Landform Architecture As Reconnecting Presence For Campus Complex Design

LANDFORM ARCHITECTURE AS RECONNECTING PRESENCE FOR CAMPUS COMPLEX DESIGN

A Thesis Presented

by

YI WANG

Submitted to the Graduate School of the
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of the requirements for the degree of

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ABSTRACT

LANDFORM ARCHITECTURE AS RECONNECTING PRESENCE FOR
CAMPUS COMPLEX DESIGN
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This thesis is an investigation into how land evolves into an architectural presence and representation to reconnect physical construction with social realities, human perception, and environmental considerations. As buildings lose their plasticity and their connection with the surroundings both physically and psychologically, they become isolated in the cool and distant realm of vision, lacking authenticity of material and tectonic logic in their construction. Landform architecture, which allows land to be engaged in an architectural representation, penetrates multi-dimensional architectural meaning through the manipulation of space, material, and structure. The built form of landform architecture is fundamentally developed from articulations of the terrain, but it transcends the topography in that it suggests and strengthens the potential relationship between physical construction and the outside world, thus allowing an enriched value to be attached to this emerging architectural typology.

The project that I develop will illustrate how landform buildings bridge artificial and natural constructions with enriched state of sensory and cognitive engagement as enmeshed experience in campus complex design. Most importantly, I will integrate energy saving approaches and other sustainable strategies through extractions from and extensions to the land. Instead of studying landform architecture as a novel building form, attention will be paid to the wide range of potentials that can be nourished in its future development. Reflections on the moral, technological, and design issues that enable landform architecture to perform an intensified articulation of reality is of great importance to the exploration of effective design methodologies that are able to generate the intensified interactions between human beings and buildings as framed by post-phenomenologists.

The design project is located in UMass Amherst, working as a campus complex to facilitate students and community member's mingling, as well as the continuation of New England's agriculture tradition. Permaculture theme guides the development of building programs and the evolvement of building form. By combining both passive design strategies and active design strategies, the building will work as a multifunctional campus facility which contributes to agricultural research, community involvement, and interactions between human beings and the nature.

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CHAPTER 1

INTRODUCTION

1.1 Landform Architecture As Neo-Vernacular Building

Landform architecture serves as a combination of earthwork and framework, contributing to reconnect man-made construction with site context, human perception, and environmental considerations. Different from conventional high-end “magazine buildings”, landform architecture has with great potential to involve the characteristics of vernacular buildings and developing into neo-vernacular buildings during its evolutions. In fact, vernacular buildings are usually overlooked in the real world. Compare to “high style” buildings, vernacular buildings seem to be too “ordinary” and “common”. Steward Brand’s research of the development of vernacular buildings in "How buildings learn"[1] is to discover the “unique” potential that lies in the formation of vernacular buildings. According to his argument, the way vernacular buildings learn from each other and generate their own unique form is of great value when it comes to architectural practice. Rather than following other buildings’ style, it is more important for designers to think about what drives building forms to respond to the deep variations of time, context, and culture in-depth. In Steward’s view, compared to “high road” buildings, vernacular buildings are better examples that people

[1] Stewart Brand. How buildings learn: what happens after they're built.(New York : Penguin Books, 1995, ©1994.)

should learn from, especially in how they are built to be adaptable and changed as needed (Figure 1).

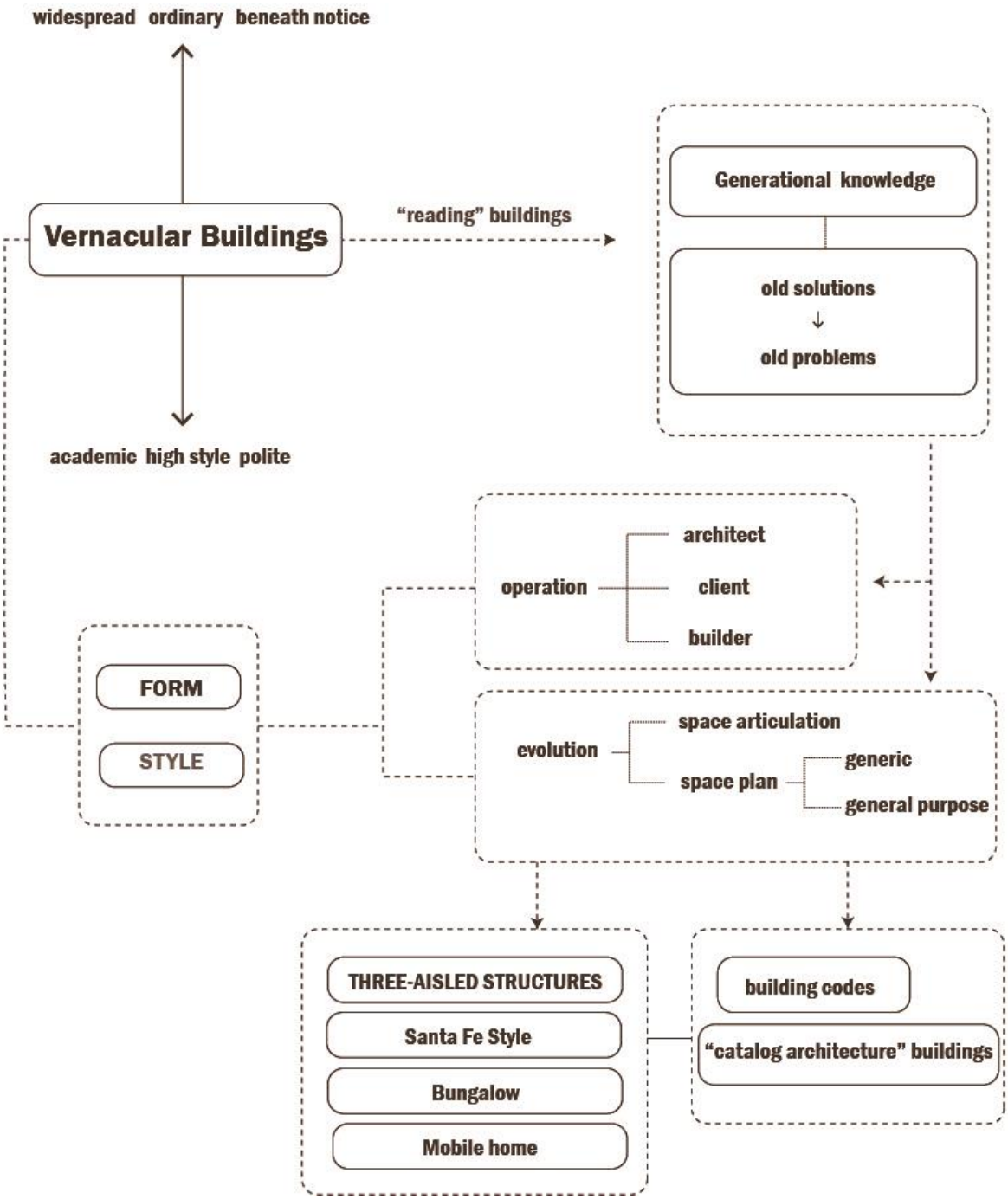


Figure 1 Diagram of Brand's research of vernacular building

As Neo-vernacular building, landform architecture will keep the characteristics of traditional vernacular buildings but transcends them in that it takes newly developed design considerations

into the evolution of built form. The vernacular basics can be integrated with new design requirements and let architecture become the representation of complex realities. Most importantly, the old wisdom in the construction of vernacular buildings will be taken into consideration under a new context, generating all kinds of potentialities in landform architecture that make it possible that architecture can be a linkage between human beings and nature. As Peter-Paul Verbeek argues in his book *What Things Do: Philosophical Reflections on Technology, Agency, and Design*[2], technological artifacts come into our life and reshape the relationship between human beings and their belongings, the experience, behavior, and perception, thereby allowing objects to be able to connect human beings with the world. What landform buildings do can be illustrated from this post-phenomenological perspective, as its appearance has open up new ways in dealing with topography during the design process and also stimulated new connections between building and surroundings.

1.2 The Tectonic Form Of Landform Building

How the qualities of ambiguity and transparency enter into the tectonic expression of landform architecture helps to generate particular human experience of physical construction, topography, and landscape. Basic architectural elements are able to serve as inspiring patterns rather than prosaic patterns when they are applied in landform buildings. It is important to take the production issue into the discussion of how a building is represented and causes human beings' responses afterwards, because today's landform buildings are fundamentally outcome of high technology. However, the reason that they deserve our in-depth study lies in the logic behind their

[2] Peter-Paul Verbeek. What things do : Philosophical reflections on technology, agency, and design.(University Park, Pa. : Pennsylvania State University Press, ©2005.)

programming and the attachment between people and physical construction that is nourished in those built landform buildings. When “Magazine buildings” with international style occupy our cities overwhelmingly, it is time to rethink the reality that people lost senses of the place they dwell. This lack of “engaging qualities” in architecture is not due to application of technology. If we explore the designing and building process of these buildings, we can find that the problem is that people get used to build something according to some existed pattern and typology. A wide range of building codes as well as voices from different parts make designers fear to free their thinking and look into the context, craft, and potential dimensions patiently. As an emerging architectural typology, landform building is a combination of different thinking about environment, social reality, and tectonics; it will exert great influence on the development of future architecture, landscape. My research has two main directions: one, how landform architecture can offer new experiential opportunities that integrate building and land, interior and exterior; two, how its surface is designed, constructed, and perceived will show how creative organization and combination of structure and construction lead to subtle variations in expression, thus allowing the uniqueness of the building to be recognized and perceived.

