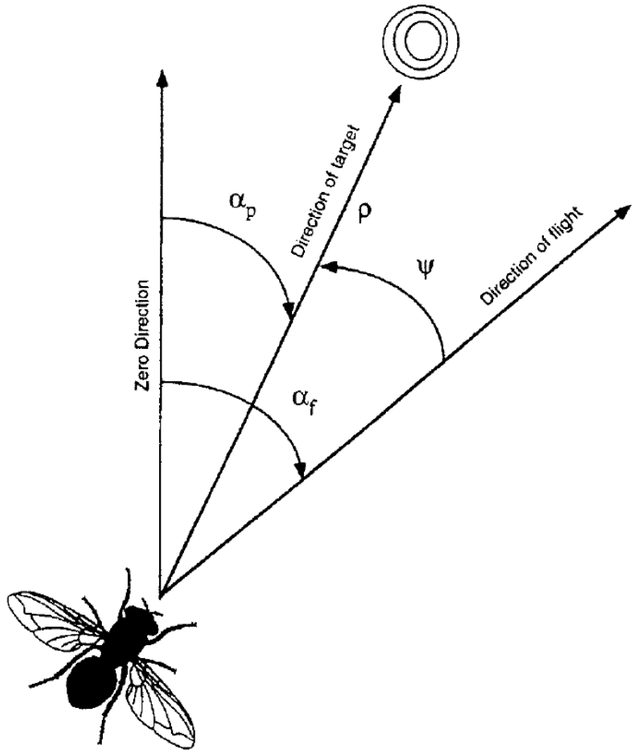
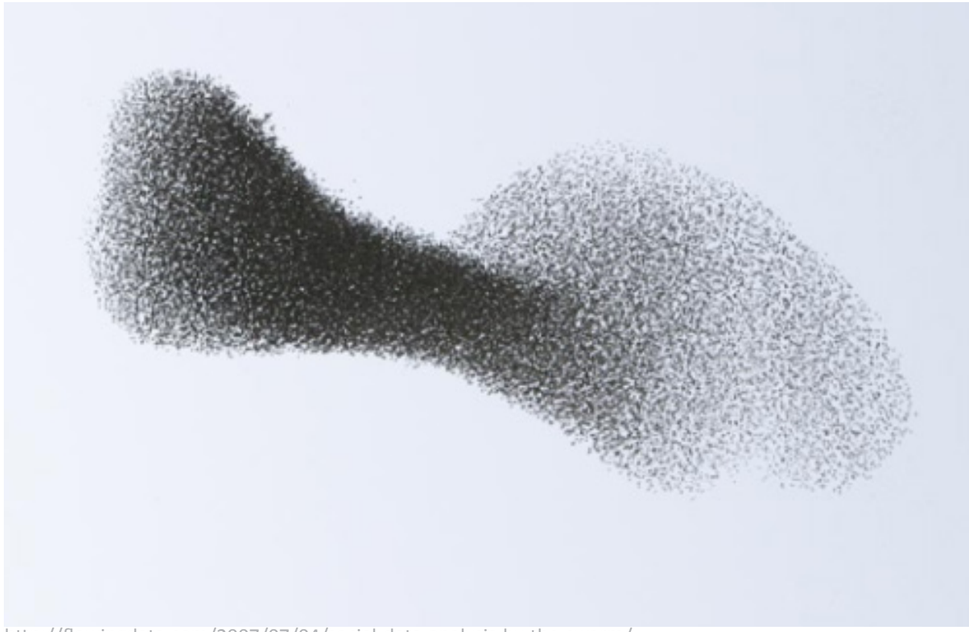
» Swarm Behaviour

response to the attractor



Poggio,M. and Poggio,T. (1994) ,Cooperative Physics of Fly Swarms: An Emergent Behavior, retrieved from http://www.dtic.mil/dtic/tr/fulltext/u2/a295622.pdf



http://flowingdata.com/2007/07/04/social-data-analysis-by-the-swarm/

- Computation Theory
- Collective Animal Behaviour
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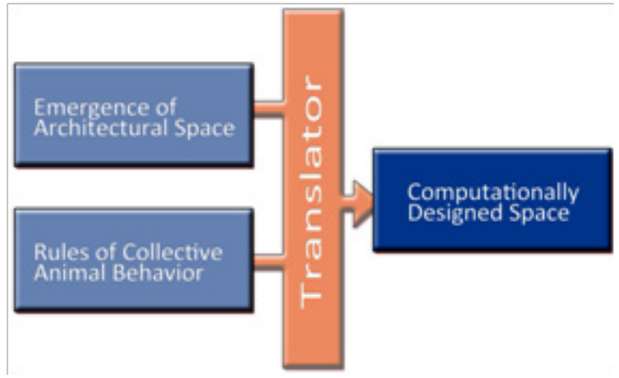
- Research Questions & Hypotheses

Research Questions & Hypotheses

I. What are the domains to create a computational space from the concepts of

1. Collective animal behaviour
2. Emergence of an architectural space
   "artificial intelligence + designer" as a translator

II. What are the opportunities and limits of biological computation on architecture?
III. How these behaviours should be analyzed and translated?
IV. Where am I standing on that field?



Understanding Human motion in the realm of swarm intelligence

Rules:

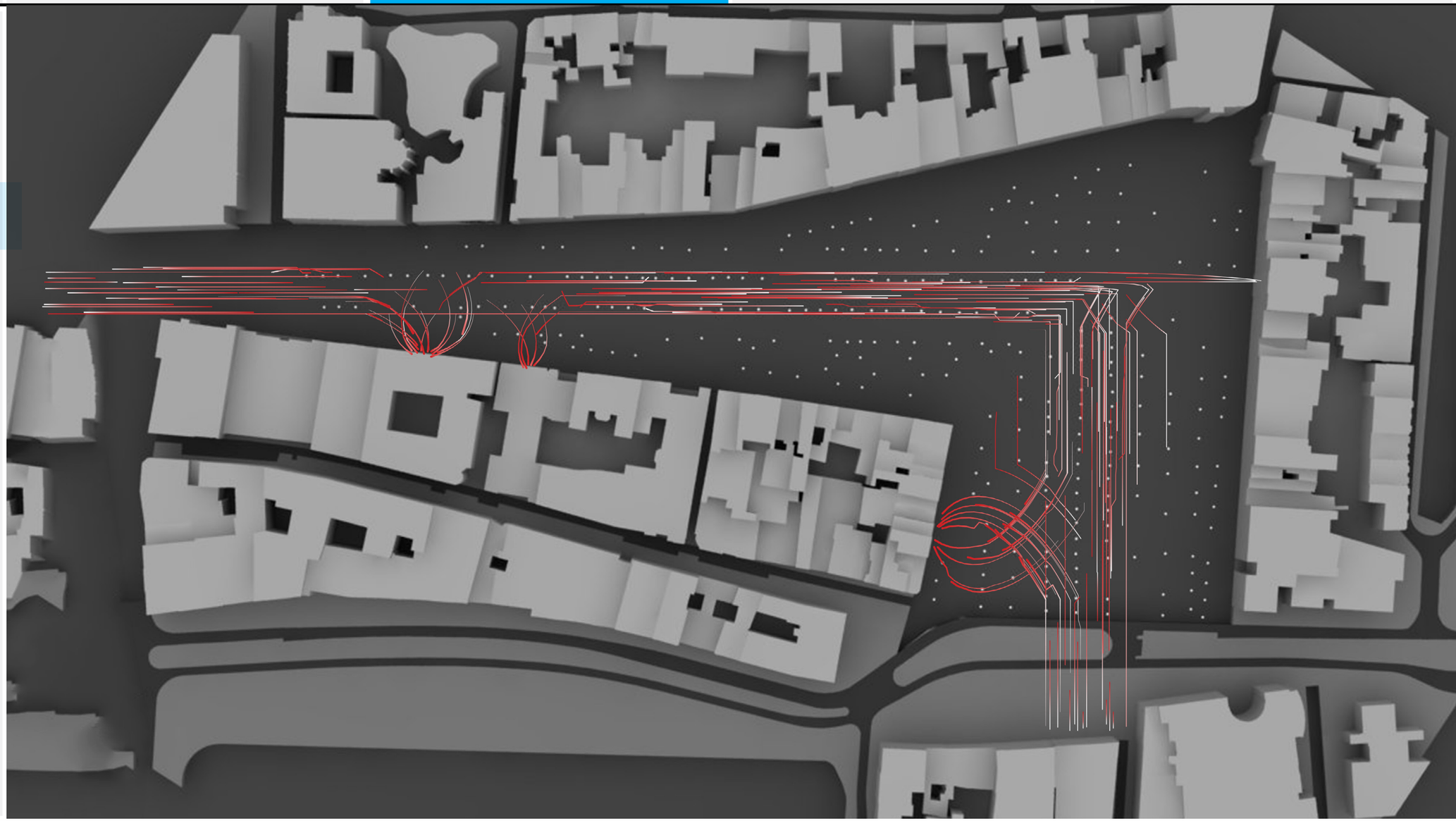
- Move towards the attraction point
- 1. Move in the same direction as your neighbor
- 2. Remain close to your neighbors
- 3. Avoid collisions with your neighbors and obstacles

- Understanding Human motion in the realm of swarm intelligence

- Human Motion Diagram on the site

- Emerging Rules
  * Architectural Approach to Define the Initial Site Grid
  * Divided Grid according to human motion paths

- Rules to for Elements



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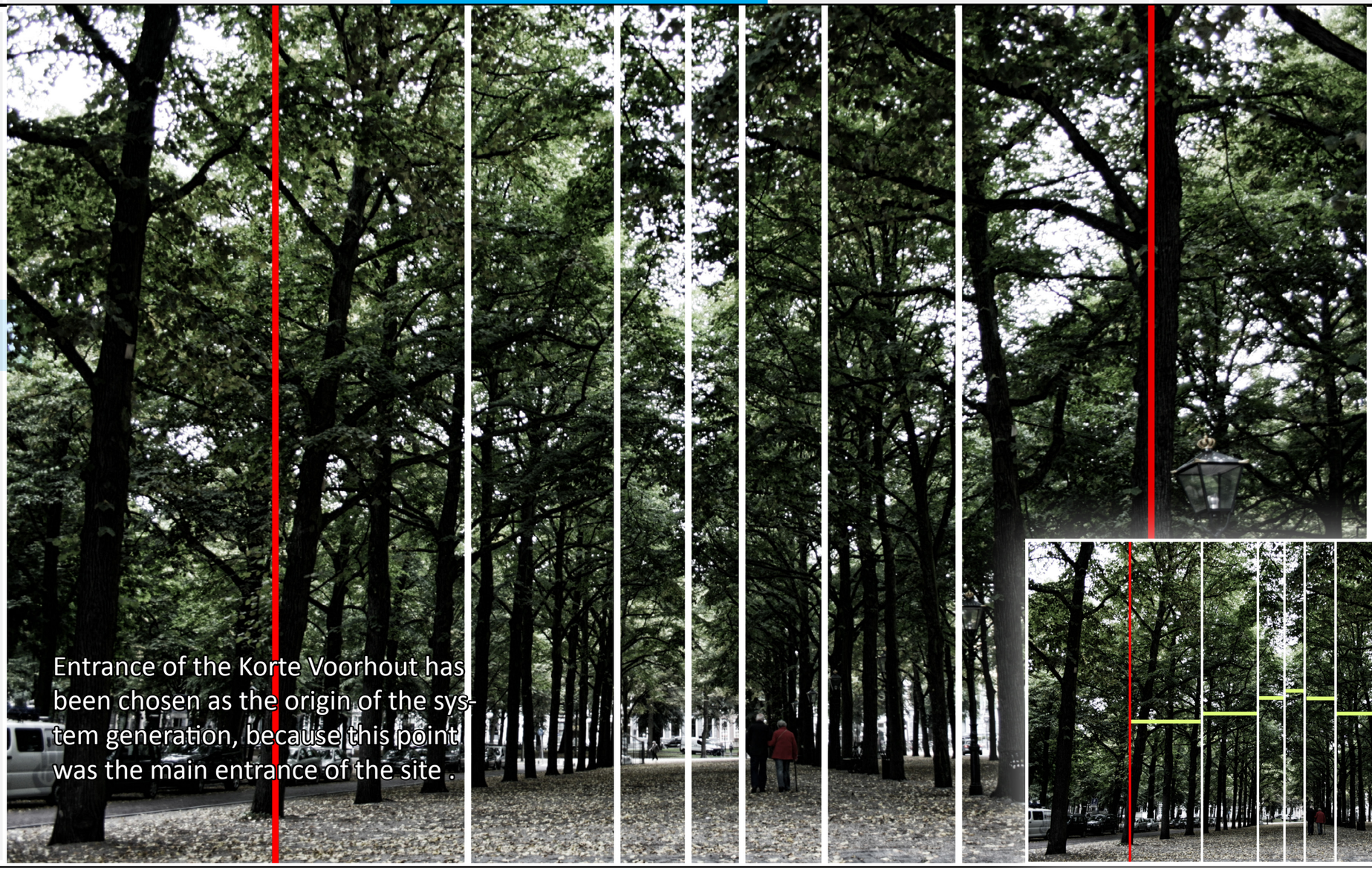

