VOID EXPANSION
SPORTS COMPLEX ARCHITECTURE DESIGN

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DATE: 26/09/2014
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Along Lake Michigan on the Southeast Side of Chicago lies a huge empty tract of land. Probably the largest vacant parcel of land in the city, it was formerly home to the U. S. Steel South Works, the largest integrated steelmaking operation in Chicago. Almost 20,000 people were once employed where empty fields of concrete and rubble now sit.

The facility that eventually became South Works began in 1857 under the name of the North Chicago Rolling Mill, which was located in the northern part of the city of Chicago. The plant later moved to South Chicago because raw materials could be shipped in via Lake Michigan, as well as an existing labor pool and available fresh water from the lake and the Calumet River. In 1889, the facility merged with three other steel mills to form a new company called Illinois Steel, which later became part of Federal Steel. By 1901, the company was under the control of US Steel.
At its peak, the steel mill employed some 20,000 people, which spurred the development of a new community centered around the mill. The mill complex covered a total of 600 acres, part of which had been reclaimed from Lake Michigan with molten slag.

Beginning in the 1970s, the facility began downsizing due to a shifting market for steel, and by the end of the decade the number of workers at the plant had declined to 10,000. The mill continued its decline, and on 9 January 1992, it was announced that the facility was to close. On 10 April, the plant permanently shut down with fewer than 700 people employed at the time of its closing.
Through an online survey, the four Chicago neighborhoods listed on the “25 Most Dangerous Neighborhoods” in the nation are number 4 on the list, South Halsted Street and West 77th Street in Chicago’s South Side Auburn Gresham neighborhood. In this neighborhood, the data reveals that there is a 1-in-9 chance of being a victim of a violent crime. The violent crime rate is 116.56 for every 1,000 persons.

Number 13 on the list of 25 is South Homan Avenue and West Roosevelt Road in Chicago’s Southwest neighborhood of North Lawndale. In this neighborhood, the data reveals that there is a 1-in-12 chance of being a victim of a violent crime. The violent crime rate is 80.17 for every 1,000 persons.

The third Chicago neighborhood listed on the national list of 25 comes in at number 16. This is South Ashland Avenue and West 76th Street in Chicago’s South Side’s Auburn Gresham neighborhood – the same city neighborhood as Chicago’s most dangerous neighborhood listed at number 4 on the national list. At South Ashland Avenue and West 76th Street, the data reveals that there is a 1-in-14 chance of being a victim of a violent crime. The violent crime rate is 73.05 for every 1,000 persons.

The last neighborhood on the total list, number 25, is around South Indiana Avenue and East 60th Street in the Washington Park neighborhood. The data reveals that there is a 1-in-15 chance of being a victim of a violent crime. The violent crime rate is 65.77 for every 1,000 persons.

Not only violence, the South Chicago is also suffering from unemployment, low qualified education and serious health problems. The whole neighborhood is waiting for a powerful future plan to reactivate this land.
Developers and community leaders have long discussed what to do with the vacant South Works steel mill site, which encompasses 600 acres along Lake Michigan in South Chicago. SOM, working with an international team of experts, has conceived an ambitious plan that calls for transforming the brownfield property into a sustainable, mixed-use community that aims to be an exemplar for future developments.

The neighborhood would include housing, businesses, and green space. Every home would sit within a three-minute walk to a park, and residents and visitors alike would have waterfront access. The city’s rail and bus system would serve the district, and pedestrian and bicycle paths would connect with downtown. Other sustainable strategies include water recycling, native landscaping programs, and the use of solar and wind power. Part of the LEED® for Neighborhood Development Pilot Program, Lakeside will demonstrate the potential for converting an industrial relic into a thriving green community.
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Unveiled on August 16, 2011 by Mayor Rahm Emanuel, the Healthy Chicago policy identifies 16 health outcome targets, 12 priority areas, and 193 supporting strategies. It is a continuous project with stable investment, and the government’s support make the healthcare development available. A part of the agenda has been put into practice in small scale projects, and in the following years, it needs a place to establish a strong and centralized public health base.

Based on the policy, our group began to develop a top-down strategy to bring in a powerful new anchor to Chicago southworks. Health City, the theme came up from the Healthy Chicago policy, will help to build a nice future version to largely improve Chicago southworks.
A campus is almost a guarantee to have a mixed race without any significant social problems since it attracts multiple people. The neighbourhood where De-Paul University is was 30 years ago a poor, gang-invested, high crime ghetto area and now it is one of the best neighbourhoods in Chicago.