1.3 Design With Nature

The concept of designing with nature is especially obvious in the evolution of landform architecture. The way landform buildings achieve sustainability will involve both architectural and landscape design techniques, thus allowing environmental thinking to be taken into practice with new potentials. Some ecological design strategies in landscape design, such as waste management, will bring new possibilities to lower the energy use of landform building as a whole system rather than a separated construction.

In the study towards how nature involves in the design of landform architecture, the meaning of the word “nature” means living systems and living things. Distinct from imitating nature in its physical aspect, environmental sustainability enters into the development of modern architecture based on the thinking that ecosystems engage with the building systems in order to create a new ecology in which models of nature will be emulated and modified at the same time. The possibilities inherent in the cross field between architectural design and landscape design will suggest new green approaches and facilitate the experiments of a wide range of new technologies. The potential of landform architecture is to create an ambiguous interface between land and structure, therefore diminishing the discontinuity between nature and architecture.

1.4 Landform Architecture As New Milieu

Architecture affects human beings’ perception of the milieu. Sometimes building serves the same role as literature, enabling people to reflect on themselves and the surroundings. This process is what YI-Fu Tuan describes of how thinking dematerializes the world around us[3]. Every manipulation towards the building and the site will lead people to acquire particular sensation towards the surroundings, not only about building, but also about moral values, culture, and even history. For architects, it is important to take use of a wide range of information to develop stimulating signs and symbols, thus allowing people to be more sensitive towards what happened around them. My research of landform architecture is to rethink the role of land in architectural design, aiming to illustrate the way different values are taken into consideration to formulate the new environment that human senses could be inspired.

3 Yi-fu Tuan. Space and place : the perspective of experience. (Minneapolis : University of Minnesota Press, ©1977.)

Yi-Fu Tuan's research involving how human mind is correlated with environment and behavior will be introduced as one of the theoretical considerations underlying my future analysis. I have read Yi-Fu Tuan's book Topophilia: A Study of Environmental Perception, Attitudes, and Values during my graduate study in China, which allows me to access to some insightful thinking about how the environmental experience in urban area and rural area influence human beings' sense. The affective bond between place and people, which Yi-Fu Tuan defines as "Topophilia" here is also an interesting topic when it comes to the architectural and urban research. When people complain about the disconnection between building and human sense, the main problem is that what we build lost the power of connecting place and people. For both architects and urban designers, how to reformulate the intimacy between human being and their place is worth in-depth research. This potential affective bond decides how physical constructions are perceived by people and whether they can find a sense of belongingness in the place.

Among all topics Yi-Fu Tuan mentioned in his article, the discussion about sign and symbol is very influential in inspiring my new thinking towards how the way landform architecture addresses site contributes to initiate a dialogue between environment and human behavior. As Yi-Fu Tuan talks about the cross that appears on top of a church spire, it may function as an affective sign: that is, it will arouse a certain mood or feeling. In landform architecture, this kind of "affective power" can be created through a wide range of medium, and what I will concentrate on is how landform architecture transforms tectonic expression into articulation of spatial cognition, as well different values and meanings. How we deal with the site by way of adding structures, recreating surfaces, and applying particular materials can be seen as manipulating the schemata of signs and affective signs that people live and move in. It is even more obvious when it comes to landform architecture as reinforcing the connection between human behavior and physical construction become part of the design purpose, thus the didactic logic that buildings are independent elements has been weakened and even eliminated. Instead of distinguishing inside and outside according to traditional

formal logics, it is important to adhere, melt, and merge different components and go beyond the limitations that stem from inertial thinking.

A basic understanding of how environment and communication are interrelated in Yi-Fu Tuan's argument also reminds me of Steven Holl's research about site circumstance and idea. If thinking is not only what we pursud in the privacy of the mind but also can be understood as conversation or dialogue as a public form, then it makes sense in that ideas are not abstractions-but become fused with architectural program and emerge as the working principles of a building. As an architectural typology that responds to the differing circumstance of site and reframes space, nature, and time in architecture, landform architecture enables the revelation of the moving process from the conceptual and perceptual to the cultural message through morphological study. In my research, the encounter of the representation bound with sequence, space, and time and landform architecture will be studied through case studies of existed design projects, examining how the manipulation of land relates to the manipulation of space and the interpretation of values. The embodied experience will be analyzed in order to acquire in-depth understanding of the myriad links between environment and not only observable behavior but sentiment and thought, thus allowing us to explore the significance of taking landform into building process.

CHAPTER 2

ARCHITECTURAL PRECEDENTS

2.1 Dutch Embassy In Addis Ababa, Ethiopia

The precedents which are taken into examination contribute to illustrate how continuity enters into "building the site" process in order to confer meaning or reorient the context. What kind of construction method we adopt, how we deal with the functional disposition, as well as which form we select to apply are basically determined by the finite location, as well as the climate, the topography, and the materials available in each area. Also, it is important to notice that the harmonious relationship between the building and the character of the landscape is more than an achievement of logic and calculation. In fact, sentimental factors are of great importance in stimulating the spirit of emotional freedom and artistic imagination. Therefore, my investigation of landform architecture will concentrate on how continuity engage both human beings' "outer perception" and "inner perception", responding to the particularities of site and circumstance based on the duality of intention and phenomenon.

The first precedent is Dutch Embassy in Addis Ababa, Ethiopia (Figure 2). To retain and enhance the quality of the site's landscape, Bjarne Mastenbroek and Dick Van Gameren designed this building into a strict horizontal mass cutting into the hill. The sloping terrain naturally divides the building into two programmatic units: the ambassador's residence and the chancellery. How the building is

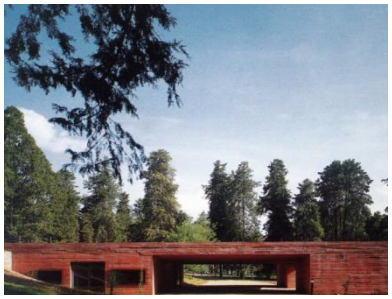


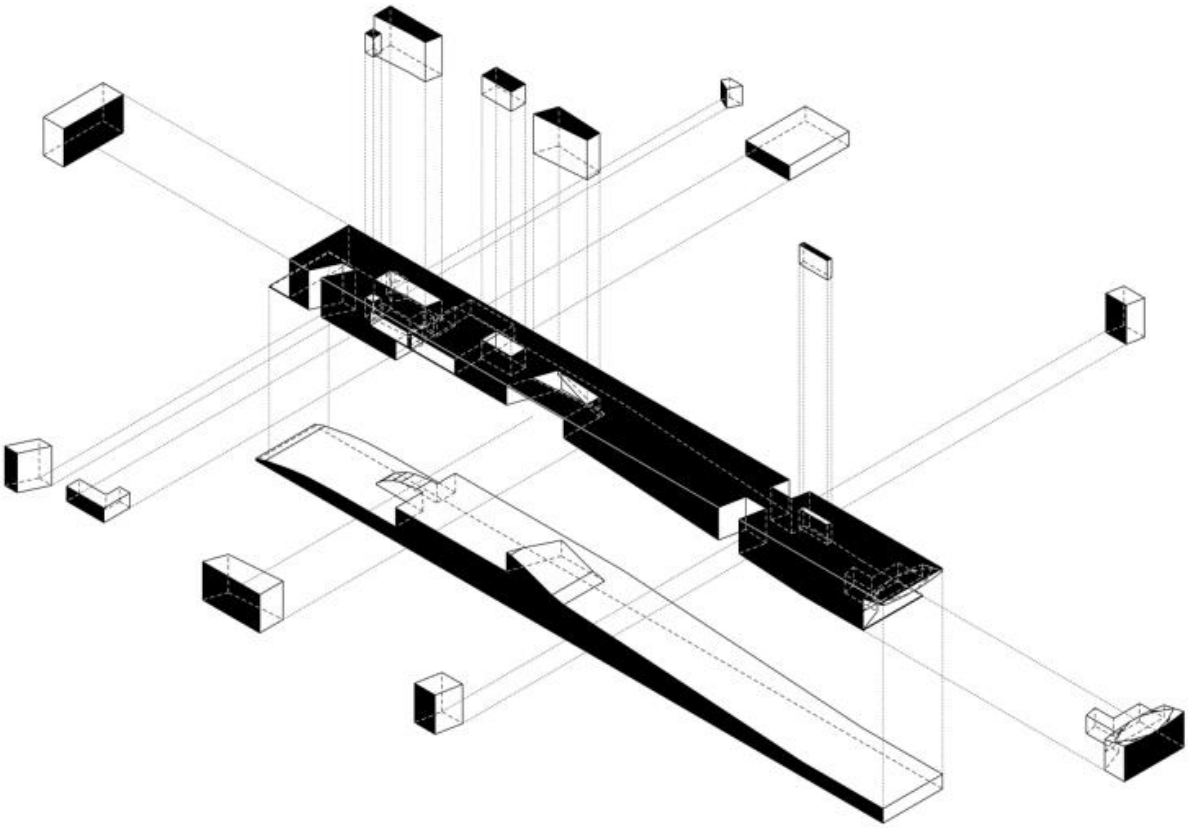
Figure 2 Dutch Embassy in Addis Ababa, Ethiopia

merged into the field demonstrates the power that architecture holds to inspire and transform our day-to-day existence. Enmeshed experience of the field is combined with physicality of architectural objects and practicalities of programmatic content to create an “in-between” reality, which is not merely a place of events, but intangible existence emerging from the continuous unfolding of overlapping space, materials, and details. And different from other European embassies in Africa which intend to take use of imported materials and human resources from outside, this building is constructed by local contractors, using the only widely available local construction material concrete, coupled with Ethiopian stone and timber for the interior finishes. Instead of delivering an overpowering message, designers try to create a particular expression of identity through involving the visible and invisible particularities of the site into expression of identity.