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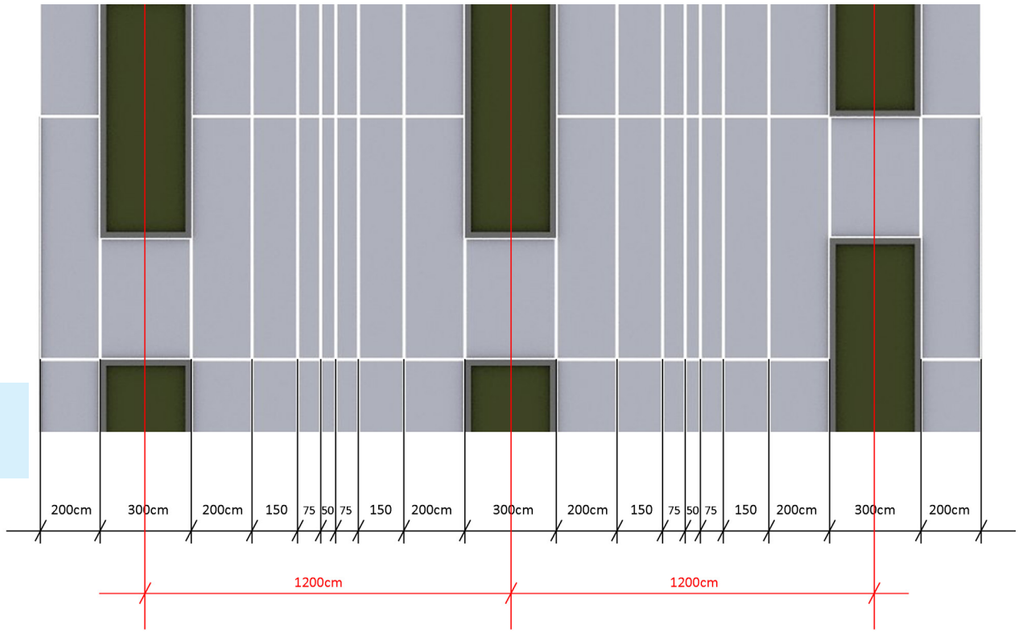

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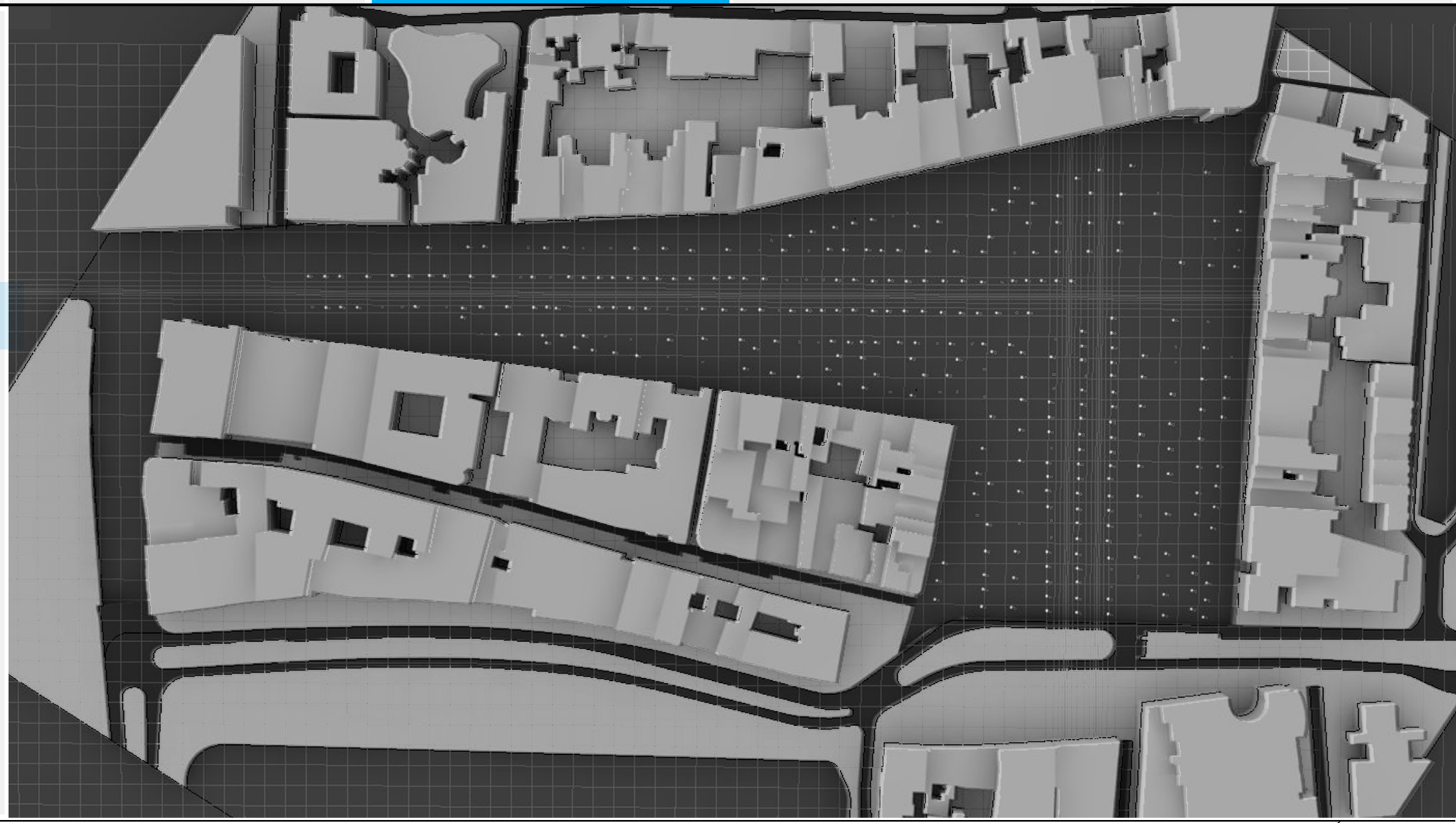

Computational **Process**
of Emergence of the site Organization

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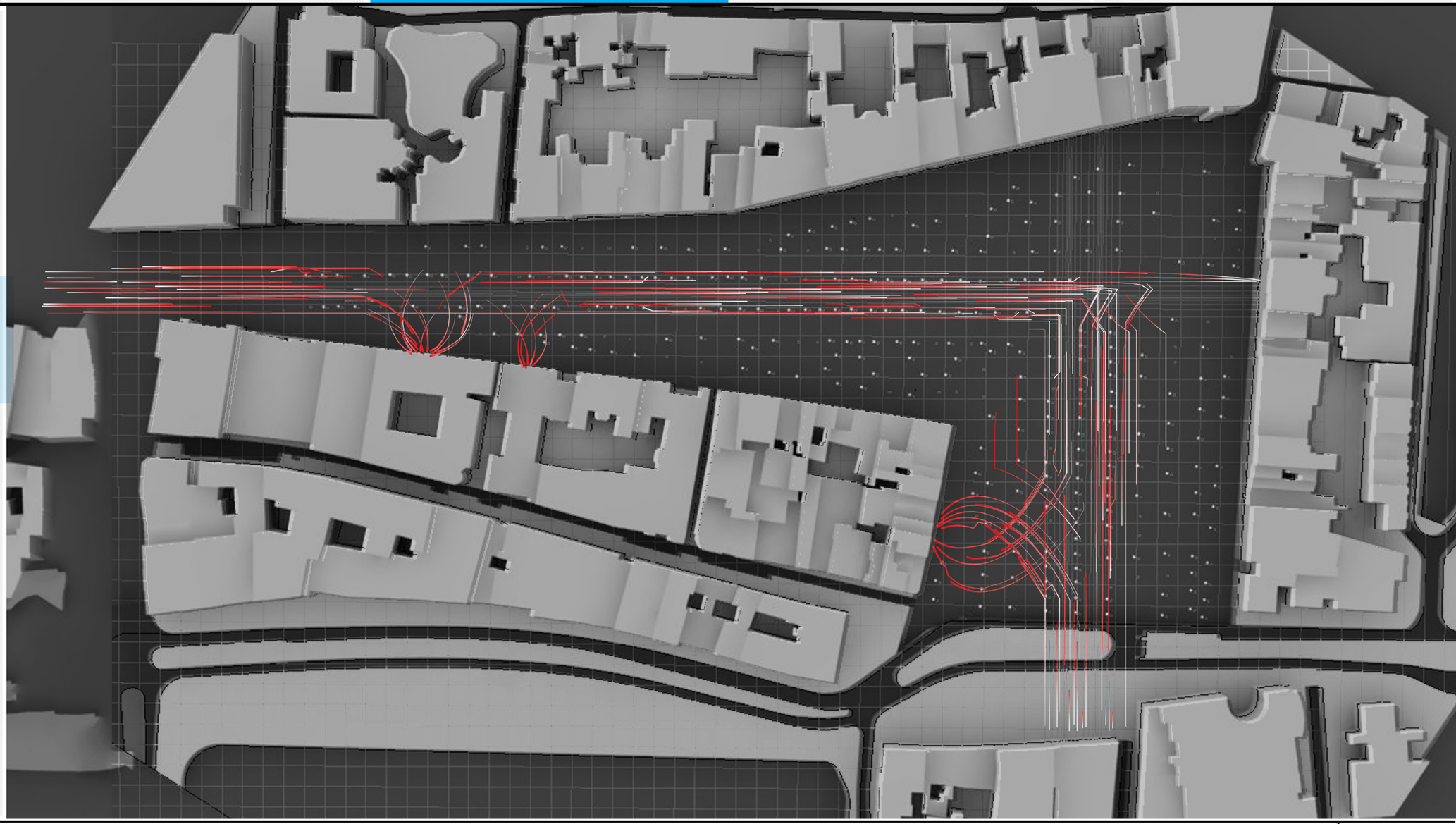