To respond the connection with existing neighbourhood, the health city is centralized with a health science campus. And several healthy lifestyle communities located on each side of it.

We defined the exact definition and components of a Health City. The ten parts come from health science related and healthy lifestyle related. We designed a mixed campus including all components to achieve the Health City goal.
In the group strategy, we will develop the central area as the first stage. Ore walls are the great element to absorb large amounts of people and bring them into the campus. Our four individual designs are also between the walls. At the very beginning, education center, sports center, library, research center and some residential buildings will be built. This is also a corner of the central campus. Based on the first stage, the other parts will be completed in years.
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In the definition of the Health City, the need for recreation and sports is one of the important components of healthy life related elements. Exercising is the best way to keep a healthy body. The health cluster needs a place to offer people play sports items.

Various groups of people are in the campus area, including students, teachers, researchers and some patients. There will also some visitors out of Chicago southworks. To clarify the common need by all these people, it is clear that a healthy body is needed for everyone to achieve their own goals. Fitness quality is always the base to do other activities. If combine the research of the South Chicago neighborhoods we can find that there are only several outdoor baseball court. A sports complex with some popular items as basketball, fitness, swimming and rehabilitation is essential in the Chicago southworks.
This is the future version of the central area. With research and educated facilities around, the sports center can easily connect all the other buildings together and absorb large amounts of people. The project is not a stadium for audience, but to encourage everyone to join it and exercise the body. After the heavy research or study in the campus, people will love to spend their time to have fun in the sports center to become healthy, and enjoy it.
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Ore walls are the most important heritage in this vacant land. To better develop further architecture design within the ore walls, the dimension of them is essential. There are four ore walls in the central area of Chicago southworks, two in the south are taller and bigger. They are 3m wide, 8m high and 700m long, which is huge. Two in the north are 1.5m wide, 6m high and 600m long, which is a little smaller. The ore walls were used as shipping goods, now they contain the memory of US steel company. In our plan we keep all of them and develop our own projects inside them. We all try to activate and improve the spatial qualities of the walls.
Considering the large dimension of the ore walls, I made the spatial section to analyze the space between walls. It is clear that with the join the building volumes, the space will be more vivid and interesting.
The contrast between the man and the ore wall is strong, but it will also become an interesting startpoint to develop spatial qualities. We are allowed to demolish small part of the wall or dig a hole in it, but not suggested to destroy large block of the walls. It becomes a challenge.
These are the connection between the harbor and several roads through the ore walls. Each road has its own characteristics. Along the ore walls there are also the path towards the lakeshore. So in individual design we cannot block these acess. It is very essential to organize the relationship between the building and all these traffic roads.
It is essential to find a specific location of the building. Along the ore walls we designed six roads across the walls and connect the both sides of the harbor. The one in red is different. It is an axis. It not only connects the shore, but also connects the building from north to the south. The path is part of the axis, but currently there is nothing in the walls. To continue and strengthen the axis, something needs to be done between the walls.
After the discussion, we all find our own spot to begin the individual architecture design, which is shown in the picture. Finally, a conference center, a library, a sports complex and an education center will occur in the central area within the ore walls.
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The path is already there, but it is only a path, which means it only has the function of letting people through it. Since the building will be designed within the path, I try to find an appropriate way to combine them together. There is no doubt that the path is the main traffic for people to enter the building, but the relationship between the path and the building is important.

In the sketches, if the building is on one side of the path, the path actually changes nothing. But, if the building is on its both sides of path, the definition of it has changed. The spatial feeling is stronger than before and, the path becomes part of the building. On the other hand, I didn't forget that the path is part of the axis.
Next, with the join of the building volumes, the path is much stronger than before. However, it is still a path. It still only has the function to let people walk through it, which is quite a pity. The building can help to develop more space within the path. If expand the space towards both sides, the road will become much more interesting. Space is created, and the path also changed. It still has the function as traffic, but adding more activities as playing, staying, etc.

The sketch through four ore walls represents the changing space at the ground floor. Solid and void, dark and bright, a lot of things will happen.
Space is formed because of bounders. The medium of boundings can be everything. We can imagine a one floor high space is like a box. A box has six facades, when standing on the land, the spatial feeling is weakest. With one face, the feeling becomes stronger, but still weak. With more and more faces are added, finally the person will be wrapped inside of a room. One single unit has 9 possibilities, when put 2 or 3 units together, the space will be much more interesting.