Figure 3 Dutch Landscape and Roof Pool

On the borderline of the two functions, the landscape intersects the volume. The roof, which comes into the sight at the moment when the road intersects the building, has been implemented as a shallow pond, a reference to the Dutch landscape (Figure3). Elements belong to different time and space are rearranged and demonstrated as series of partial experience. As philosopher Henri Bergson’s clarification of the idea of “duration” as a “multiplicity of secession, fusion, and organization”, how day to day experience is unified into the architectural spatial morphology here can be understood as a combination of “lived time” and “real time”, transforming the physical and perceptual experience of architecture from scattering temporal fragments into a concentration of energy.

Spatial analysis towards the interpenetration of inside and outside helps to reveal designer's intention of creating invisible surface based on the delicate manipulation of land and architecture (Figure 4). Simultaneous perception is nourished upon spaces which are positioned on different places, thus allowing visitors to conceive the flotation of space in a continuous activity. When people move through the central corridor, they are able to acquire a "complete perception" of the building based on the architectural synthesis of foreground, middle ground, and distant view, together with all the subject qualities of material and light.



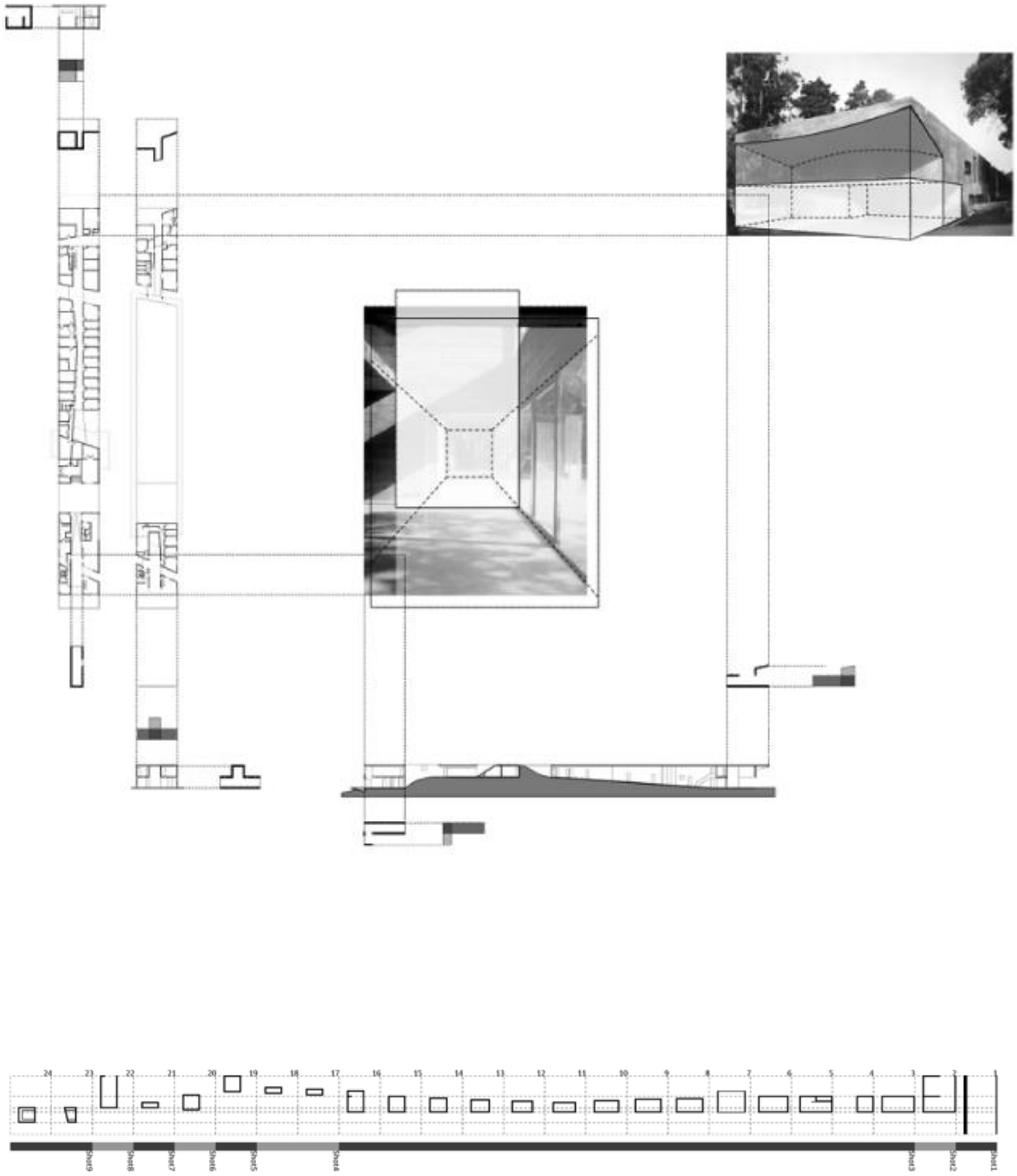


Figure 4 Spatial Analysis

2.2 Seattle Art Museum Olympic Sculpture Park

The second precedent is Seattle Art Museum Olympic Sculpture Park which was designed by Weiss/Manfedi (Figure 5). The importance of this building as an example in the investigation of landform building lies in that it appears as challenge towards the conventional disconnection of the roof from the land. And its masterful design of an elegant zigzag park over train tracks, a parking garage, entrance ramps, and a museum also redefines the public space in metropolitan area. The streets, plazas, and parks, which are assigned as traditional public space before, are transformed into a mountainous terrain of a third, semi-public space in the city, revolutionizing human beings' perception of private and public structure, inside and outside space, as well as what is ground and what is roof.

Figure 5 Seattle Art Museum

The overlapping spatial network of Seattle Art Museum makes it possible to free rooftop from isolated and separated architectural surface that human beings can hardly perceive its

existence to ground with multidimensional representation. The folding planes, bifurcation, as well circulation above, through, and below spaces, which characterize those large scale horizontal structures , create fluid continuities and connectivities in landform architecture, suggesting manifold presence of superimposition in its spatial system (Figure 6). From the complexities that exist inside the arrangement of the building's spatial network, it is easy to tell a fusion of constructive regularity with the diversity necessitated by functional use, responding to the requirement of building in the real world while transcending the routine operating way in handling spatial relationships ad connections. The distinction between the garden spaces and the architectural functional areas is with minimal formal distinctions, and the continuous surface flows across the whole building is conceived as an artificial landscape, where complex programmatic variations can be activated. What is facilitated in this organization of land and building is spatial connections that permit continuous fluctuation of interpretation to be developed due to the