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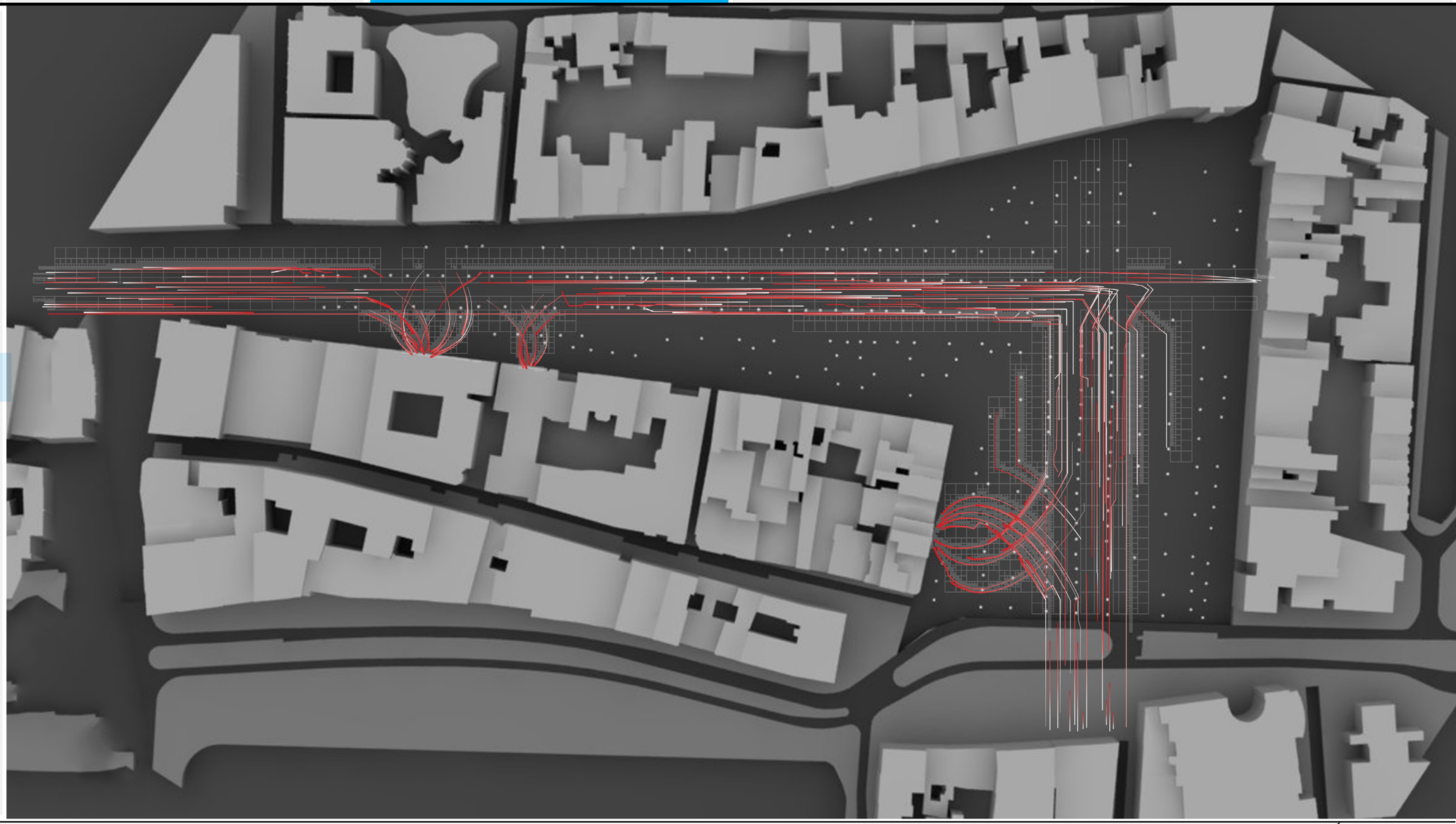

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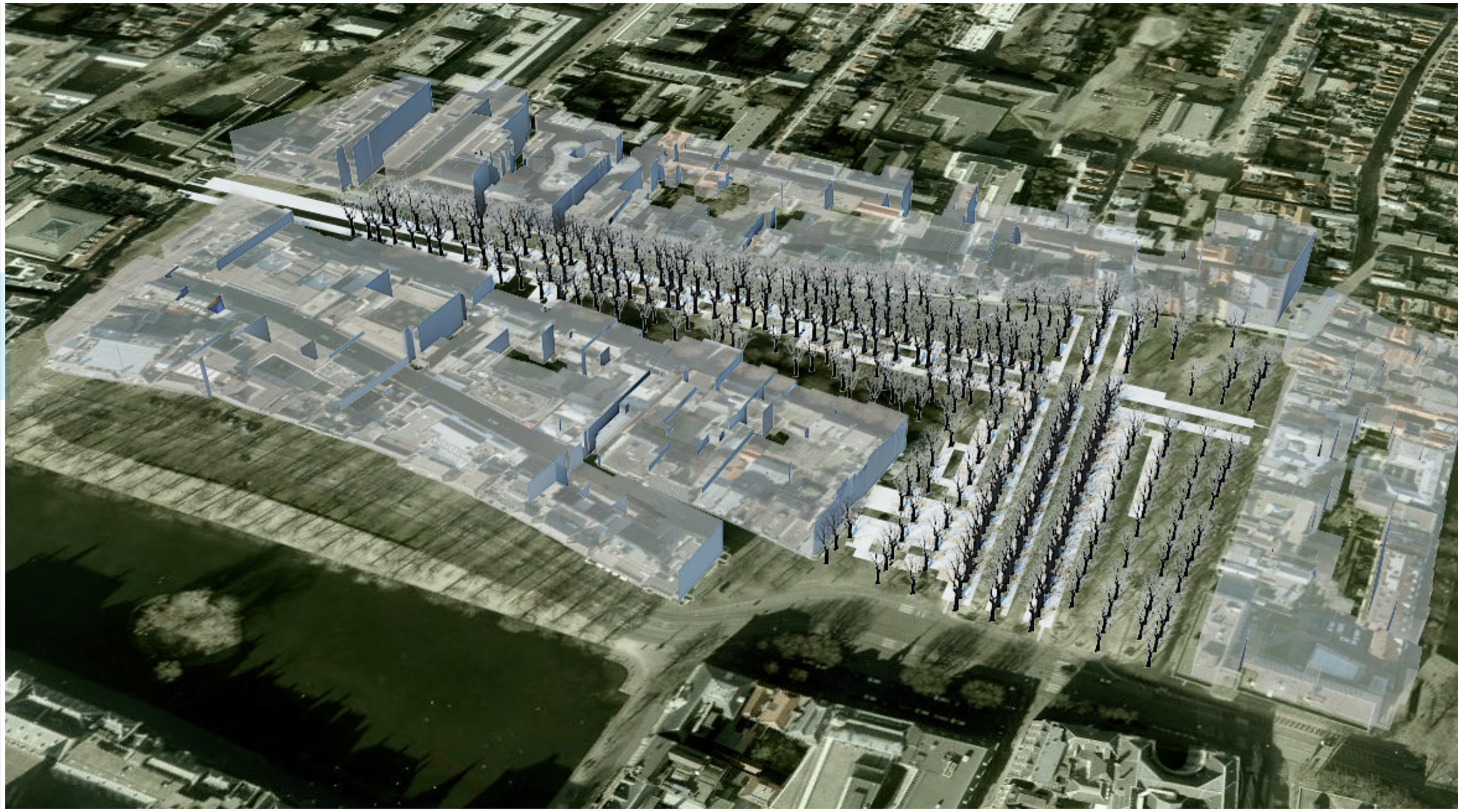

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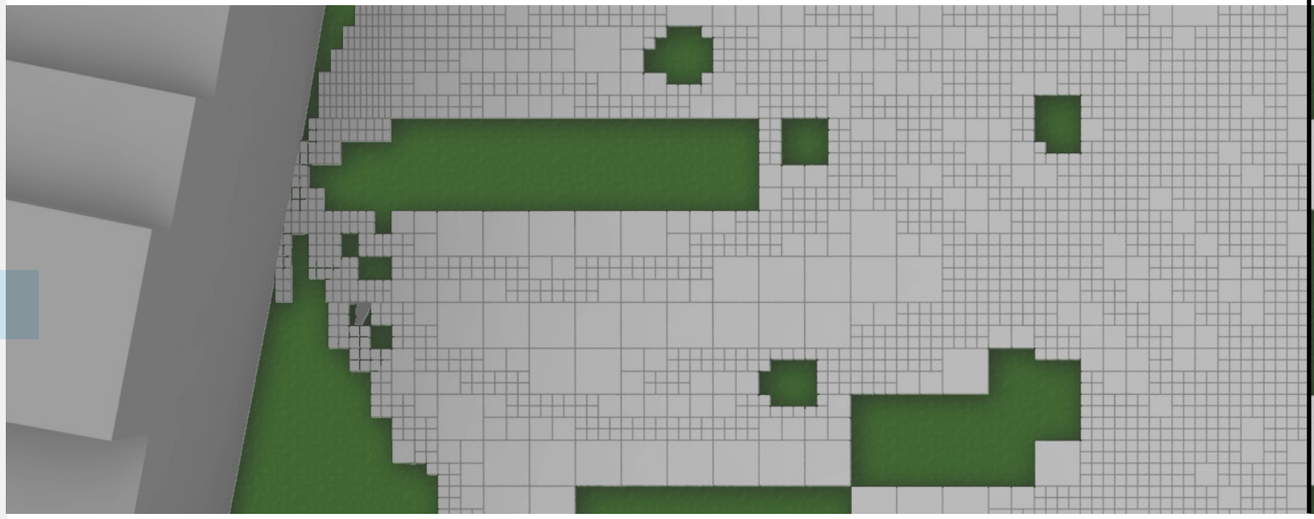
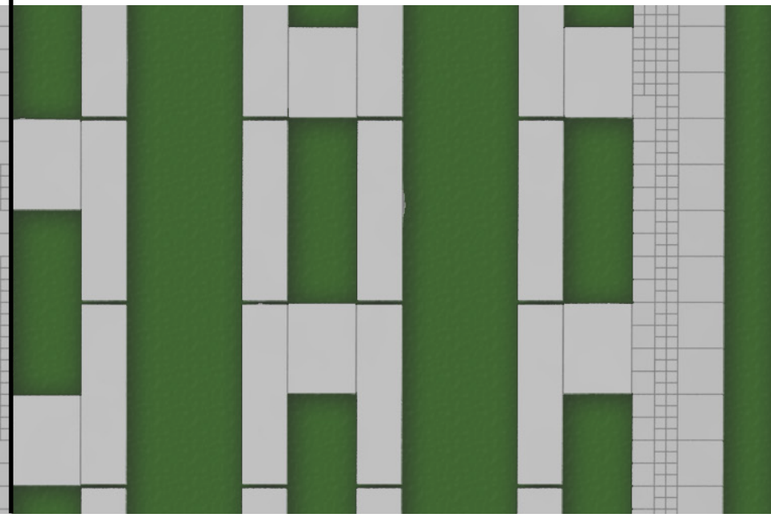
Computed Site Organization



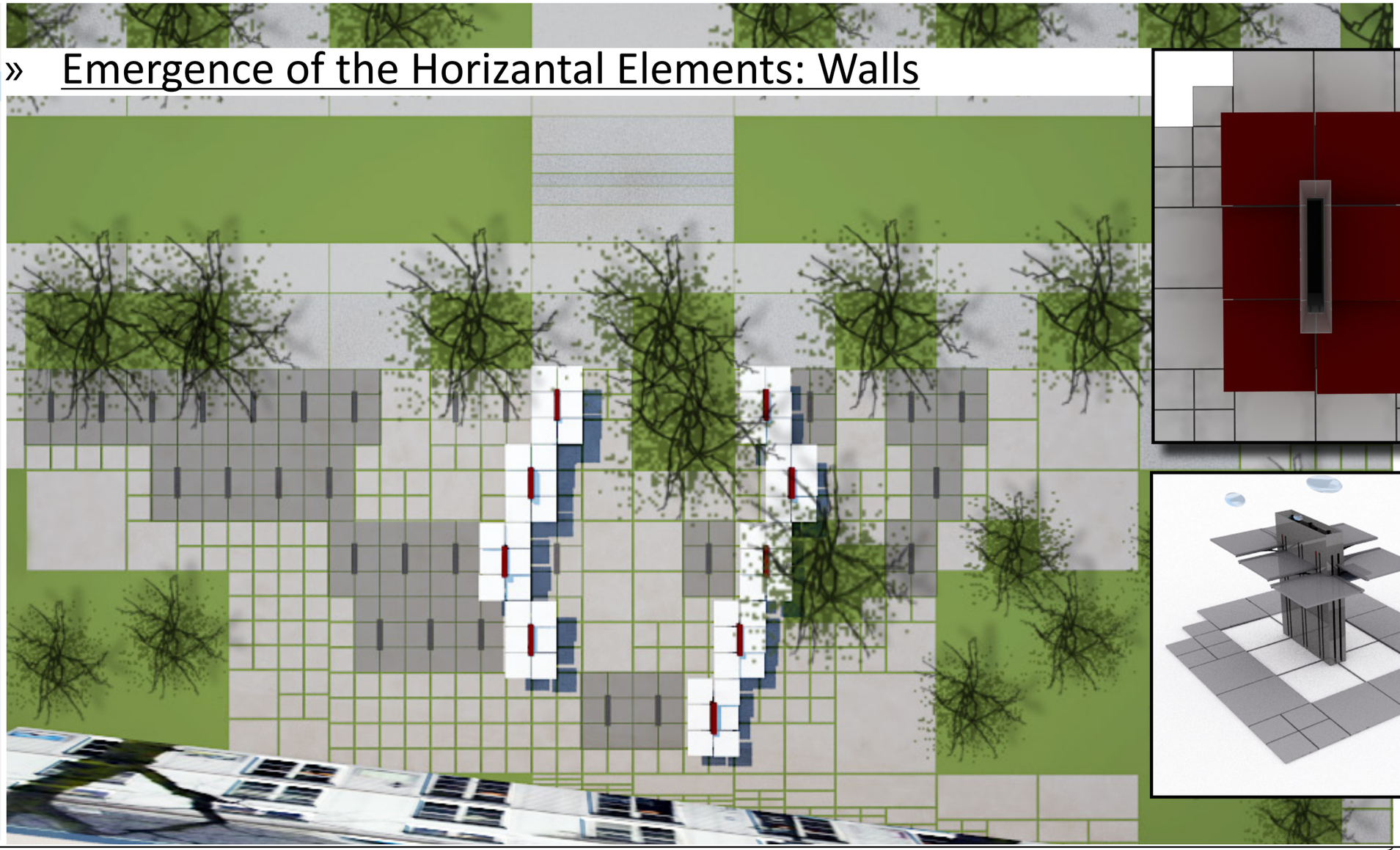
Intuitive Design with Architectural Concerns