Four types of space occur in the later design, with the stack of 4 units.
Through 6 steps the building reaches its final stage. Every step is based on the site conditions as the ore walls or sunlight.
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Flying roof, the spatial concept of the ore walls. To keep a distance with the top of the walls, the building will form an interesting space with sunlight shining inside. Atmosphere is created.
The other side is the same, but it is one floor flying over the walls towards the harbor. The white facade of the building makes a clear contrast with the ore walls, leaving a distance between them. In this way the space is able to have a depth inside.
There are six types of space formed within the ore walls in the building. Considering the characteristics of the ore walls, many possibilities will happen.
The wall is long and high enough, a skylight formed with the wall will bring in nice sunlight to form an atmosphere. The shadow of the truss is on the wall screen. The indoor basketball court will become very comfortable.
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Courtyard space with the ore wall.
Indoor basketball court with the ore wall
Horizontal path along the ore wall
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Fitness, basketball and swimming are the three main functions inside the building, and they are also very popular in Chicago.

Functions are bubble everywhere, a central traffic is an essential way to organize all of them. With the big and long central traffic in the building, it is convenient to reach everywhere.
In the section of the east block of the project, the building is mainly consists of functions in small rooms as the restaurant, squash and offices. the flexibility in this part is larger than the other half of the project. the main entrance is also in this block for better management.

Fitness center, indoor swimming pool and the basketball court are the biggest functions inside of the building. they are all in the west block of the building. changing rooms are connected with them.
On the ground floor, because of the ore walls so the building must be divided into four parts. to keep the path in the middle, these four parts are indepent from each other on the ground floor. their functions are also different as the main entrance, the basketball court offices for staff, and the swimming pool.on the floor, people are free to go anywhere but they can enter the building only from the east block.

The main traffic corridor is in the right volume of the building. with horizontal connections, the two parts of the building is convenient for people to walk anywhere. the connections above the ore walls also devide the central path into several blocks. the space is divided and organized.

Above the ground floor, the building is well connected. on the 1st and 2nd floor people are free to walk in any rooms. there are corridors on the orewall, ensure the route is convenient and efficient.

Vertical traffic as elevator and stairs are located in many places in the building.

Without the building, the path is still a lonely path. the building is not going to cut or block the path, but to redefined it and bring in more spatial possibilities. with the form and volume of the building, some space in small size is created along the central path. the path is still has the function for people to walk through, but also gets more functions for people to stay or keep away from the rain.

Instead of the original situation that people walk in straight line to pass the road, now people can slow down and enjoy the feeling of the building on both sides. the central path still directly connects the four ore walls to the horbor, but people can stay in the courtyard or change to walk in horizontal way along the ore wall.
The vertical traffic isometric diagram. Stairs and elevators are placed in each part of the building.
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Floor heating & cooling system under the floor.

Winter/heating

Summer/cooling
The application of the aquifer under the Chicago land has a long history. It is 500 feet to 850 feet deep down there, containing large amounts of constant underground water. The temperature is about 18 degrees, which can be used as pre heating and cooling in different seasons.

The ventilation is mainly based on the skylight from above. Fresh air will be absorbed in the heated by the energy from exhausted air. Heat exchanger is in the ceiling and helps to transfer the heat from waste air to cold and fresh air in winter. In summer there is no need to transfer heat, but to cool down the fresh hot air from outside, so a air cooler is needed.
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With the network, the main structure system of the project is 200mm thick reinforced concrete load bearing walls. Wall is the main structure element is also because of the ore walls on the site. Walls help to organize space. The distance of the net is in 6m/unit.

Reference project, the art center in concrete wall structure.
To achieve the flying architecture feeling, the truss is used to make the cantilever beam. With the diagram of the force on a cantilever beam, the shape of the truss can be determined.

On the other side of the project along the harbor, the truss on the roof is lift the volume of the building by steel columns. In this way a flying box and a flying roof can be made in straight lines.
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1. INSULATION GLAZING:
   12mm TOUGHENED GLASS + 20mm AIR CAVITY + 12mm LAMINATED SAFETY GLASS IN ALUMINIUM FRAME, ANODISED BLACK.

2. 10mm WHITE RENDER ON 12MM GYPSUM BOARD.

3. 2.5mm ALUMINIUM SHEET METAL, ANODIZED,
   50mm CONCRETE ELEMENT, ANODIZED,
   40mm THERMAL INSULATION,
   VAPOUR BARRIER,
   BITUMINOUS SEALANT LAYER,
   200mm REINFORCED CONCRETE.
1 70mm ARTIFICIAL STONE PARAPET COPING.