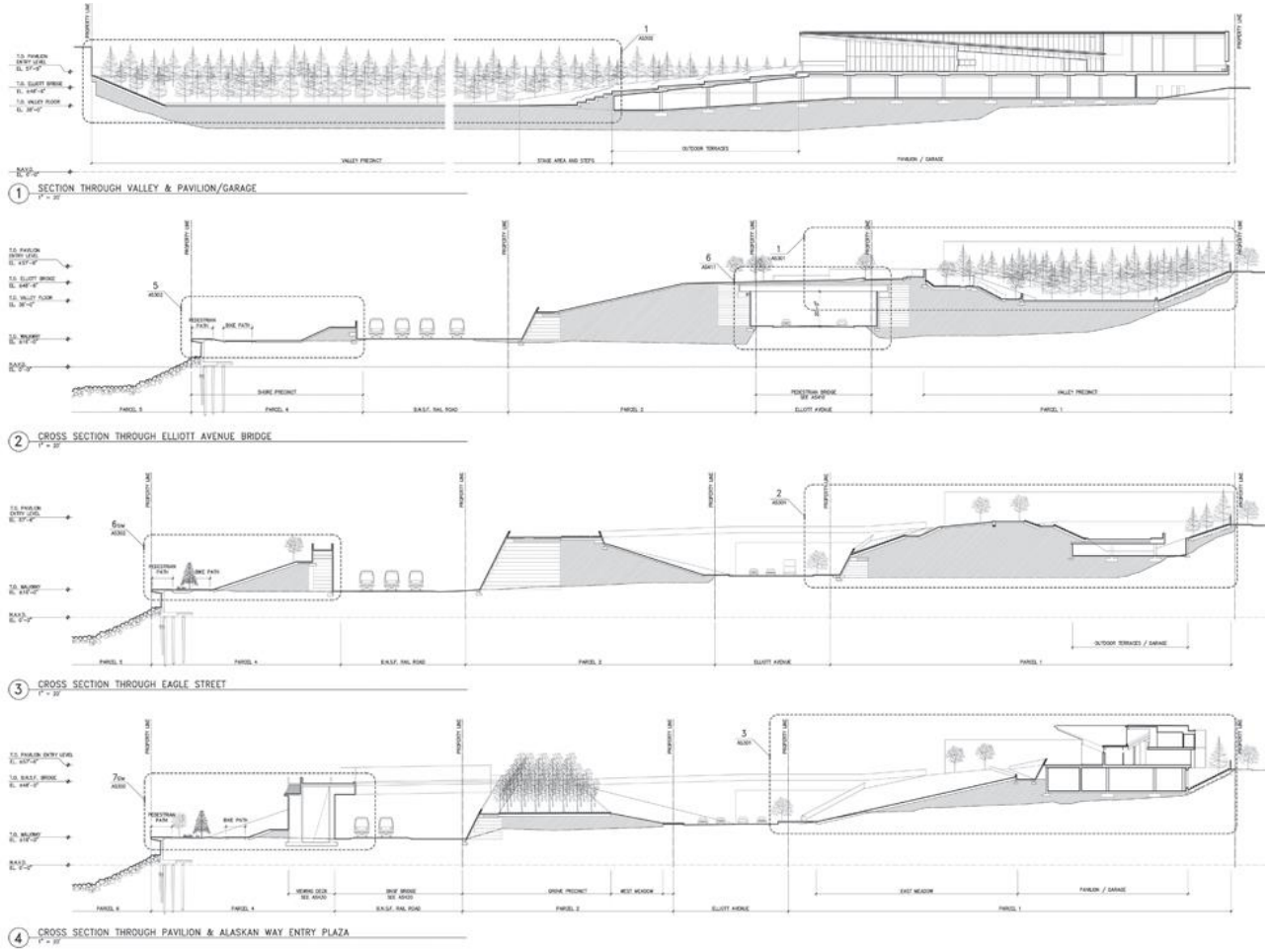


Figure 6 Manifold Spatial System

flexibility that exists in the intersection, protrusion, and attachment between multilayered mediums. And the reason that Seattle Art Museum is of special value in clarifying this point is that it is located in a condense urban context and has to adapt to complicate city environment, which asks designers to take a wide range of elements into consideration when they try to place something unconventional within the city area. As Weiss/Manfedi made this building into an integration of complex social realities and complicated functional programming, it is possible to assume that landform building is with the great potential in renewing our cityscape, leading human beings to experience the juxtaposition of landscape and building , and most importantly, combing multiple biotic systems into the architectural integral, all of which can be read as new opportunities for urbanism, a phenomenon that individual building is connected to the larger metabolism of the urban environment through material, energy, water, food, and pedestrian, and response towards newly evolved cultural and aesthetical understanding.

Figure 7 Public Space

In the design of Seattle Art Museum, the characteristics of flow, ambiguity, multi-overlapped, and changes within a mixed structural system is interweaved into the building to form a connective machine. Through reorganization of density and connection in-between, a new functional system is generated to allow people to reconsider the life of city within the space of intense movement. Both formal and informal activities could happen within the realm of the building's surface, of which the function can be identified as outdoor exhibition, roof plaza, and gathering space. And these surfaces

are demarcated socially, temporally, and organizationally to make an ambiguous border between the interior and the exterior, the public and the private. Movement, experience, time, and fluidity are synthesized into the formation of the building. The folding and creasing surfaces generate a new terrain, where the strong separation of interior and exterior disappears. The blurred border which establishes the transparency that lies in the space contributes to form an enriched sensibility towards the inside and outside. Especially when people move from one area to another, what they perceive is not crossing a settled border between definite inside and outside but moving around the rolling landscape. The life of the city is engaged into the environment of this physical construction, thus allowing an immediate and constant connection among human being, architecture, and landscape can be established. The blending of land and building has mirrored not only physical but also psychological interrelationship between architectural elements, environmental elements, and human beings. The complexities and flexibilities that are reflected in the spatial transitions give rise to a transparent system in its organization, which enables the bodily existence to be experienced while people move around the continuous space.

2.3 Neurosciences Institute In La Jolla, California

The third precedent that I plan to study is Neurosciences Institute in La Jolla, California, designed by Tod Williams and Billie Tsien. This building is a perfect example to elaborate how building-form is derived from the geometries and dimensions of landform. Through tectonic representation, earth is unfolded by architecture. Topography is not an extra part that we try to make our design to adapt to passively. Rather, it is combined into physical construction to create a framework that enables both below ground constructions and above ground constructions to be erected as a whole. Studying of the relationship between this building and the site shed light on the question of how landform buildings elaborate the terrain, insert into the terrain, and cooperate

with the terrain. And among all the architectural elements, architectural envelope turns out to be the most convincing part in clarifying such relationship. How Williams and Tsien deal with the shadow behind the surfaces, the void and solid space between surfaces, as well as the

view people get through the surfaces is not merely based on functional consideration or aesthetic consideration (Figure 8). In fact, what they aim to inspire is the thinking towards earthwork and framework in terms of phenomenological theory, which means that the emotional experience and human existence is what they want to create through bringing new attributes to this building. In addition, how material aesthetics is involved in the design work also deserves our observation. People usually hold landform building as innovative buildings with high-road style. However, this Neurosciences Institute appears more like a vernacular building hidden in the landscape. The tone, texture, and color of the materials are compared and selected carefully according to the social

Figure 8 Shadowed and Illuminated Surface in the Courtyard

context and natural context, thus allowing the surface of the building to be demonstrated as the

“outgrowth” of the terrain rather than artificial addition. This material consideration also contributes to create the ambiguity and transparency in the spatial qualities, which is one of the most important characteristics that landform building owns (Figure 9). As Williams stated:” we wanted to establish a relationship of the inside to the outside in that the materials on the inside world find themselves on the outside and those on the outside world find themselves to the inside.” [4]

Figure 9 Material Representation

Looking into the excavation and extension that contributes to shape the form of this building, it is easier to understand how a place is defined within an extended and articulated terrain. When ground narrows into ramps that curve up towards the sky or dive down into the earth, it demonstrates the rootedness which happens from cutting away, making a fissure in the land, as well as the sense of infinite escape interrelated with extension. And when it comes to the lab part, designers try to encase these laboratories into the hillside as separated hollows. Every lab is enclosed on three sides with opening onto the swell of the plaza through the full height of the wide glass windshield. And from the line of resistance which is stiffened and thickened by the perpendicular fins shown in the plan, we can tell that only the back one of the three walls encasing

4 David Leatherbarrow. Topographical stories : studies in landscape and architecture. (Philadelphia : University of Pennsylvania Press, ©2004.)

the labs is with the function as retaining wall. What is interesting in this project is that designers try to create the reminiscent of these inclined and thickened “retaining wall” elsewhere in this project. The walls and ceiling in the auditorium, which are created with the thickness that within the folds of canted surfaces, can be seen as masterful excises in building such evocative connection. Through further investigation of these wall and ceiling, we can also find that these faceted surfaces work to resist the lateral thrust of earth which comes from the great mound piled up against the building on its western side. The origami of canted buttress that oppose the pressure of the mound both frame and roof a slope, indicating the inhabitation of a retaining wall through its configuration (Figure 10). What is articulated from all these settings of this building is a buttressed prospect cut into the land. And the play of encaved dark and terraced brights indicates the relationship between earth and sky, presenting the architecture as modulated earthwork within the terrain.

Figure 10 Ramp and Ceiling

2.4 Brooklyn Botanic Garden Visitor Center

Brooklyn Botanic Garden Visitor Center is a newly completed project in New York City. This building is designed to become an inhabitable topography defining a threshold between the city and the garden. How to create a building that works as a seamless extension of local landscape is

the fundamental issue the designers think about in this design work. By integrating landscape and architecture in this design, an unique interface between cultivation and culture , city and garden will be developed through this physical construction (Figure 11).

Figure 11 Brooklyn Botanic Garden Visitor Center

Brooklyn Botanic Garden Visitor Center is located at Washington Avenue, serving as an intriguing place for people to find a peaceful place to stay and get close to the natural world. The center is conceived to bring people experience of an overlapping system which is three dimensional and continuous. The elliptical event space, gallery, information lobby, orientation room, and cafe in Brooklyn Botanic Garden Visitor Center allow visitors to have diversified public

space to communicate with each other and learn about the surrounding landscape . This experience is strengthened through the framed views of the botanic garden the designers aim to take inside for building occupants, thus allowing the building to become a medium between human beings' sense and the landscape (Figure 12).