- **Tress** should have **2Ø Area** to survive
- Slabs **close** to buildings more than **5 meter** will remain static pavements
- **Walls** will be placed to **support many slabs** as possible
- walls will be totally **detachable**

- Elements of the System
  - * Walls
  - * Slabs
  - * Bracings
  - * Roll-up Closure Elements
- Axis Shelters and Pavilions
- Space Variations that system creates
- Additional Features
  - * Lighting Elements

» Emergence of the Horizantal Elements: Walls



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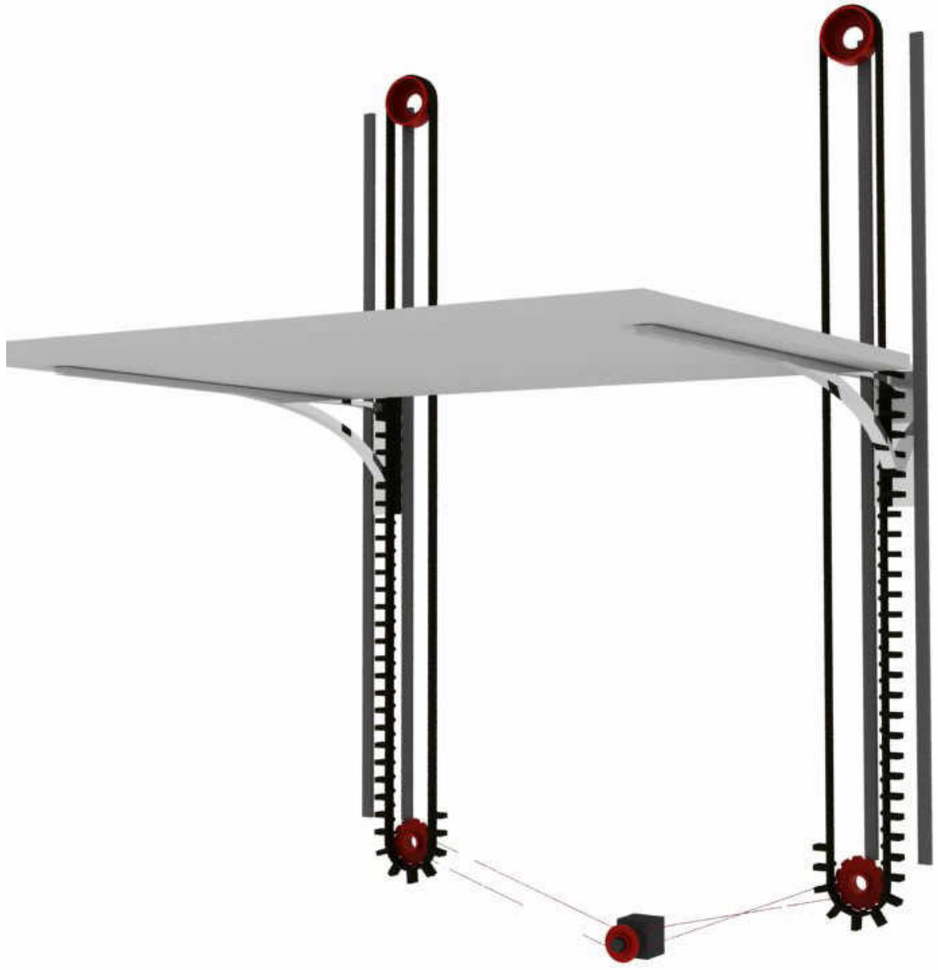

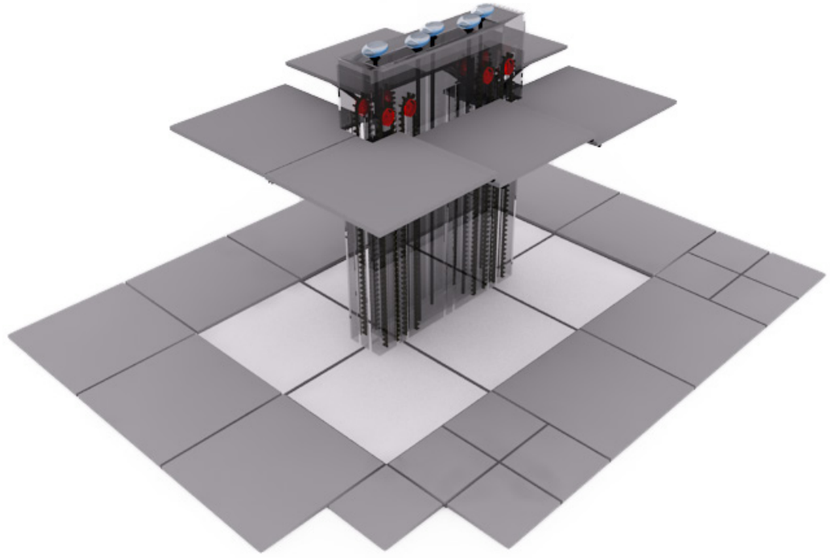

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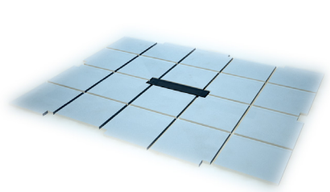
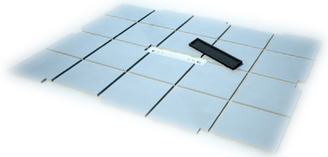
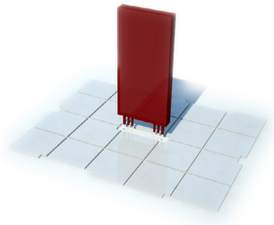
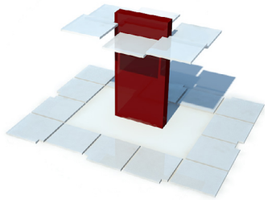
Structural Elements: "Walls"

- Backbone of the space emergence on the site

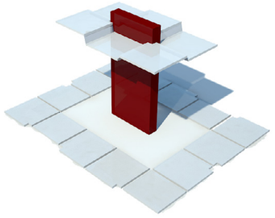
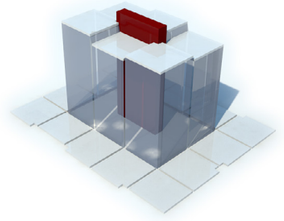



Wall nest on site → **Remove the cover** → **Carrying with forklift** → **Wall will be placed** → **Slabs will be elevated**

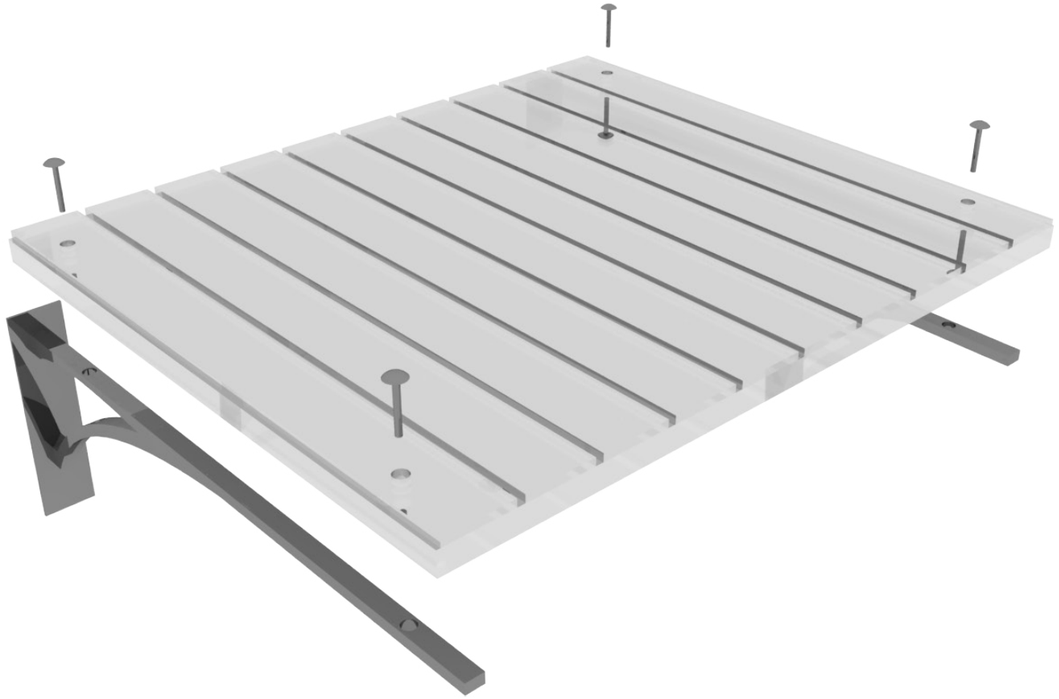
- Additional wall will be carried with a forklift to its location
- Wall will be attached to its nest
- Because it has its own mechanism and power source, wall will just use the ground as a structural foundation.
- With a remote control, slabs will start to rise on the wall with the support of the engine and gear system (conveyor belt system) of wall.

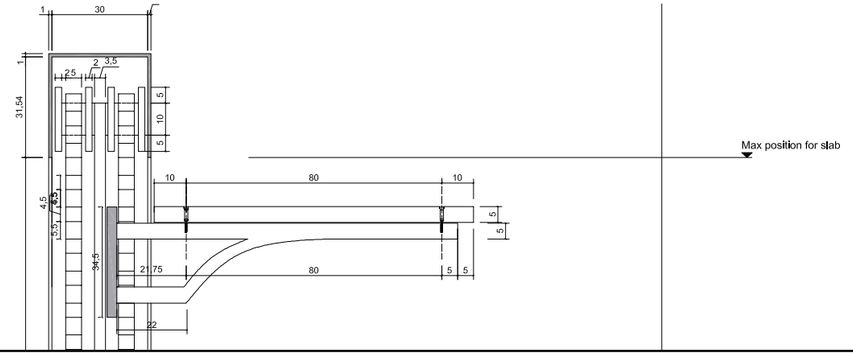
- Depending on the requirements expected during event, system can provide sun shading, protection from precipitation or fully closed exhibition place.

