This reflection paper is about my stance on the graduation project which has been performed in the studio of Strategic Architectural Design Development (SADD) in the chair of Materialization. We, SADD studio, suggested United Nations to create a new council of sustainability, as environmental issues are growing and they are critically influencing our life as economy, culture or wars do.

While I have been designing the new UN Headquarter for Sustainability (or UNEC, UN Environmental Council), I tried to achieve the academic goal of the chair of Materialization. The chair of Materialization focuses on a right craft choice to develop ideas from paper to material reality.

*The making of any architectural work started with an idea. However, between the first notions and the final work lies an ocean of possibilities and choices.*

*Design Development is about recognizing those possibilities and making the right choices, using the right tools and input, at the right moment, on a proper scale. As such, the design develops energetically and smoothly, and the work acquires a clear, mature coherence and expression.*

—Introduction in <SADD reader>, fall 2011

As the introductory article of SADD studio stands for, what I mostly focused on during the design process was to make a smooth and coherent transition between architectural concept and its form, and between the architectural form and materialized model.
ARCHITECTURAL CONCEPT and FORM

1. URBAN ANALYSIS

My architectural concept is developed mainly by the building’s urban position. SADD studio assumed that the new UN Headquarter for Sustainability (or UNEC, UN Environmental Council) will be located in New York, just next to the current UN Headquarter buildings at Midtown.

My research was started from reading the city to understand urban condition. Building design should be derived from its urban context, because a building has a reciprocal relation with its neighbourhood, in that the neighbourhood accommodates the building, while the building accommodates inhabitants in the neighbourhood. Especially, when the site is located in a highly dense metropolitan city, the relation between the building and its society becomes stronger. Among the many aspects of the city, I focused on the city’s dominant ‘spatial’ property. And then I researched how does the dominant cityscape affects the daily routine of the city, and tried to find an answer about what kind of change or intervention should be brought for sustainable city.

- The cityscape of New York City, especially of Manhattan Island is distinctively homogeneous with high-rise towers on a strict street grid. In Manhattan, there are over 200 streets and 16 Avenues. There are almost 6000 high rises buildings in this Island. Such cityscape was developed only from 200 years ago with The Commissioners’ Plan in 1811. The street grid enable the city expand horizontally, and high-rise towers are suitable to vertically accommodate the high density of population. The Manhattan grid and high-rise tower is definitely effective system for this growing mega-city operation. However, humanity has no priority in this cityscape. The highest priority in this city is efficiency of growth and movement, thus saving time and money. Raymond Hood, an architect of Manhattan (42th street) said that ‘New York is a city of Tower.’ And the New York citizens are ‘easily working without thinking on account of the amount of work that there is to do’. The cityscape forces the citizen just to rush to achieve the goal in front of them.

The spatial property that derived from the current cityscape became a base of my building suggestion. Thus, my building suggestion is aiming to escape from the city, which means that my building design, that possibly totally confront against the city, can have the relation to the city to belong in the city.

- In this context, public space, or a space for public benefit, in New York City should provide the citizen a moment to stop rush and get relaxed escaping from their hectic city life and from the strict city grid frame. In this regard, I started to study distorting grid space, aiming to provide proper intervention that the neighbourhood asks to the plot for the public benefit.

As such, I got a design method (twisting grid surface plane) from the urban analysis. I think combining spatial problem from the step of idea making was a good starting point that makes form shaping process goes easier and more coherent.

2. PUBLIC DEMAND

As a next step, I moved to my point of view from urban scale to neighbourhood scale. I researched the demands on the site from the neighbourhood. The UN plot is facing 1st Avenue at one edge and East River on the opposite edge. In short, the plot is placed between city and nature. I could find the public demand towards the plot, and the demand becomes a guide line the way how the grid surface plane should be twisted.

- New York City need more green space. In 2004, New York City published Manhattan Waterfront Greenway Plan. This plan is about to connect all the existing waterfront parks so that the city has 32-miles of continuous green route that circumnavigates Manhattan Island. By then and until now, the waterfront along the UN plot has no public access due to security concerns at the UN and lack of space along the FDR road. However, responding to the strong need from the neighbourhood, UN already agreed to build a waterfront park on its property.

- Following this future vision, our studio made our common design direction which is to create an active connection between city side and riverside on the UN plot so that public from the city side can easily access towards the waterfront park and vice versa.

3. PRIVATE NEED
Even though the building plot has a strong demand from public, the building itself is private. Thus, designing the site and the building is a process of compromise between public demand and private need.

- After 911 attack, office buildings and public buildings in Manhattan enhanced their security level, and UN building was not an exception. All visitors should be thoroughly checked before they enter the building. Thus, to compromise between the need of security and the need of openness to public, it is ideal to clearly divide public zone and private zone.