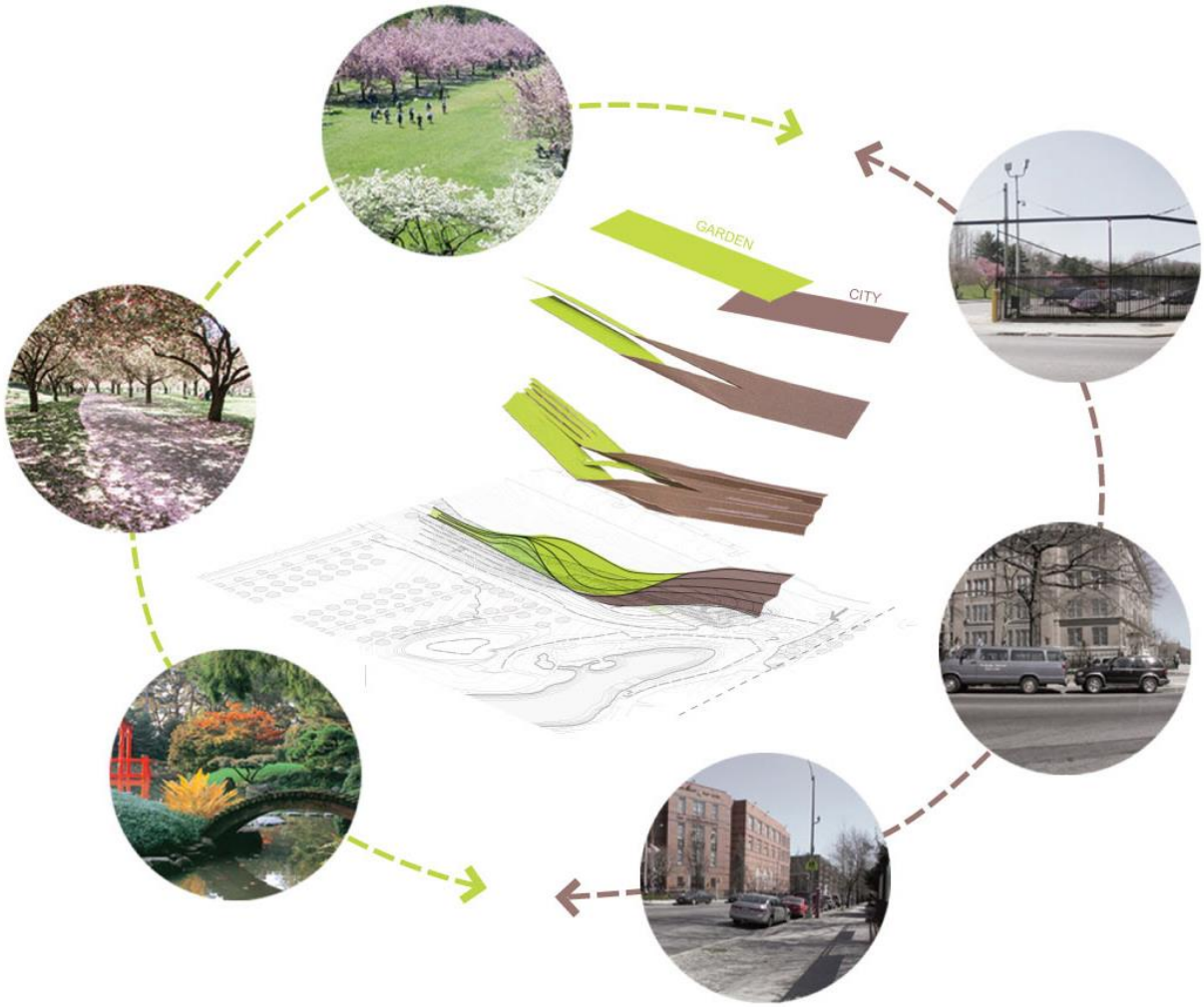


Figure 12 Landscape design concept

The living roof system is an important feature in this design work, which contributes to establish an interface that really merges architecture and landscape. Throughout the year, the green roof change s all the time, leading to a transformation of the architecture during each season.

The physical and philosophical relationships between human beings and environment are further extended through the dynamic and organic building form. Design towards the route on site is integrated with the structural design and programs design of this building, combining architectural elements into the site work as an integral (Figure 13).

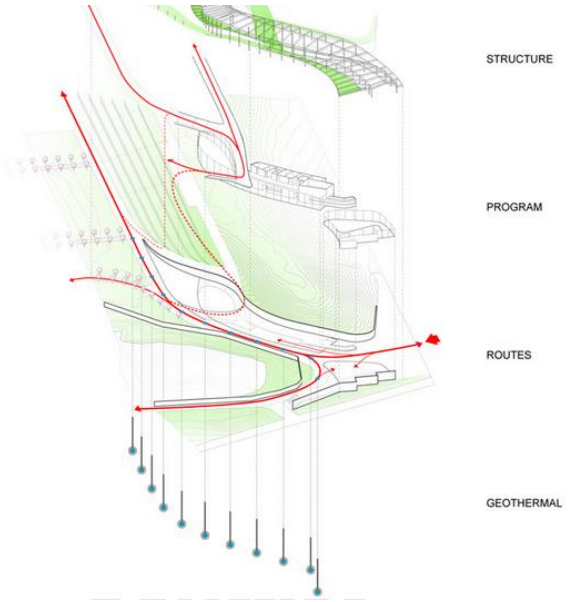
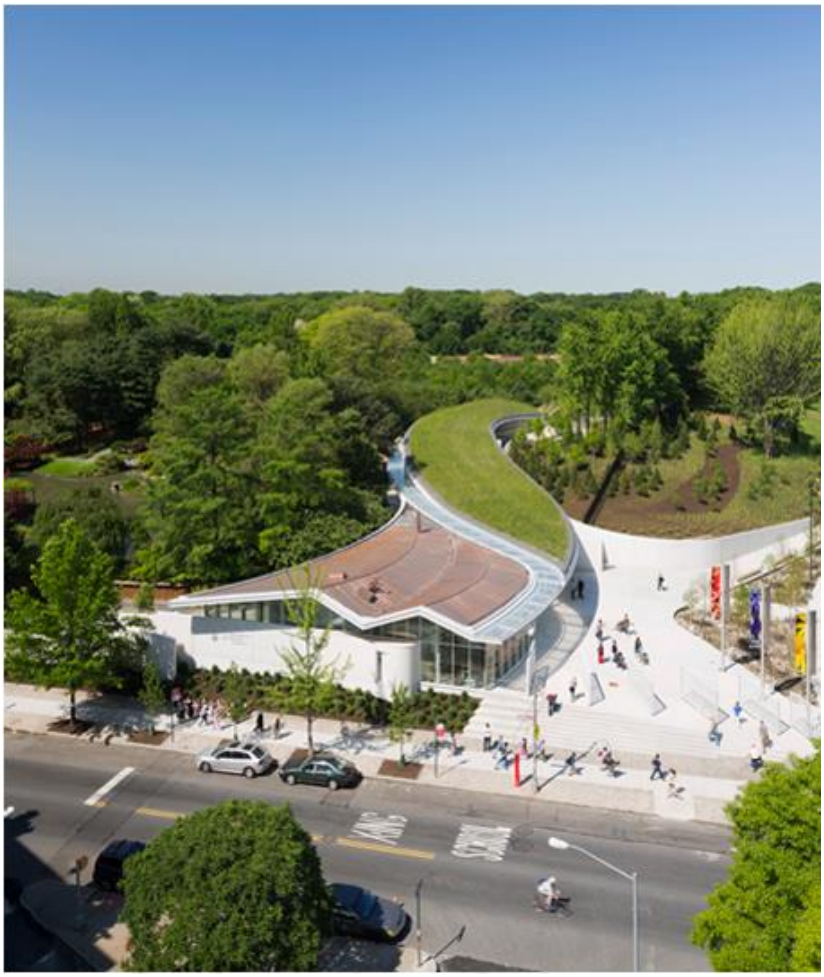


Figure 13 Structure and circulation

Around the Visitor Center, there are more than 60,000 plants installed. Native roses, viburnums, magnolia, tupelo trees, cherry, and water-preferred plants for three rain gardens constitutes the diversified plants group for the site (Figure 14).



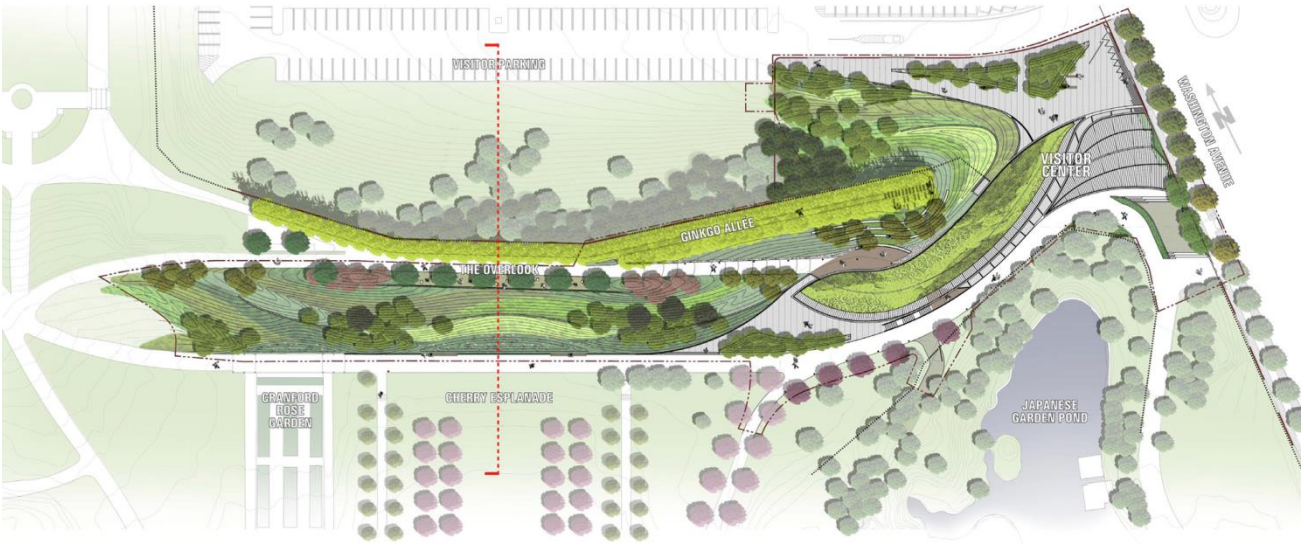


Figure 14 Master plan

Figure 15 Glazing

With curved glass walls facing the botanic garden, the Visitor Center provides occupants veiled views towards the plants in the garden. The Fritted glass contributes to filter light, offering ambient environment for the building. Different from the newly constructed southern face, the north side of the building is designed to use the preexisting berm, thus allowing thermal efficiency to be achieved. The combination of clerestory glazing and fritted glass on the south walls is able to maximize natural illumination and minimize heat gain (Figure 15). For the interior space, a geo-exchange system handles the heating and cooling for the building, and the rain gardens which are designed to be situated on the site contributes to stormwater management, collecting and filtering runoff to improve water recycling on the site.