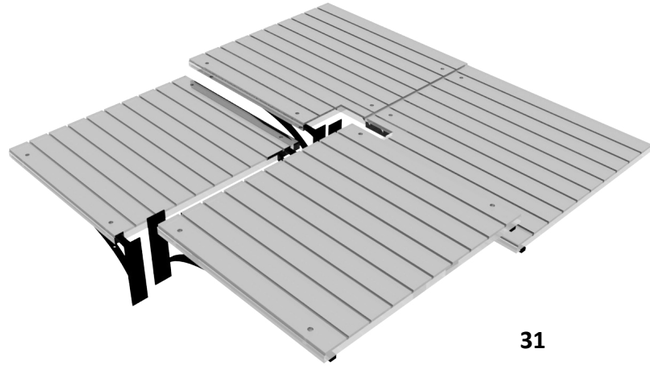



Flying Elements: "Slabs"

- Elements of the System
  - * Walls
  - * Slabs
  - * Bracings
  - * Roll-up Closure Elements
- Axis Shelters and Pavilions
- Space Variations that system creates
- Additional Features
  - * Lighting Elements







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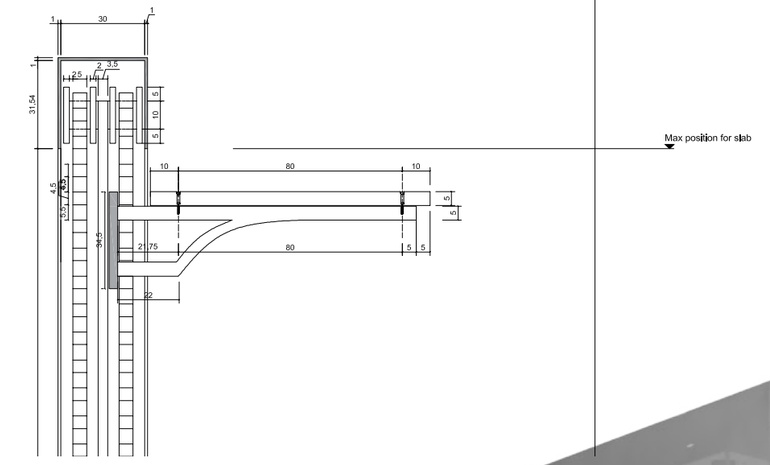
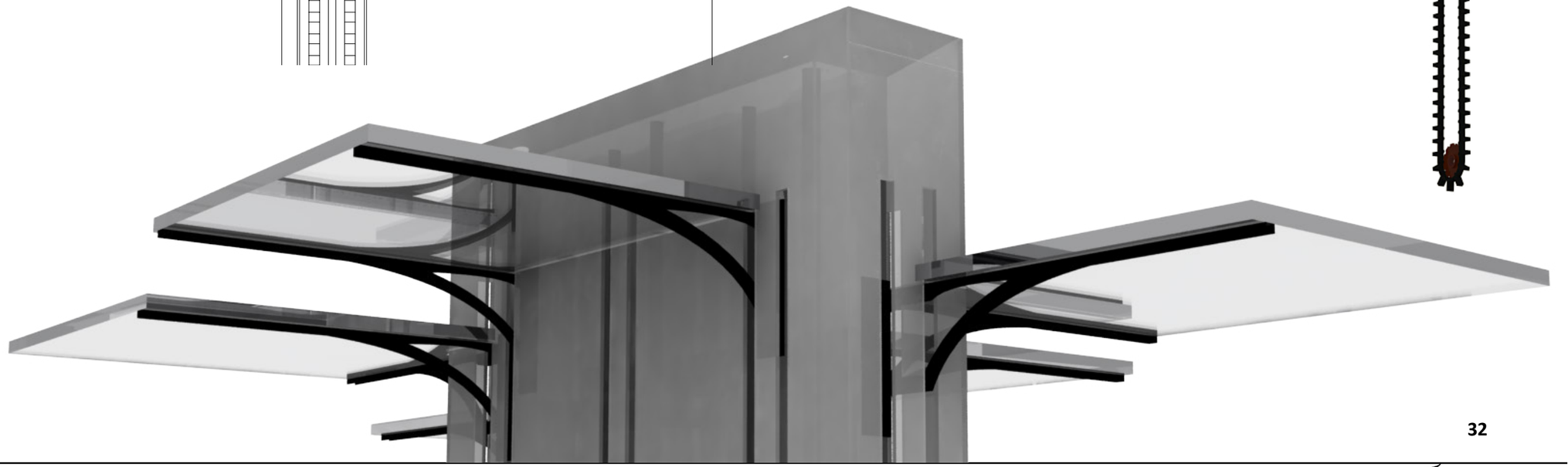
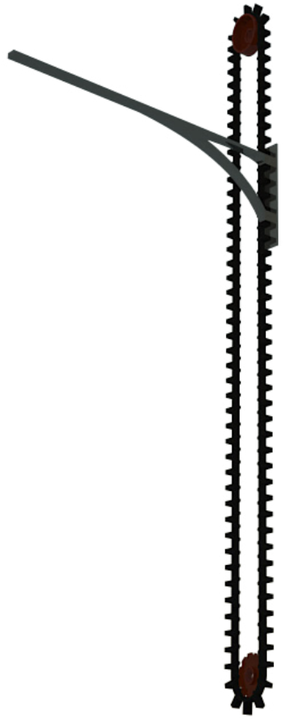
Structural Elements: “Bracings”







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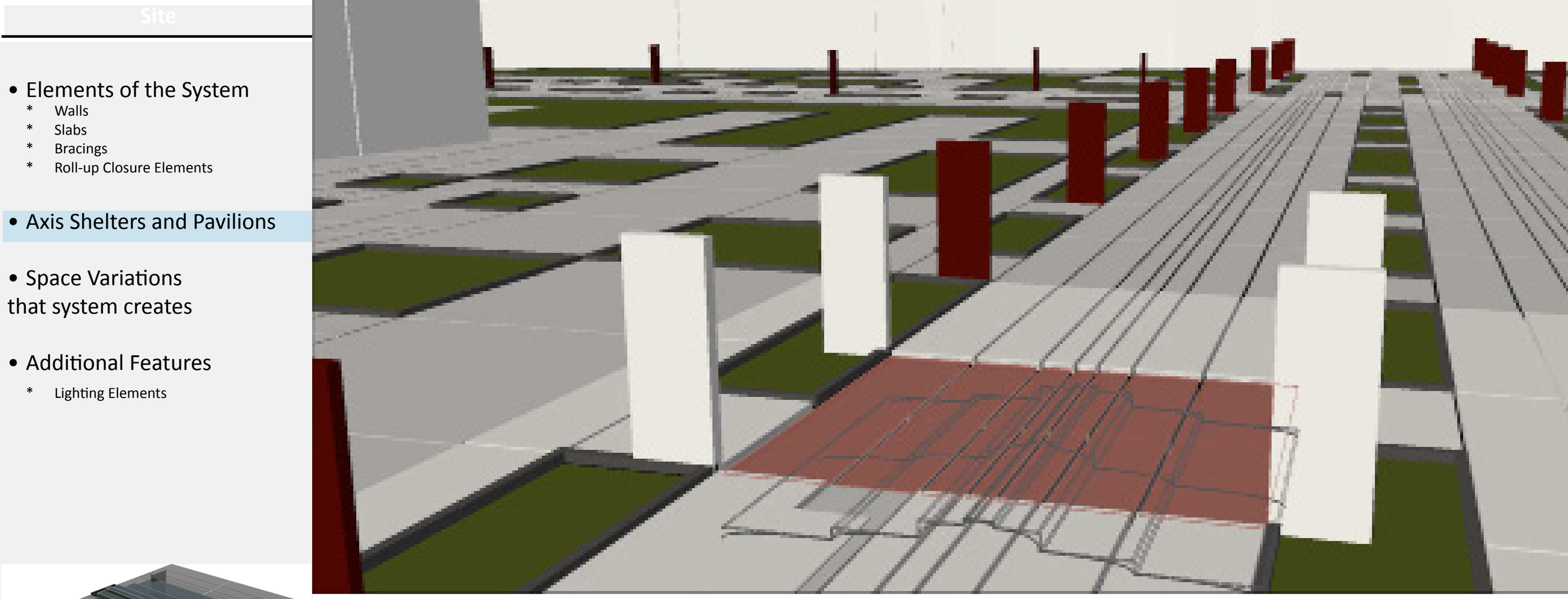
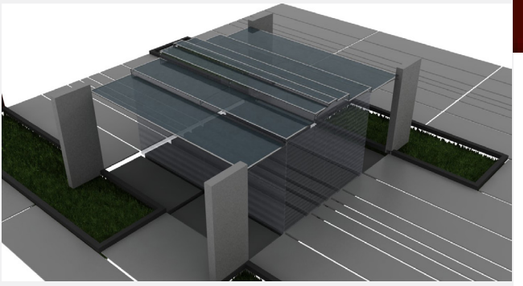
  - * Roll-up Closure Elements
- Axis Shelters and Pavilions
- Space Variations that system creates
- Additional Features
  - * Lighting Elements

Roll Up Closure Elements

- Between Slabs
- Between Slabs and the floor

- Elements of the System
  - Walls
  - Slabs
  - Bracings
  - Roll-up Closure Elements
- Axis Shelters and Pavilions
- Space Variations that system creates
- Additional Features
  - Lighting Elements

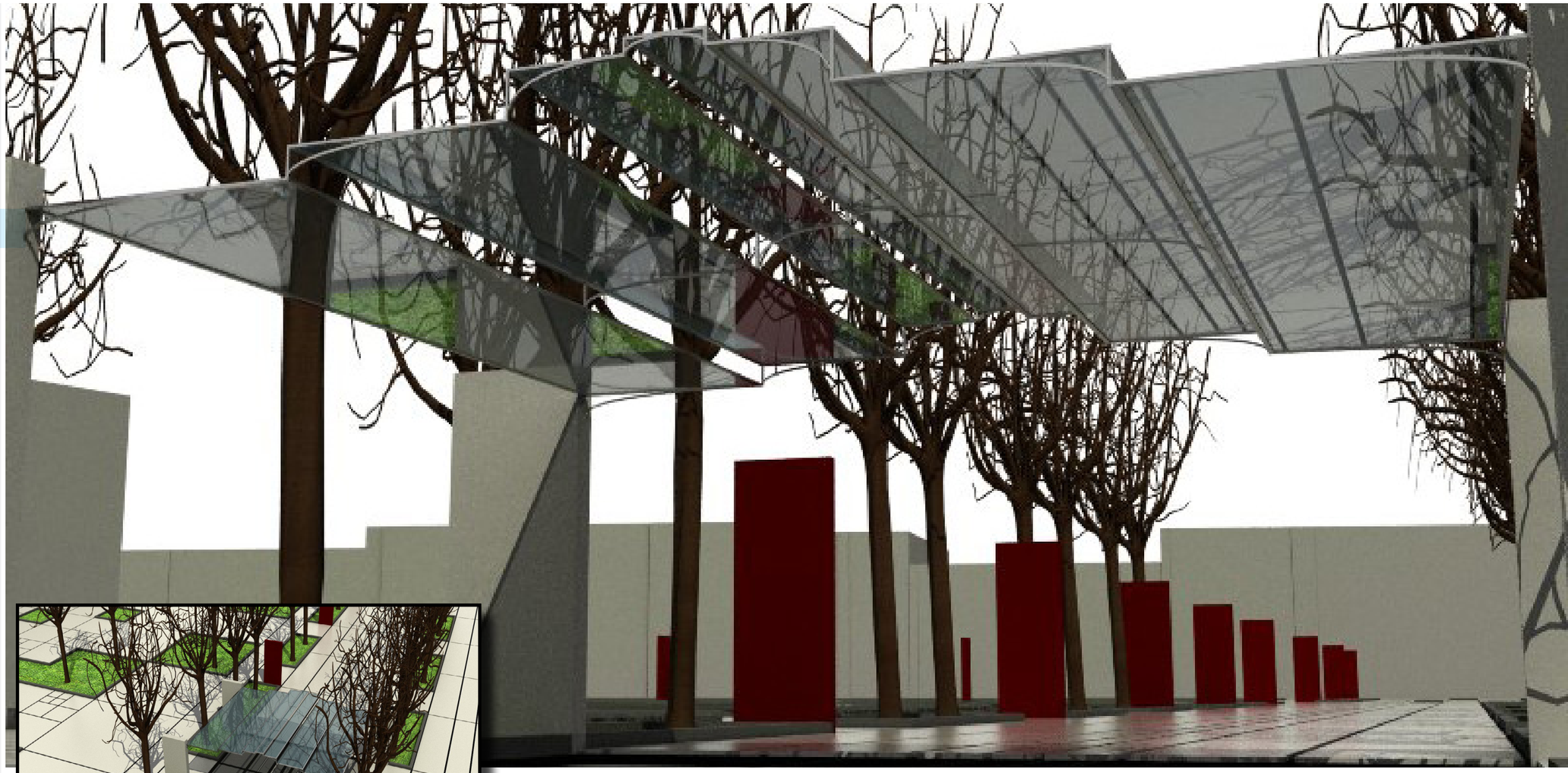




Axis Shelters and Pavilions

- Fixed frame underground the pavilion location
- Adaptable height according to the event that is going to happen

