MAOSEN GENG
4228472
A HIGH RISE
AGRICULTURAL
RESEARCH CENTER
ARGUMENT

Chicago is the capital of nothing since the Midwest doesn’t exist.

The continued decline of the United States Midwest region, specifically the last decade, has affected Chicago in the way of shrinking population and jobs. The population of Chicago has been in decline for the past few decades. In fact, in 2010, Chicago was the only city to see its population decrease. While New York and LA population reached record highs in 2010, Chicago’s population dropped a huge amount. In fact, in columns such as India and China, Chicago would not be legally defined as a city.

The question is not whether Chicago belongs to the highly developed areas of the world, but whether it is a gateway city, acting as an appropriate combination of human resources, personnel, and infrastructure and facilities. It is located for eleven of the most successful corporations in the world. Nearly 30% of the Fortune 500 companies, which headquarter in the Midwest, are located in the Chicago metropolitan area. These companies generated over 3.5 million people in 2005.

However, Chicago’s lack of a major airport associated with world-class global city status is a significant industry. Hence, New York, entertainment in Los Angeles, government in Washington, etc. Perhaps this lack of definition, could even be seen in its industrial strategic element.
For a city of this size its main vision is to become an "alpha" city, where a lot of players, one shouldalganoma has for the second time of the region and the hundred cities, hold Chicago talk from its true potential. However, the strategic organization of the region, via transportation and mobility, as well as strong culture, definition, social policy, Chicago the resources and ability to develop a Global Hub, therefore, the development of Chicago and its ability to unify the Midwest into a cohesive and functional region, will further define it as the "hub of the next," and allow it to compete with New York and LA.

The Lakeside city, will be explored, as the site with an ambition to help Chicago achieve its global ambitions.

Re-unify the Midwest as a political, economic and cultural region. Sustainability. Help Chicago achieve its ambition to become a global city. In order to achieve its ambition, the strength of the Midwest should be unified, which mean, agriculture, academic research institutions, cultural landscape and fresh water resource in Great Lakes.
Summary Of Initial Research
USA vs MIDWEST GDP | in millions of dollars

36% of all USA agriculture activity
18 OF THE TOP 100 UNIVERSITIES
TOP AGRICULTURE UNIVERSITIES IN MIDWEST

LEGEND
- UW Madison
- Purdue University
- Iowa State University
- Ohio State University
Highspeed proposal
USE THE NEIGHBORHOOD
Neighborhood Needs

Community Farm School

Community Food School

Greenhouse

University Building

Community Health Care Facility

Algae Storage
Community Farm School

Case: Greenbank Farm @765 Wonn Road #A201 Greenbank, WA, US
Area: 5000 M2
GFA: 500 M2
FAR: 0.1

Program:
- Local Commerce
- Agriculture
- Recreation
- Natural Resource Stewardship
- Community School
- Community Partners
LOCAL INTERVENTIONS
PHYSICAL INTERVENTION
Food Market

Food Pavilion // Restaurant // Food Booth
Agriculture Gathering

Research // Education // Communication // Restaurant
Agriculture Museum

Exhibition // Lecture // Restaurant
Rural Tourism

Farm// Fishing// Communication
Farm and Food School

Lecture// Farm// Cook
CTA & Metra Station Plaza

Transportation // Retail // Agriculture Exhibition
Agricultural Education

Research // University
CAMPUS AREA: 6.2 KM²

POPULATION:
STUDENTS: 20,939
STAFF: 2,874

CORNELL UNIVERSITY

FACULTY
RESIDENTIAL
SPORT
ADMINISTRATION

ARGUMENT
CONCEPT
DESIGN

CORNELL UNIVERSITY
FOUNDED A.D. 1865
PROGRAM ANALYSIS

CORNELL UNIVERSITY
HARVARD UNIVERSITY
UNIVERSITY OF ILLINOIS
UNIVERSITY OF MICHIGAN
UNIVERSITY OF TOKYO
WACHNINGEN UNIVERSITY

OTHER
SPORTS
ADM.
RESIDENTIAL
EDU.
Researchers Working Stuff

need

12.5 m² area in Research Building

1 m² Research Facility

need

2.6 m² Research Field

\[ \times 12,000 \text{ People} \]

are estimated to work here, including researchers, scholars, students and working staff
In Total

Total land area for agriculture research: 670,000m²

Land use program in agriculture research:
- 390,000m² Research Field Facility
- 30,000m² Building Construction Area
- 140,000m² Landscape
- 110,000m² Transportation Area

150,000m² Research Facility
390,000m² Research Field
Agricultural research buildings occupied the majority of the land, but left only a few land for agriculture research field. Even though it is a agriculture research community, its identity is not so clear. It is rather an urban area than an agricultural area.
But what if we combine all the research buildings together, we stack them into one mega agriculture research facility. The density of research facility would increase dramatically, but the total area of it would stay the same. Then, we'll have enough field area for outdoor agriculture research.
In the final masterplan, we only proposed several buildings, but with high density. So that it would left vast land for field. The agriculture research community would rather be a rural land area than an urban area. In addition to that, this area would have clear identity, the vast rural land and high rise agricultural research tower.
PROGRAM ANALYSIS

OFFICE 42.6% 31161m²
SERVICE 10.6% 7700m²
RESEARCH 48.8% 34279m²

OFFICE 40.3% 29521m²
CONFERENCE 2.25% 1640m²
RECEPTION 4.4% 3200m²
SERVICE 6.2% 4500m²
GREEN HOUSE 0.7% 508m²
LABS 28.5% 20863m²
ACADEMIC 17.6% 12908m²
Based on some simple principles, the program volume are split and re-mixed into the building. For example, service area are divided and each of them are adjacent to office and research area, so that it can serve more space. Green House area are located between lab area and academic area. Conference area are caught between research part and office part.