Horticulture exhibition is an essential feature in this design work. From upland to lowland, a gradation of typologies can be distinguished through the transformation of the planting palette. Native plant communities are organized for the landscape design of this project to establish high-performance botanic collection with meadows, shrubs, and trees. These plants can withstand negative climate and present different views with the seasonal change. Besides the function of beautifying the local landscape, the horticulture design which allows different plants to be introduced to people who come to Brooklyn Botanic Garden Visitor Center plays an important role in serving as pedagogical tool to showcase native plants (Figure 16).

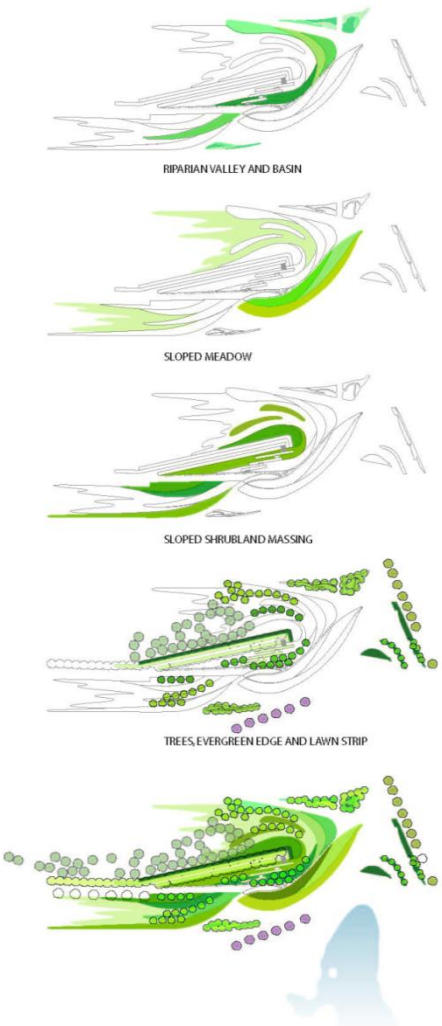


Figure 16 Site design analysis

CHAPTER 3

LANDFORM ARCHITECTURE AS CAMPUS LANDSCAPE

3.1 Site Selection

The project's site is located in front of University of Massachusetts Police Department, which is a land with hilly topography along Eastman Ln (Figure 17).

Figure 17 Site Location

The decision towards choosing this place as the project's site is based on three considerations. In the first place, the geography of this land offers both limitations and opportunities for the future explorations of landform architecture. My survey of the site helps me find out that there are a diversity of plants living in this area, and the wetland hiding behind the trees and shrubs. How to protect the vegetation and the water requires cautious thinking towards

how to organize construction elements on the site, but at the same time, how to combine the vegetation and the water into the design work in order to discover the benefits that the site is able to bring to the building will be productive and meaningful investigation into uncovering the sustainable, creative, and aesthetic potential of landform building. In the second place, the location of this site makes it possible that more vibrant open space, diversified and flexible programs, as well as exciting landscape to be created and incorporated into the future constructions here. Plus, the accessibility of this site is also one of the points that I pay attention to when I did the selection of my site. On site survey shows that this site is easy to be accessed if people drive or take bus, but how to encourage people to choose biking or walking to get this place is a challenge which is developed from this site selection (Figure 18).

Figure 18 Open space and accessibility

Since biking and walking contributes to reduce energy consumption and emission of carbon dioxide, how to improve the bike ways and pedestrian roads to encourage people to cycle and

walk is an important research point in my design work. Planning and designing of those paths for this site encourages in-depth thinking towards the relationship between this spot and the existing campus planning as well as appropriate approaches to deal with the problems.

After site survey and analysis towards the traffic condition around the site, the existing path which connects Eastman Lane and East Pleasant Street is chosen for the placement of main entrance for the building. This design allows people to access to the building easily and lower the possible traffic pressure this new building might exert on campus lane and the street leads to Amherst downtown area to the least. Plus, by using the existing lane on site instead of developing new path, the environmental system can be well protected and preserved (Figure 19).

Figure 19 Site plan

3.2 Program

Permaculture idea is taken into this project as an essential concept for program's development. This involvement of permaculture concept not only comes from the strong relationship between permaculture design and landform, but also comes from the comprehensive research towards the relationship between human beings and the environment. Since UMass Amherst is located in New England area , the connection with agricultural traditions plays an important role in shaping the campus culture. This integration of permaculture theme can offer a chance to strengthen the relationship between diversified campus culture and local traditions. Also, considering the great potential that landform architecture owns in using environmental design method to benefit permaculture design, this practice towards combining landform architecture design and permaculture concept provides an opportunity to explore the applicable measures for ecological design , ecosystem protection, and environmental conservation(Figure 20).

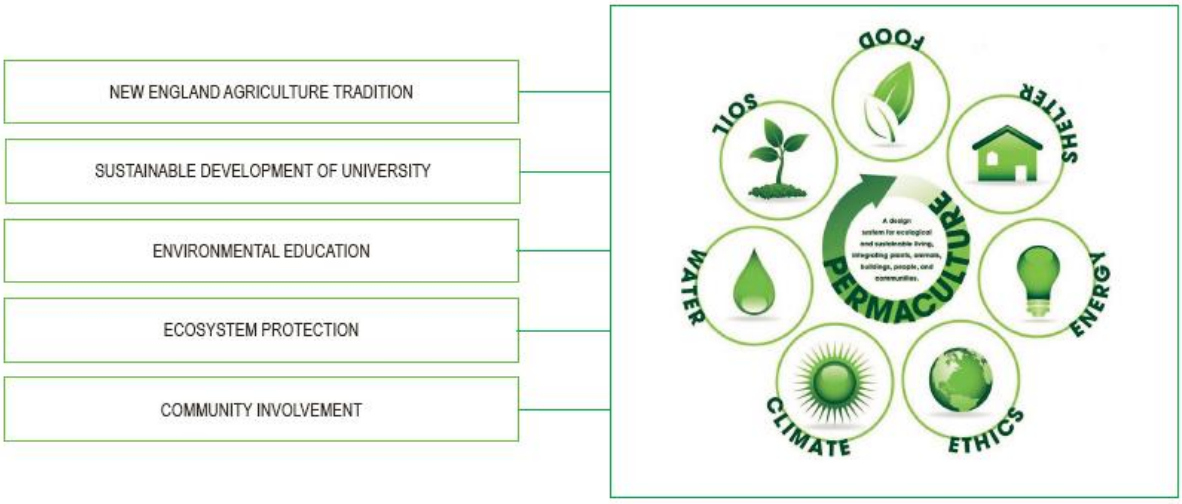


Figure 20 Permaculture concept integration

Building programs are developed based on the consideration towards how to take use of the permaculture concept to create inviting environment through integrated design of architecture and landform. All the functional spaces and their location are designed according to the in-depth research towards how research space, living space, and public space can be organized together to foster people's interest towards cooperation and sharing. On one hand, occupants' privacy can be ensured to allow them to have satisfying environment to study and rest. On the other hand, overlapping systems and multifunctional space make it possible that people can access to different areas easily, thus facilitating the communication between different parties (Figure 21).