- Elements of the System
  - Walls
  - Slabs
  - Bracings
  - Roll-up Closure Elements
- Axis Shelters and Pavilions
- Space Variations that system creates
- Additional Features
  - Lighting Elements



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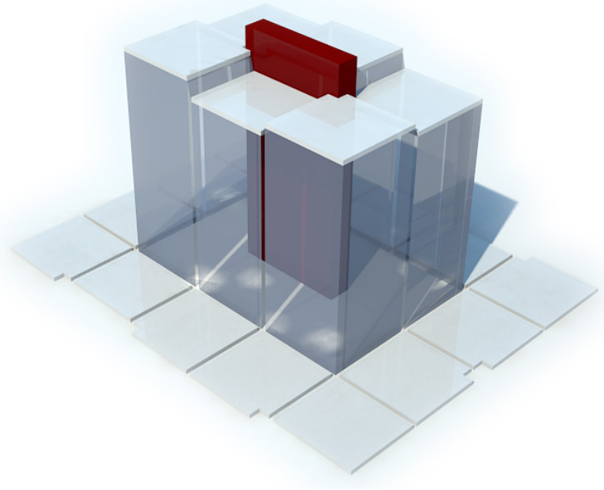
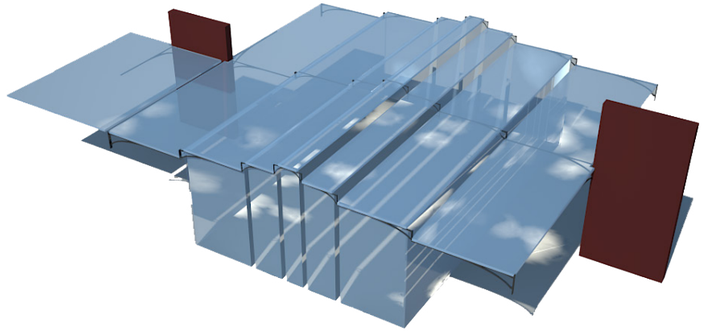
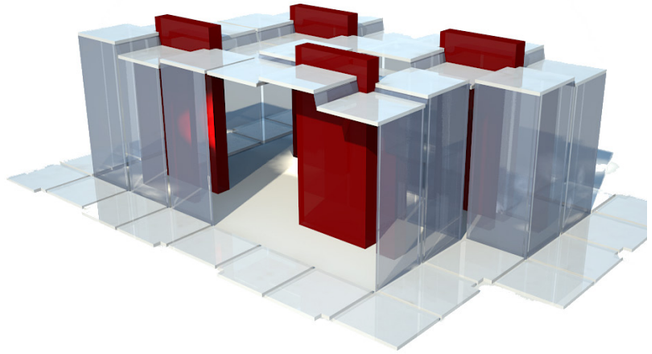
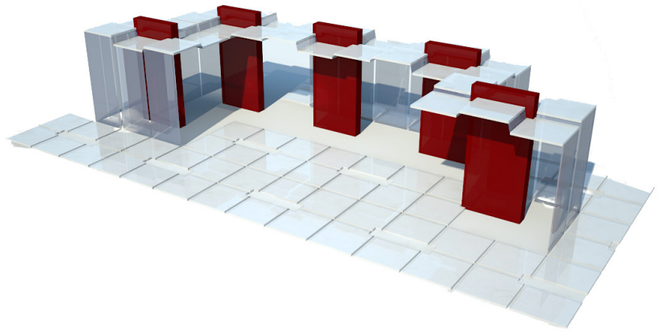
» Space Variations that system creates









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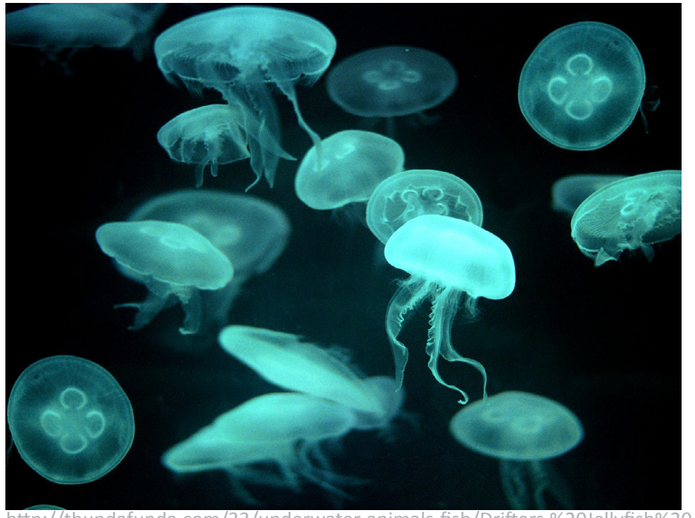
» Lighting System Elements : Helium Balloons

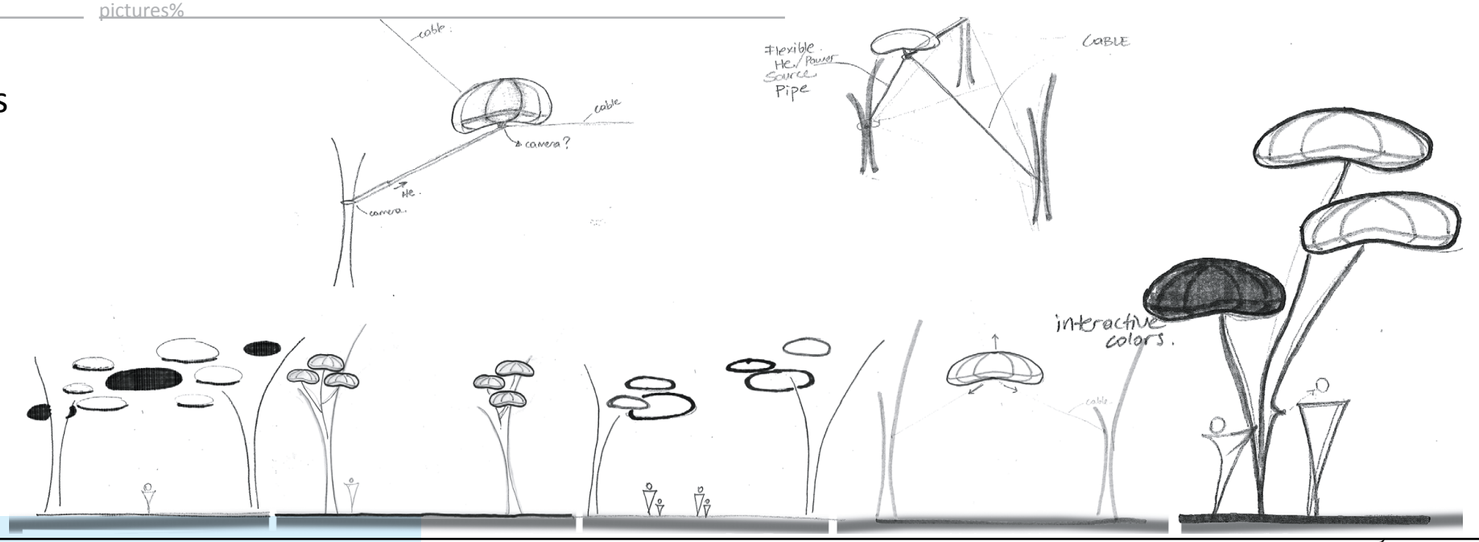
http://www.exchange3d.com/3D%20Model%20of%20Jellyfish/prod_3752.html



http://thundafunda.com/33/underwater-animals-fish/Drifters,%20Jellyfish%20pictures%

Inspiration: Jelly Fish

Initial Ideas



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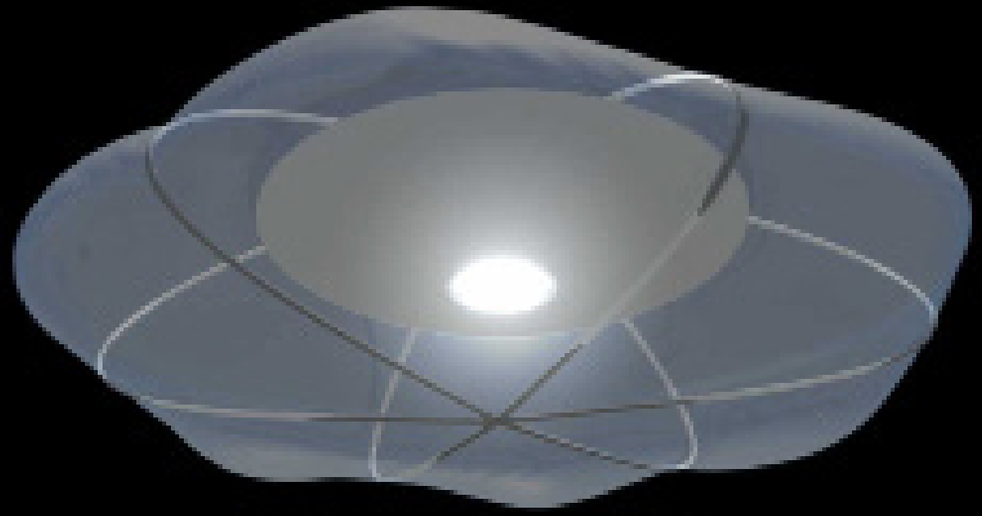

Elements of the Balloons

Reflective surface including GPS device

LED Lamps

Metal Skelaton

Latex Helium Balloon

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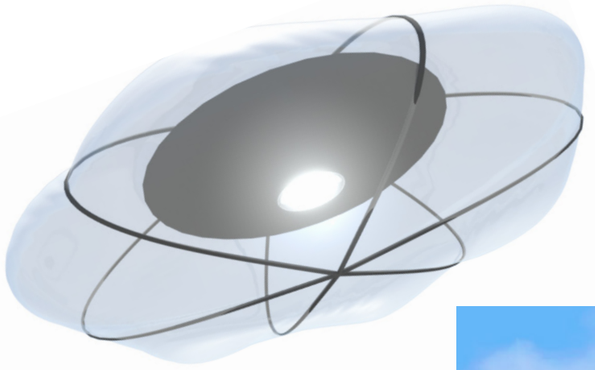