Public demand and private need are easily conflicting. Public wants to open the territory, and building users want privacy and safety. What they need for their own needs is a border between public space and private space. There are several architectural ways to split these two zones. For example, two zones can be divided by a horizontal border providing level difference. Also, a vertical border can be introduced to share the ground level territory.

4. Architectural Concept and Form making

However, what I wanted to achieve from the border design was not only its efficiency but also humanity,—humanity is what I found that the city needs from urban analysis— not only clear spatial division but also intimate face towards public. The border shouldn’t be just a strict fence or a wall against the public, but it should express that the border is welcoming and embracing public flow. At the same time, this public–friendly gesture should also give a benefit for the quality of private zone.

The architectural concept about border design between public space and private space was formed in an architectural shape with the grid twist method that I previously defined from urban analysis. I tried to make a surface shape that enhances the public flow between city and waterfront park, and also that clearly and friendly divides the public space and private space. Thus, this one simple architectural shape fulfils the demand from the three different scales.

1. Urban context : high rise towers on grid street structure = hectic life → distorted grid space can be introduced for public space
2. Public demand : to allow public connection between city and waterfront park on UN plot
3. Private need: to procure security, clear and friendly division between public zone and private zone

Following diagrams explain how I twisted the grid based on my architectural goals.
ARCHITECTURAL FORM and MATERIALIZATION

Developing architectural form into materialized model is a process dealing with reality. My border surface, a ruled surface, was studied by computer 3d modelling tool. The geometry of the surface was defined only by reference points and lines, thus the surface has no thickness. To realize the virtual surface into a building envelope, the surface has to be replaced with realistic materials with thickness. Thus, detail solution should be researched to minimize the gap between architectural form and realized form. Also, the material should be chosen logically in terms of structure, construction, climate and maintenance.

1. STRUCTURE

The first step to realize the embracing entrance façade for public influx was to remove visual obstacles on the ground. Thus I needed to study mega-cantilevered structure without columns that are supporting the structure from the outside. Since I wanted to make the building architecturally very simple, so that people can only focus on the suggested entrance façade, I tried to avoid any additional noticeable structure for the cantilever such as a pole for tension cables. Instead, I designed a huge steel truss cantilever as we can see in the double leaf bascule bridge.

For the material choice, I searched several projects with shell-like façade or roof like my building. Among them, the most important reference project was Metz Pompidou (2010) in France designed by Shigeru Ban. The roof of the museum is made of laminated timber shell structure. The timber shell consists of double layers of intersected laminated timber beams in three directions. Laminated timber is very qualified load-bearing material while it can be bended or twisted. (In my building’s case, the roof only has torsion but no bending.) When they are intersected with double layers or three layers of timber beams, the structure gets stronger and it can bear a long span maximum around 60 meters. Also, compare to other load-bearing materials, timber is light-weight. Considering this, I should hang the timber shell under the cantilevered façade: light-weight was very important factor to choose material. Most importantly, laminated timber beam structure enable the reference lines visible, so that the grid surface façade delivers the initial architectural idea.

2. CONSTRUCTION

Joint detail between ruled grid surface and cantilever façade was also carefully designed. The outdoor effect and indoor effect that my border surface façade brings were both important. However, I put higher priority for the outdoor effect of the façade, as it gives the first impression to everyone (both to public and users). Thus, I offset all the needed material detail inwards, and I tried to remain the outline of the façade the same with the outline of the architectural form.

At the same time, I tried to simplify and standardize the joint detail. Even though the architectural form follows one simple principle, realized joints have all different angles and shapes. To be able to use standardized joint detail for all connection point, I aligned the pivot of the hinge joint component on their common reference axis. And then I designed the hinge joint component to have a slot for the connection with each end of timber beams—which are inserted with correspondent slotted steel shoes—to be arrayed inwards of the grid surface façade.
3.CLIMATE and MAINTENANCE

Finishing material was chosen by practical reasons such as climate or maintenance which are inevitably stronger reason than architectural intention.

The timber material is weak at moisture. Even though special treatment for waterproof, it has a possibility to be swollen by moisture. My architectural intention was to remain the reference lines visible and tangible. However, in reality, safety reason and practical reason come first than architectural reason. Thus, I covered the outside of the grid surface with insulating glass resulting tangibility of the reference lines very weak.

Also my architectural intention was to assign the same material solution for the whole grids shell façade, so that it has homogeneous and continuous appearance. However, depends on whether it is located, the façade becomes a roof or a floor. Such changing functions made it difficult adapt the same finishing material for the whole façade.

BUILDING FUNCTION in SUSTAINABILITY

As the building represents UN headquarter of sustainability, I also took sustainability of the building into account. When I designed the building form, I considered more about the sustainability that the form gives in terms of urban context rather than the building’s own climatic efficiency. Because of its place in the society (iconic importance, public role and high security and safety measures), making a sustainable intervention of the society was a main focus to design the building form. The building form provides widely open public accessibility between city side and river side, while the building secures its own private zone. The way of distorting the grid surface created an iconic, at the same time, relaxing and welcoming space in the homogeneous cityscape of Manhattan where 6000 high-rise buildings are packed on the grid streets.