2 PARAPET CONSTRUCTION:
390mmX185mmX40mm NATURAL STONE FACE,
50mm VENTILATION GAP,
9mm PUR RIGID INSULATION,
BITUMINOUS SEALANT LAYER

3 65mmX55mmX10mm STEEL L-PROFILE FOR SHEAR PROTECTION,
MOUNT TO SPACERS

4 ROOF CONSTRUCTION:
40mm NATURAL STONE,
10mm VERTICAL JOINTS,
10mm POINT FIXED SUPPORT ELEMENT,
30mm DRAINAGE AND BUILDING PROTECTION MAT,
3-PLY BITUMINOUS MEMBRANE,
120mm PUR RIGID INSULATION,
VAPOUR BARRIER,
200mm REINFORCED CONCRETE SLAB
SUSPENDED CEILINGS:
50mm GYPSUM BOARD
STEEL SUPPORTING STRUCTURE

1 FLOOR CONSTRUCTION:
20mm LARCH PARQUET WOOD FLOORING,
8mm MORTAR BED,
50mm CEMENT SCREED WITH UNDERFLOOR HEATING/COOLING
SEPARATING LAYER,
60mm PUR RIGID THERMAL INSULATION,
200mm REINFORCED CONCRETE SLAB
80mm THERMAL INSULATION,
BITUMINOUS SEALANT LAYER

2 90mmX600mm CONCRETE ELEMENT, BUILDING PROTECTION.
To help keep the "Straight lines" as the basic architectural language of the building, truss is used as the cantilever structure. The shape of the truss can be considered as the combination of a large expansion and a small cantilever.
1  ROOF CONSTRUCTION:
   40mm NATURAL STONE,
   10mm VERTICAL JOINTS,
   15mm POINT FIXED SUPPORT ELEMENT,
   30mm DRAINAGE AND BUILDING PROTECTION MAT,
   3-PLY BITUMINOUS MEMBRANE,
   120mm PUR RIGID INSULATION,
   VAPOUR BARRIER,
   60mm DIMPLED STEEL MEMBRANE,
   VERTICAL STAINLESS STEEL MASONARY,
   TRUSS STRUCTURE.

2  INSULATION GLAZING:
   12mm TOUGHENED GLASS+20mm AIR CAVITY+12mm LAMINATED
   SAFETY GLASS IN ALUMINIUM FRAME, ANODISED BLACK.

3  10mm WHITE RENDER ON 12MM GYPSUM BOARD
1  CONNECTION CONSTRUCTION:
20mm STEEL STUDDED MAT
22mm STAINLESS STEEL BOARDx2+20mm STUDDED MAT
200mmX50mm STEEL FIXING MEMBER

2  INSULATION GLAZING:
BITUMINOUS SEALANT LAYER
160mm RIGID THERMAL INSULATION
60mm ALUMINIUM FRAMING

1  FLOOR CONSTRUCTION:
20mm SANDSTONE PAVER,
8mm MORTAR BED,
SEPARATING LAYER,
15mm IMPACT SOUND INSULATION,
50mm THERMAL INSULATION,
200mm REINFORCED CONCRETE SLAB

2  SEAT:
390mmX420mmX400mm PLASTIC SEAT, FOLDABLE,
16mm ALUMINUM BOARD,
12mm VERTICAL STEEL FIXING MEMBER.

3  RAILING:
100mmX300mm WOODEN COLUMN,
40mm STAINLESS STEEL RAILING,
16mm ALUMINUM BOARD,
10mm VERTICAL STEEL FIXING MEMBER.

1  FACADE CONSTRUCTION:
40mm NATURAL STONE CLADDING
390mmX790mm/190mmX790mm,
50mm AIR CAPACITY,
BITUMINOUS SEALANT LAYER,
9mm THERMAL INSULATION,
200mm REINFORCED CONCRETE,
10mm WHITE INTERIOR RENDER.
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Based on the previous research, the Health City strategy contributes a framework of future development of Chicago Southworks to follow the Healthy Chicago Policy and brings employment back to this area.

The Sports Complex project follows the Heath City program and then develops its own depth from interactive perspectives as architecture, building technology and climate design.

Although the ore walls are over 700m long, the project redefines and improves at least part of the ore wall space, especially the axis path connects both sides of the harbor. Previously it is only a lonely path, but now it is a semi public/private space. People can stay or play inside that many activities will happen.

The building also develops space based on the combination of "solid and void". Spatial qualities and atmosphere are created with the help of natural light and the shape of the volume.

To achieve the "Flying roof" atmosphere, the building also solves the challenge from structure. The aim is to keep "Straight lines" as the basic architectural language that truss is the best way to complete the cantilever task.

The Sports Complex project creates qualities through its design and helps to become a new anchor to activate Chicago Southworks.