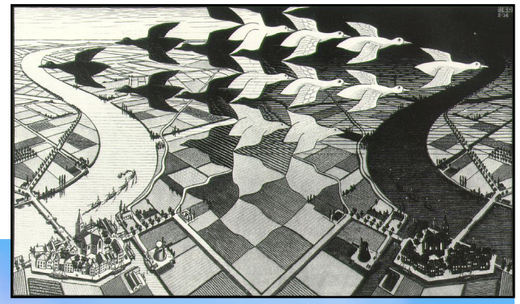

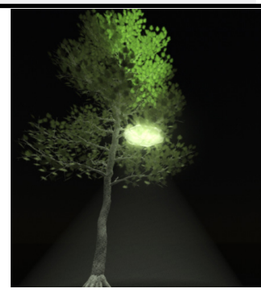

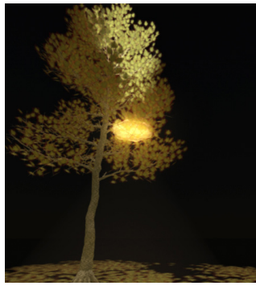

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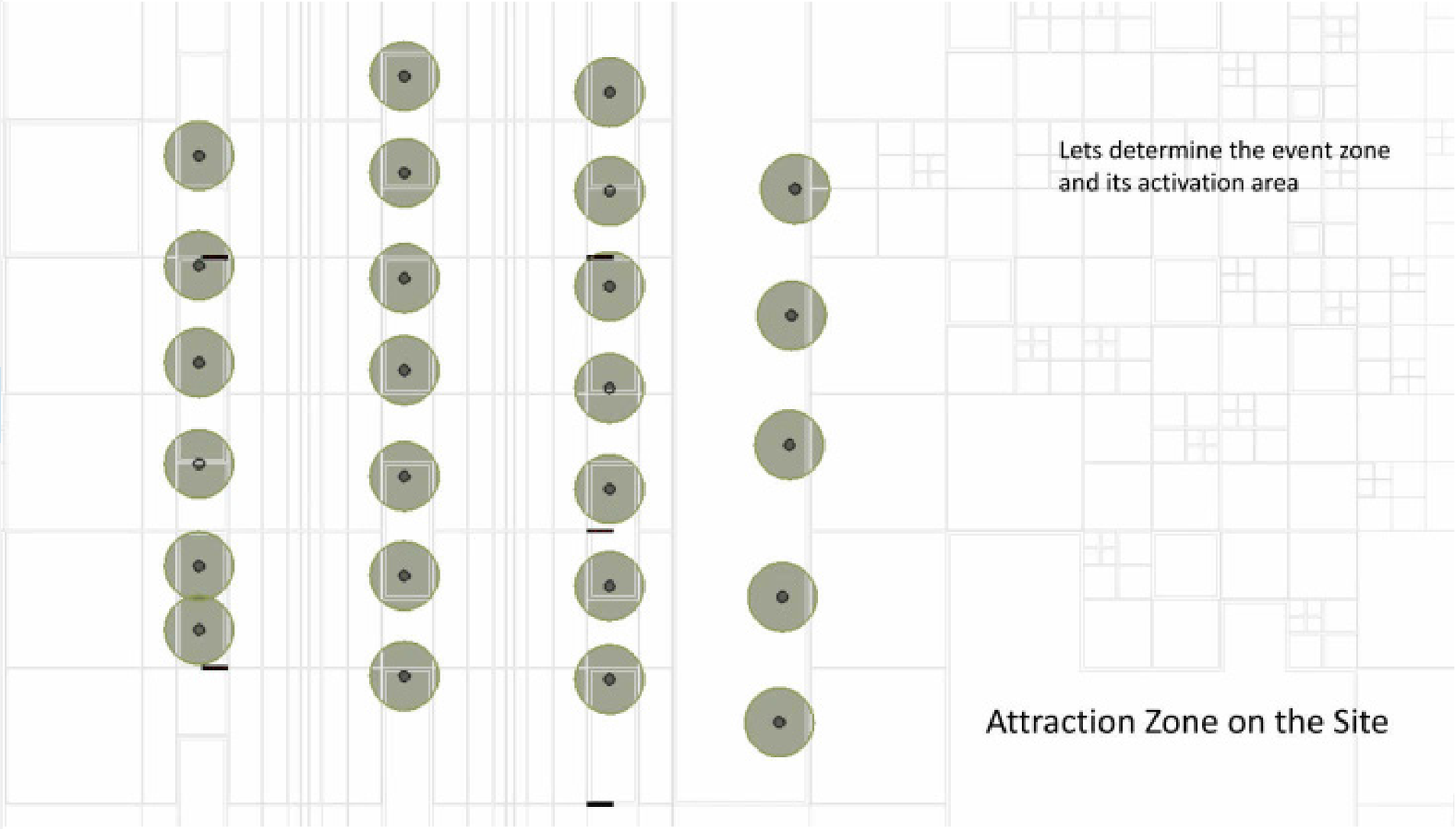

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- Possible Scenarios
  - Korte Voorhout
  - Lange Voorhout
  - Diligentia
  - Poosthorn
- Possibilities and Limits of the System
- What is the contribution of the system to the site?

Korte Voorhout : Market Place

Existing market organization has been replaced with a modular system that has been generated from the system raising from the ground.

Shelters have been created on the sides of the 2 main axises and circulation path has been cleared.

Structural walls has also been used as structure of shelfs that can be used for book and antique market.

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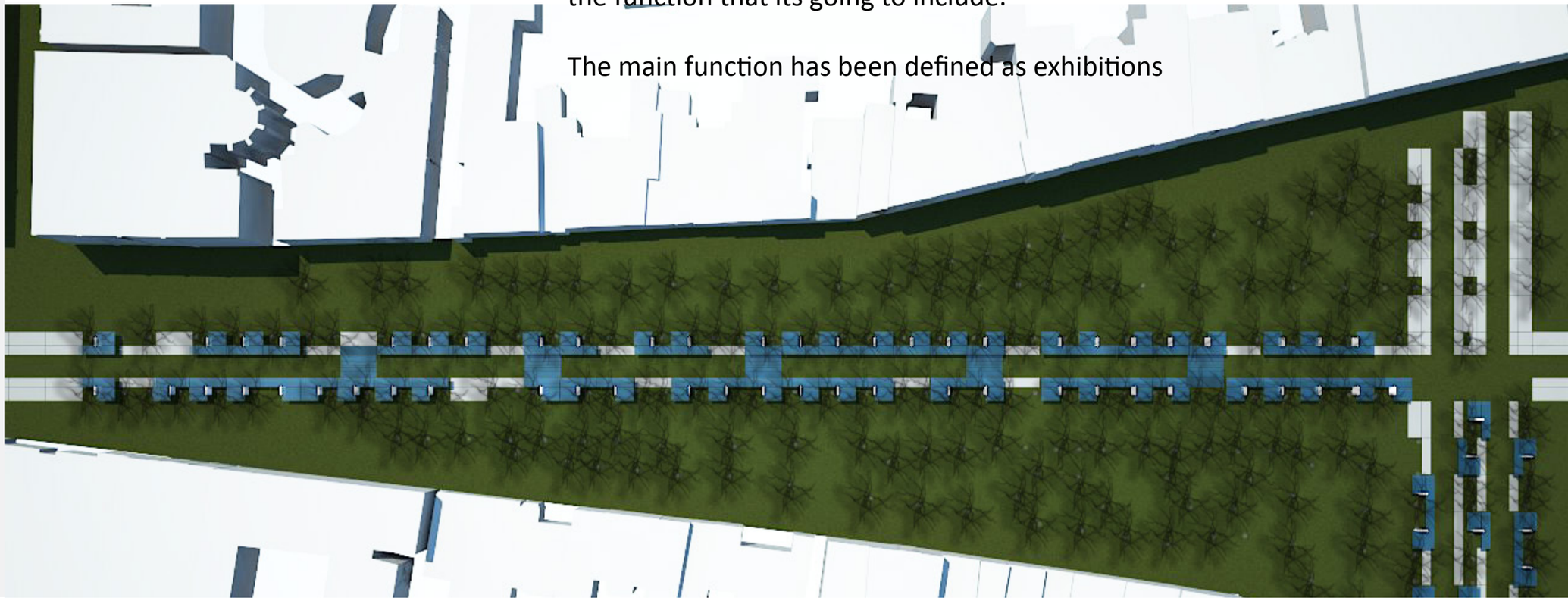
Lange Voorhout: Exhibition Axis

Shelters have been designed with respect to existing walking axis, trees and usage.

Height of shelters can be adapted according to the function that its going to include.

The main function has been defined as exhibitions



» Exhibition Area

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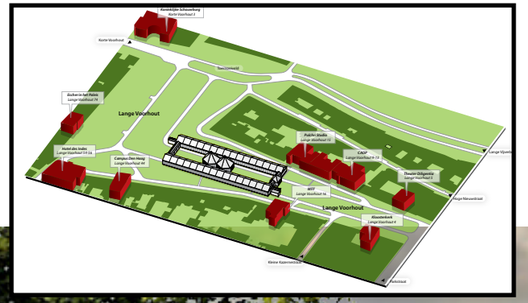

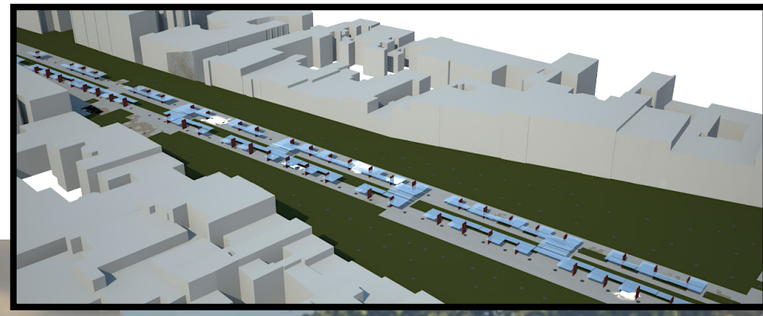

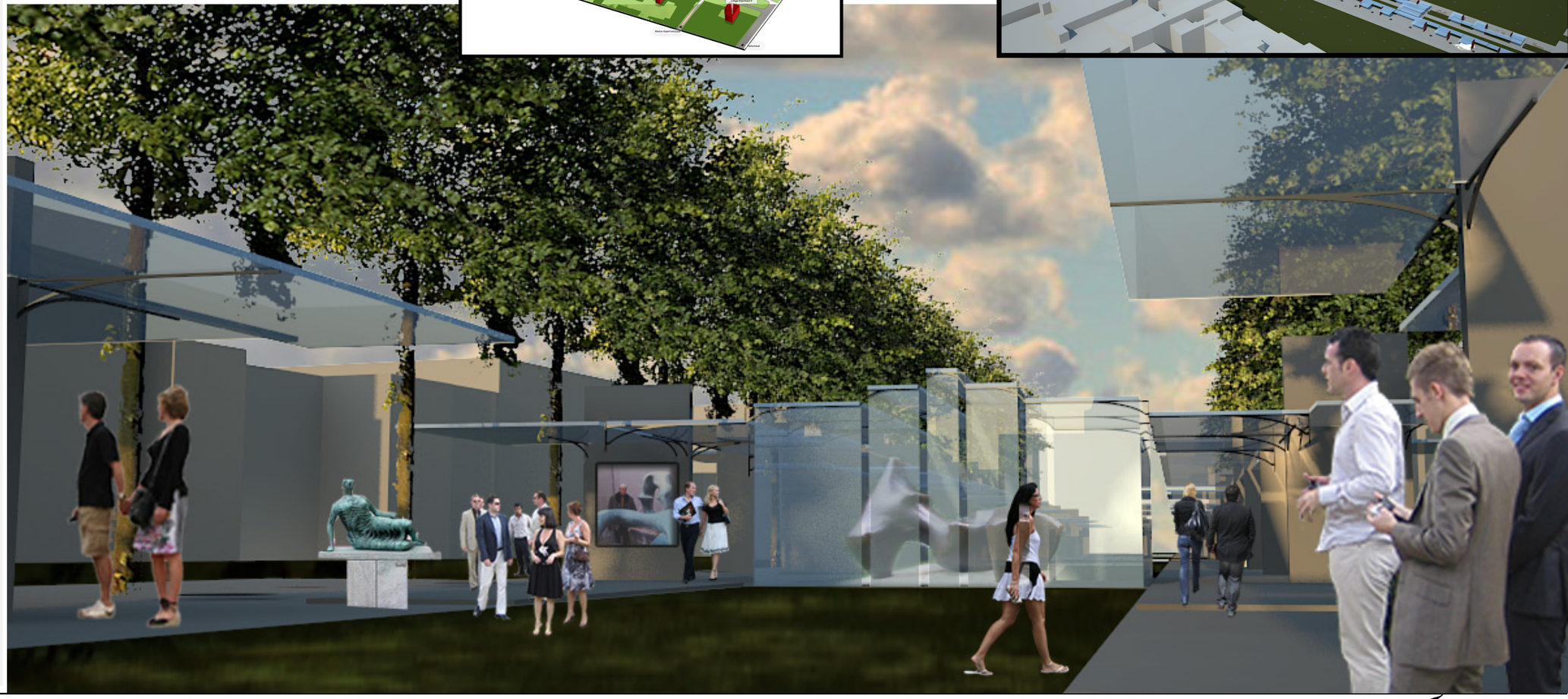

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- Possibilities and Limits of the System