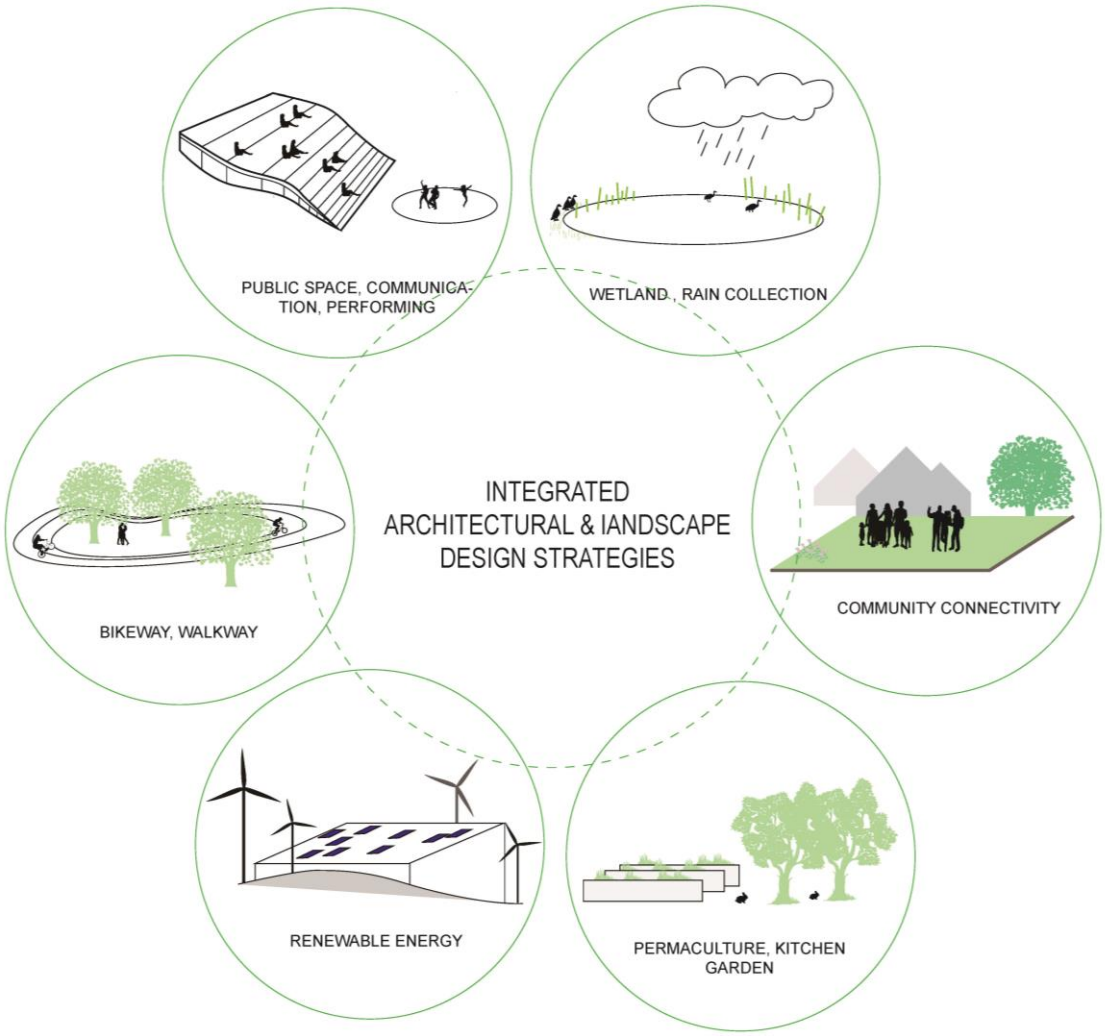


Figure 21 Integrated architecture & landscape design strategies

This building will be designed as a campus complex, which includes classroom, studio, lab, and dorms. Flexible space layout and circulation organization make it possible to strengthen the connection between the physical construction and the surrounding environment to be strengthened as much as possible. Building form merges into the land as an extension of the hill on-site, and new landscape is created by the continuous living roof, permaculture garden context, and multi-semantic open space. The feature of the land is represented through resilient site and landscape design, which is fulfilled by implementing integrated architectural and landscape design strategies. Additionally, multifunctional interface between the building and the land is established to redefine the relationship between inside and outside. State-of-art Sustainable design technology is applied to improve energy efficiency in the building and recycle resources for permaculture gardens.

3.3 Building Form

The building form is developed in contact with site topography. This hilly topography is with the highest point on the southeast corner and the northwest corner is the lowest point of the site. The building form follows the change of site elevation and contour lines, like an “outgrowth” from the existing site. By manipulating the building form to create continuous rooftop, people can move

around the site and enter into the building and its courtyard from different directions (Figure 22).

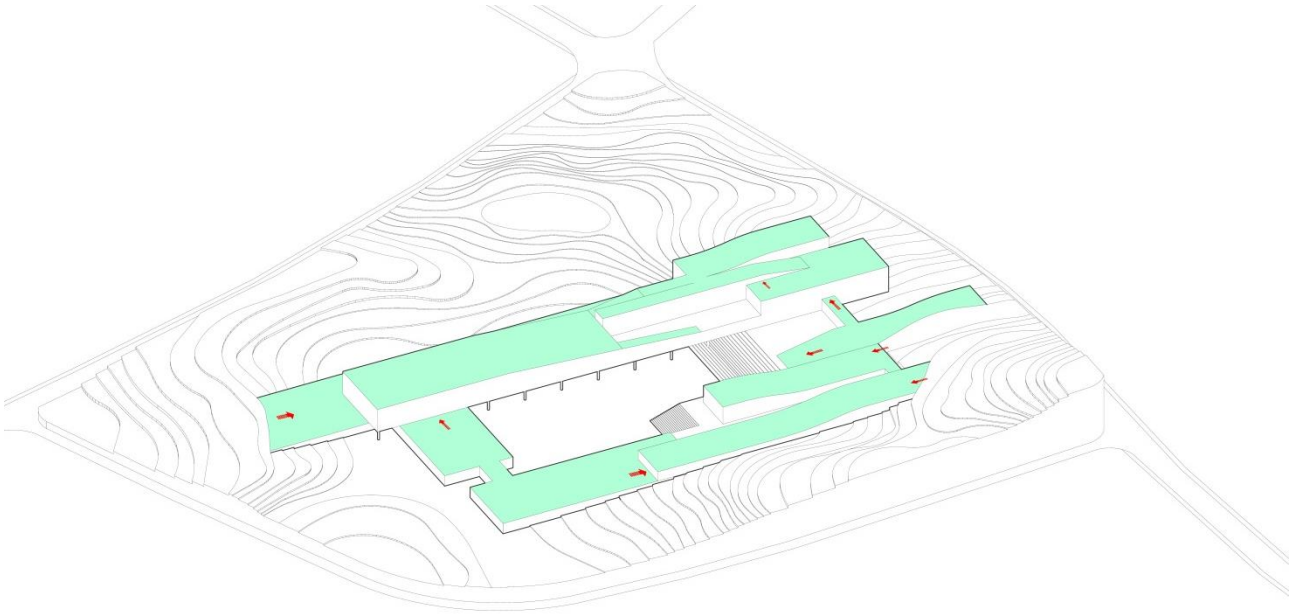


Figure 22 Green roof and accessibility

The perimeter between the building and the land becomes vague in this building. Vegetable and fruit which are grown in and around this building will bring people the feeling that the building is not an isolated existence separate from the surroundings. Rather, the building itself is part of the landscape, serving as continuation of the environment (Figure 23 & 24).

Figure 23 Perspective

Figure 24 First floor plan

The academic area is placed in the bottom part of the building, ensuring both easy accessibility to the experimental permaculture garden on the site and quiet environment for research work. Individual research studios and labs are place in the academic area with flexible public spaces inserted between them, offering multifunctional research, meeting, and

communication space for students and faculties. Media library is also situated in the first floor next to the permaculture garden. In this way, it is easy for both campus members and community members to access to the library resource (Figure 24).