Thus, in building scale, I should have to put more effort to make climatically sustainable building. My sustainable strategies in building scale was focused on renewable energy and energy-efficient climate system that are supported by smart architectural elements, providing that the building eventually consumes a lot of energy due to the building’s location and its complex function that asks high rate of comfort.

According to climatic data of Manhattan from 'Climate Consultant', a building in Manhattan needs active heating for 259 days(71%), active cooling for 41 days(11.2%), and dehumidification for 20 days(5.4%) a year to achieve comfort indoor climate, when the building has only sun shading of its window. In short, the building uses energy for more than 80% of the time annually, and most of the energy is for heating.

The building accommodates four different user types (secretariats, delegates, press, and visitors) and five different knowledge fields (collect, produce, propagate, exchange, and general department). As there are different users with different visiting frequency and duration, and as there are many rooms with different scales and different purposes, the climatic system for the building’s indoor comforts has to be largely dependent on mechanical system rather than passive architectural solution.

To fulfill high rate of comfort, the building’s mechanical climate system is controlled by both convection and radiation. Radiant heating and cooling uses water to deliver the heat to the room. This method uses less energy, and it gives higher comfort than convective method. Radiant heating and cooling heats up (or cools down) the room steady and slowly. Convective heating and cooling uses air, so the heating and cooling can be combined with ventilation. This method can change the room temperature quickly, but it uses a lot of energy, so energy recirculating is needed.

Considering the properties of each system, I planned radiant climate ceiling for constantly used rooms such as office units. For higher comfort of daily users, I additionally planned fan coil unit (FCU), which is convective HVAC (heating, ventilation and air conditioning) system, in the ventilation duct of each office room. By doing so, individual users can control their own room temperature. For the large room or occasionally used room such as lobby or auditorium, I planned air handling unit (AHU) as their main HVAC system. With this system, the room can be fast-heated.

Since heating up the air spends much energy, renewable energy is crucial for air-based HVAC system (FCU and AHU). I planned heat pump that uses ground heat source. For the 25% of electricity of heat pump operation, photovoltaic (PV) panels on building’s south façade will produce electrical energy. For ventilation, FCU and AHU uses 80% of recirculated used air by heat exchanger, and the systems will get 20% fresh air from the outside.
The water of climate ceiling can be heated by TPV (thermal photovoltaic) panels that are installed on two sky roofs. The sky roof of atria is consisting of three types of insulated panels. One is opaque module of TPV panel, one is photovoltaic module that mono-crystalline cells are inserted in double glazing, and the other is louver module that aluminium louver is inserted in double glazing.

For the elements of passive architecture, I focused on the building skin. Firstly, for sun-facing façades (south, east and west façade), where PV panels are installed, I added inner façades that create closed corridors surrounding the building (except the north part), so that the space functions as a thermal buffer. The steel truss structure is filled with concrete (high thermal mass) on its compressive elements, and the corridor floor (or steps) is made of wood (low thermal mass). The thermal buffer corridor mediates the temperature difference between indoor and outdoor. Secondly, I planned insulated sky roof on top of two atria. The atria get diffused day light through the sky roof. Also, the level difference of the atria induces stack ventilation. Lastly, the rest of the roof is green roof. The green roof prevents overheating of the building and furthermore it prevents heat island effect.

EVALUATION

I think that I quiet well brought my initial idea till the end of the design process with coherency. My initial architectural concept that deals with the current spatial problem made it easy to suggest a simple and clear spatial response, as an architectural form. Even though there was simplifying adjustment in the middle, the architectural form almost intactly converted into realized model.

What was the most difficult to achieve during the transition step from architectural form towards realized model was to fully reflect architectural intention. The architectural intention should be able to cope with realistic problem such as structure, construction or climate. Through my graduation work, I realized that seeming architecturally simple form can be actually very complex for its realization. To make the model also simple to construct, I should had to keep change and adjust the module or slope of the ruled grid surface.

When it comes to sustainability, I felt a gap between social sustainability and environmental sustainability, during the step of designing building form. There is already a best answer for environmentally sustainable building form, which is a compact shape with minimum surface area such as a box or a sphere. However, building’s surface is building’s language that talked to the neighbourhood. The language can be the same in an order to make a big collective harmony. However, when the language is too dominant, so it brings boredom or repression in human life, it is better to have a change to give liveliness in the society. I think that adding liveliness in the society is the social role of landmark buildings in terms of sustainability. As a result of focussing social sustainability of building form, I had to depend more on mechanical or smart-technical solutions rather than pure architectural solutions to achieve sustainable indoor comfort.

Building design aims an integration of architectural position, building’s programs, safe structure, effective construction, and climatic functions including façade design. The ultimate goal is always unachievable and every project remains an assignment for a future work.