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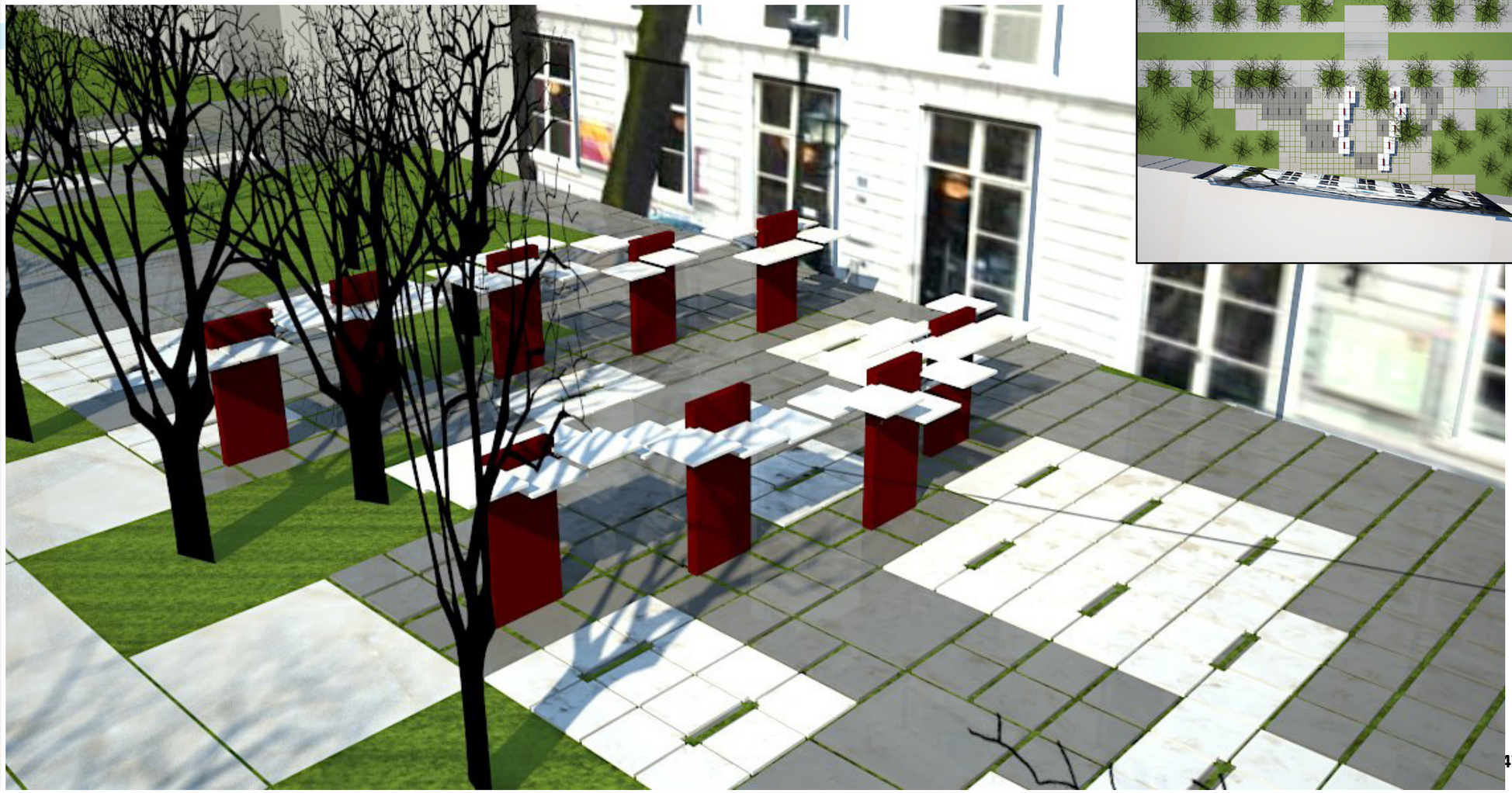
» Theatre Diligentia Open Air Foyer



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- What is the contribution of the system to the site?

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» Possibilities and Limits of the System

Adaptable : Living Environment System designed as it can be adapted either to linear or to central space organizations.

Respectful : It has a possibility to shape itself according to the site elements (in this case, trees, bulindings)

Deployable : System gives possibility to be removed not to disturb visual connection during royal ceremonies on the site.

Dynamic : one element has the capacity to be interactive to the event going on

Modular : system consists of modular parts that response to changing needs of the site

It is breathing, and living with its environment.

» Contribution to the Site

- Possible Scenarios
  - Korte Voorhout
  - Lange Voorhout
  - Diligentia
  - Posthorn
- Possibilities and Limits of the System
- What is the contribution of the system to the site?

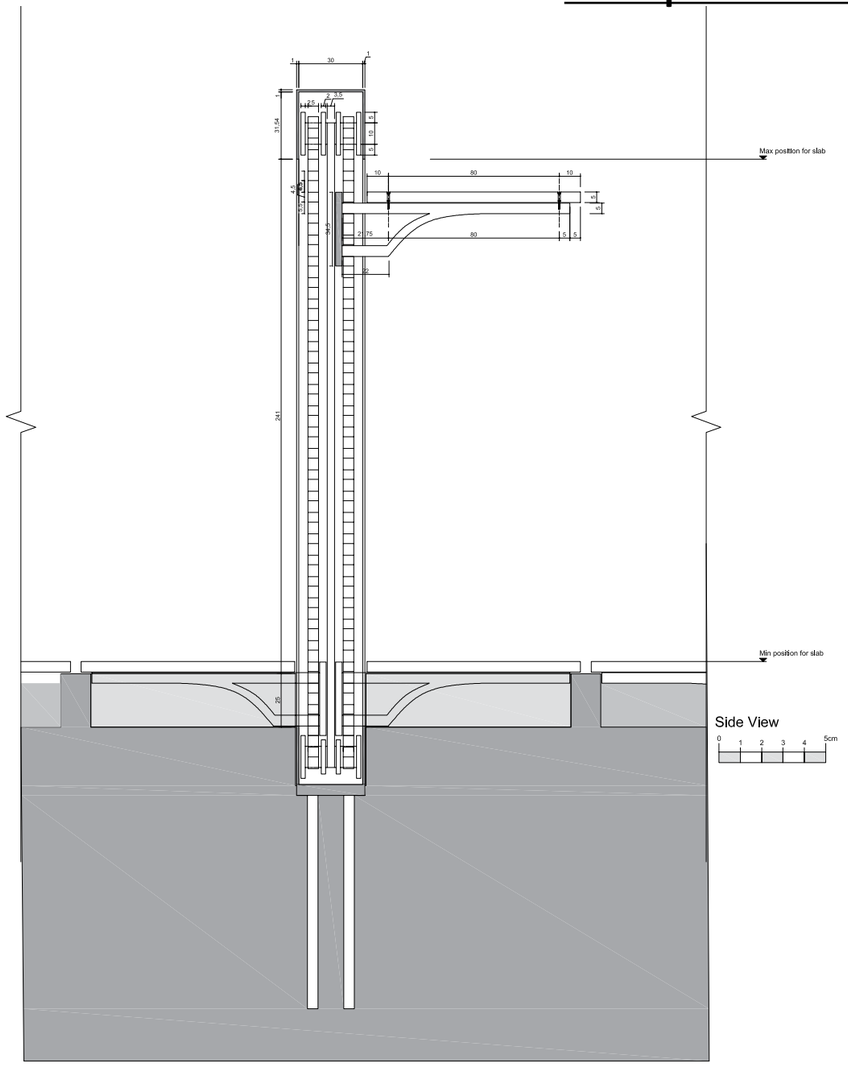
»(any) Remarks?

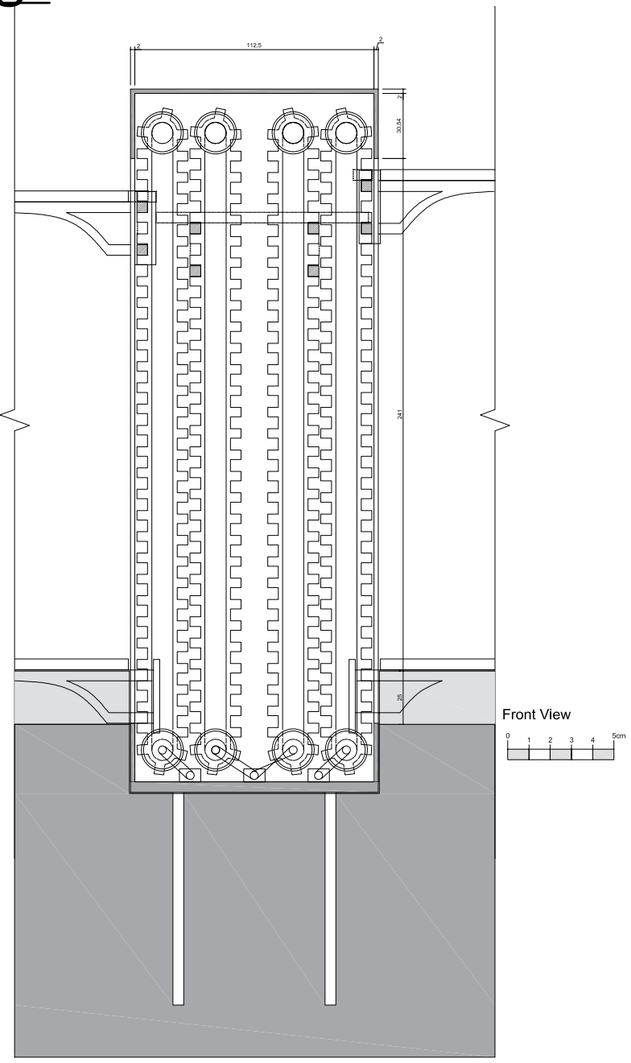
A **quadtree** is a tree data structure in which each internal node has exactly four children. Quadtrees are most often used to partition a two dimensional space by recursively subdividing it into four quadrants or regions. The regions may be square or rectangular, or may have arbitrary shapes.

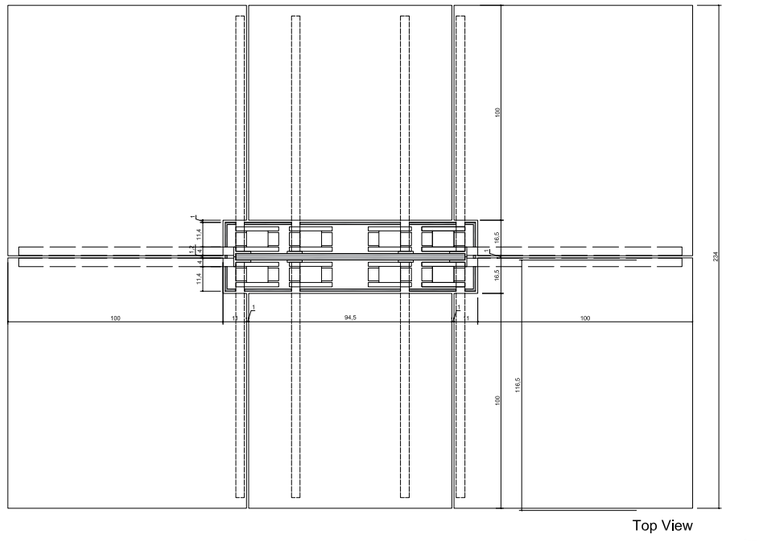
All forms of Quadtrees share some common features:

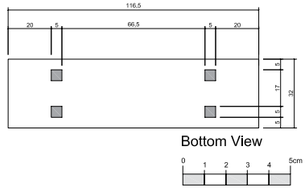
- They decompose space into adaptable cells
- Each cell (or bucket) has a maximum capacity. When maximum capacity is reached, the bucket splits
- The tree directory follows the spatial decomposition of the Quadtree.

» Shop Drawings









» Posthoorn

- Possible Scenarios
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  - Diligentia
  - Poosthorn

- Possibilities and Limits of the System

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