Extrude and solidify program bar
The total area of the building is about 73140 m². If we set the one floor area as 1450m², then the tower would be 50 floors and about 200m high. According to the dimensions mentioned above, the program bar are extruded and solidified.
Cut the program bar into small pieces and remix them. Different programs are combined together, but stay the same proportions.

Extrude the program bar in the tower volume. The combination in 3D creates a lot of potentials for interesting space, such as terrace, courtyard and high space.
RESEARCH FACILITY TYPOLOGY

AGRICULTURE RESEARCH

BIOLOGY RESEARCH

COFERENCE CENTER

AGRICULTURE LABORATORY

BIOLOGY LABORATORY
Green House Typology

Green House Units | Composition of Green House | Connection with Administration Facility | Connection with Research Facility

<table>
<thead>
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<th>10m</th>
<th>20m</th>
<th>6.3m</th>
<th>20m</th>
<th>57.3m</th>
<th>18m</th>
<th>9m</th>
<th>12.5m</th>
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<tr>
<td>8.1m</td>
<td>27m</td>
<td>3m</td>
<td>27m</td>
<td>54m</td>
<td>16m</td>
<td>6m</td>
<td>92m</td>
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<tr>
<td>6.4m</td>
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<td>12m</td>
<td>5.4m</td>
<td>3m</td>
<td>12m</td>
<td>92m</td>
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</tbody>
</table>
We split the program volumes into small pieces. The dimensions of these small pieces are based on the typology research of research buildings in those top ranking agricultural research schools and institutions. So, we can draw some simple conclusions of those research buildings. Normally, the research buildings are in 'U'-shape or 'L'-shape. The width of a research building is normally 18m, which is suitable for a 3m corridor and two 7.5m wide labs are on both sides. The dimensions of offices and service area are much more similar to research part. The width of it is about 7.5m to 9m. The dimensions of conference hall are much bigger. In my case, the dimensions of conference hall is 24m by 36m, and about 15m high. And so does the reception part. Now that the dimensions of each part differs from each other, we can create an interesting volume if we stack those volumes on top of each other.
CONCEPT ILLUSTRATION

6 PIECES OF BURR PUZZLE
CONCEPT ILLUSTRATION

36 PIECES OF BURR PUZZLE
6 PIECES OF BURR PUZZLE

36 PIECES OF BURR PUZZLE
How to stack the burr puzzle prototype on top of each other and make them a high rise building and there are fluent connections between each other?
CONCRETE CORES

Different directions of vertical elements. All of the elements are in the same size. But the vertical elements cannot go through bottom to top fluently.
Extend the vertical elements, so that the cores go through from the ground level to the roof top. The vertical transportation space and service space could be easily arranged in these cores.
High-rise Tower

Concrete Cores, which contains elevators and staircase

Functional Elements are hanging on the concrete cores

X-axis Elements
research facilities & offices

Y-axis Elements
research facilities & offices

Voids
inside of high-rise tower
The horizontal elements could be easily extruded out to make some extra space for academic research and office. In addition to that, the extruded volumes could create more terrace space for vegetation, green houses and even leisure.
Near the location of high-rise research building, there exists 7 iconic buildings. They are mainly agriculture related functions, such as food market and agricultural museum. What I propose is a virtual spiral curve, which connects these iconic buildings and loop center. This curve related the urban context with the high-rise building and helps to define the shape of it.
According to the program analysis and also the composition logic of the high rise building, it would be around 400m high, so that it can accommodate 120,000 working stuff as estimated. The only one tower was surrounded by a spiral curve, which shapes the building based on the urban context.
I cut the one high tower into two pieces, one is about 280m high, the other is 150m high. The advantage of splitting the tower into two pieces is that two similar iconic building would create much iconic atmosphere than one did. The other advantage is the height of the building is dramatically reduced, so that the shadow of the building would affect the surrounded research field less.
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WEATHER ANALYSIS

Annual Sun Path in Chicago
WEATHER ANALYSIS

Wind Frequency in different seasons in Chicago
OPTIMISE FORM OF THE BUILDING

Forms are defined by different curves. They are slightly different in curvatures and distance between curve and buildings.
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CFD ANALYSIS
AIR FLOW RATE
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Forms are defined by different curves. They are slightly different in curvatures and distance between curve and buildings.
INTERIOR MATERIAL OF THE LOBBY

- Corten Steel
- Concrete Panel
- Marble Tile
- Perforated Panel
- Plywood Panel
INTERIOR MATERIAL OF THE LOBBY

- Acoustic Panel
- Drop Tile Ceiling
- Ceiling Light
- Double Glazing
- Black Frame Door
What I want to achieve on the terrace space is the permeability of vegetations. Now that the high rise research center is for agriculture. Therefore, on the terrace, the researchers could have build their own green houses for agriculture research. In addition to that, the terrace space could also function as public space, such as for viewing and leisure.

On top of the towers, there exists glass pavilion, which are purely intended for scenery viewing and public functions.
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Those detached elements create more public and terrace space for people who are using this high-rise building.
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FACADE CONSTRUCTION
Air Exchange System

Fresh air from outside
Exhaust air to outside
Fresh air to inside
Exhaust air from Yide

Fresh air from outside
Exhaust air to outside
Fresh air to inside
Exhaust air from Yide
COOLING AND HEATING SYSTEM

Aquifer Cooling System

Floor Heating System

Aquifer Cooling System

Floor Heating System

Cooling & Heating System
COOLING AND HEATING SYSTEM

Aquifer Cooling System

Floor Heating System

Aquifer Cooling System

Floor Heating System

Cooling & Heating System