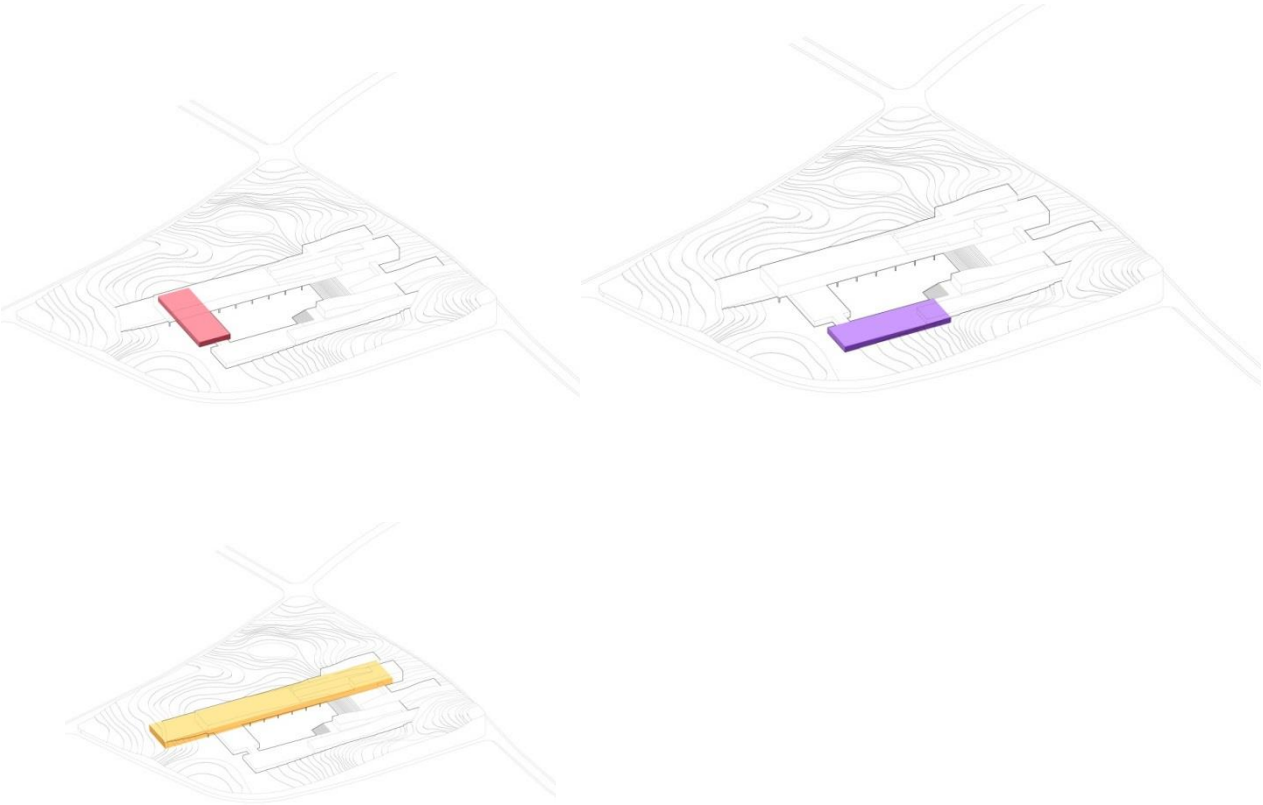


Figure 25 First floor building programs

The classrooms are placed in the lifted volume with accessibility to the rooftop containers, which makes it possible that faculties can use the rooftop experimental permaculture garden to assist their teaching and students can practice what they learn on class right outside the classroom. This design is to promote practice and experiment during agriculture education, fostering creative thinking by providing students experimental area closely related to teaching area. The dorms are organized on the east part of the building, occupying the highest levels to ensure enough daylighting and privacy for tenants. Plus, the roof of the dorm provides path for people to enter into the

Library

courtyard from the outside orchard and also serves as potential sitting place for people to stay and communicate (Figure 25). All the elements in the building system are conceived as part of the land, and they benefit both people who have activities inside or outside the building.

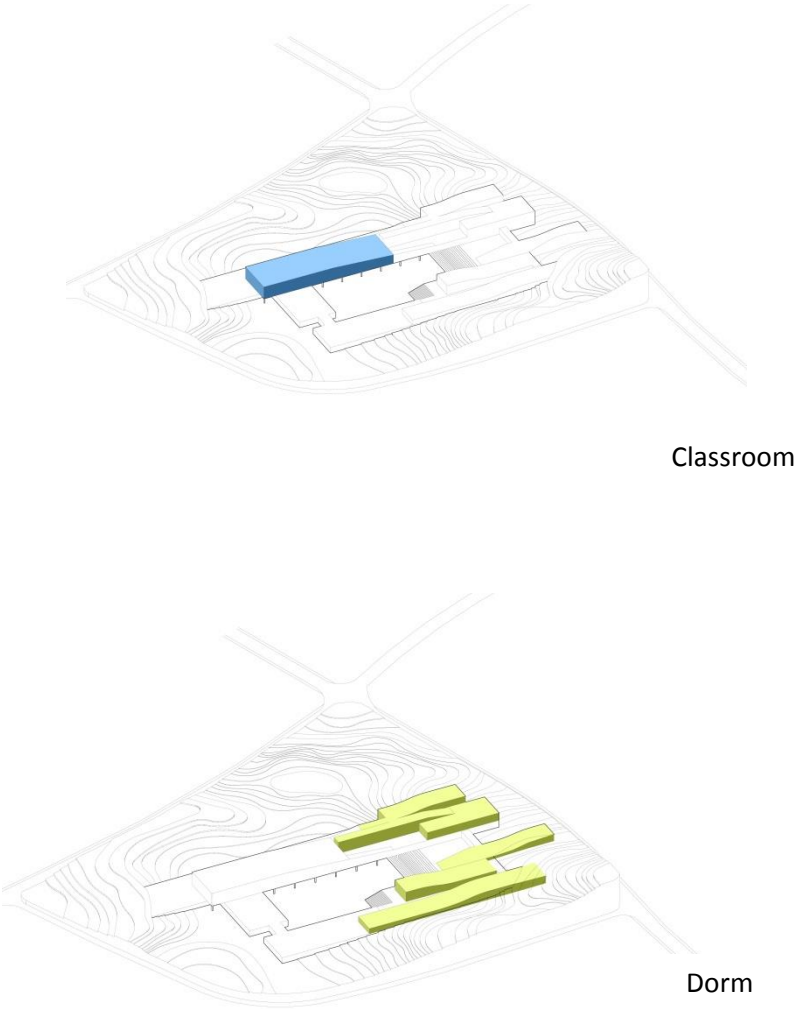


Figure 26 Classroom and dorm

3.4 Sustainable Design

Sustainable design in this project concentrates on using both passive and active design strategies to improve building performance. The facade system for the classroom area was

designed to provide appropriate visual environment for the classrooms and make full use of daylight to reduce energy consumption for lighting. Curtain wall system and exterior horizontal sunshades system are combined together to achieve environmental optimization and energy efficiency. The sunshades system is made of 12” wide aerofoil-shaped blades connected to the framing system with mounting arms and mounting brackets. This shading system controls the direct solar exposure and glare, making interior daylighting environment ambient and comfortable (Figure 26).

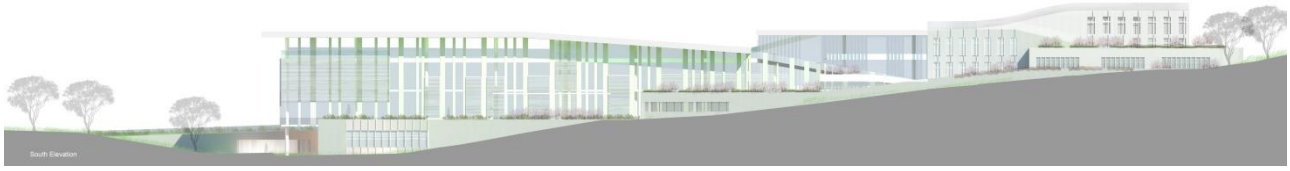


Figure 27 South Elevation

PV integrated shading system is proposed to be experimented in this project. The power produced by the PV cells on the shading devices can be used to fulfill the building’s energy demand. The shading devices can be adjusted manually, thus allowing optimized PV inclination to be achieved and generate as much PV electricity as possible to cover the electricity consumption in the building (Figure 27).

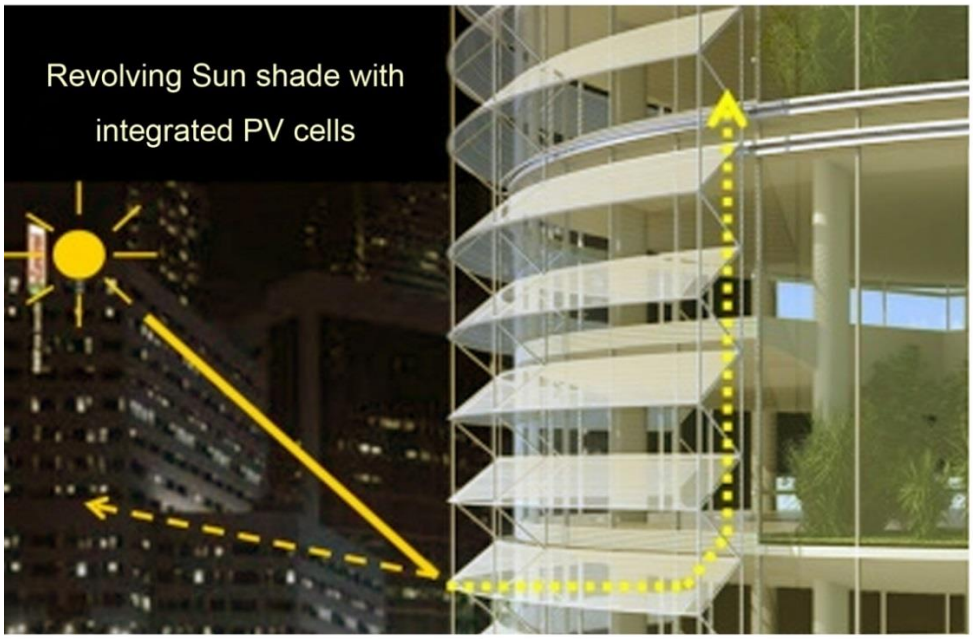


Figure 28 PV integrated shading system

The other sustainable design strategies include the green roof design. With engineered soil and plants on top of the roof, the natural processes of evapotranspiration and photosynthesis can be enhanced, thereby ameliorating the ecosystem around the building. Also, with so much roof areas covered by plants in this building, stormwater volume can be reduced and water flow can be slowed down significantly, contributing to alleviate the pressure on stormwater infrastructure systems. Additionally, this rooftop design will supplement the building insulation, lowering heating and cooling loads.

CHAPTER 4

CREATIVE POTENTIALS IN LANDFORM ARCHITECTURE

4.1 Buildings /Land Integrated Design

Landform architecture is with great potential in combining green roofs and surrounding land to provide ecosystem services, involving multiple constructed ecosystems, such as sewage treatment wetlands, bio-swale for storm-water management, or living walls to achieve biomimicry in its building system. Also, this ecosystem consideration can be integrated into permaculture design to develop a sustainable local food system in the building. Outdoor classroom and demonstration plots also facilitate educational and community outreach of rooftop agriculture (Figure 28).

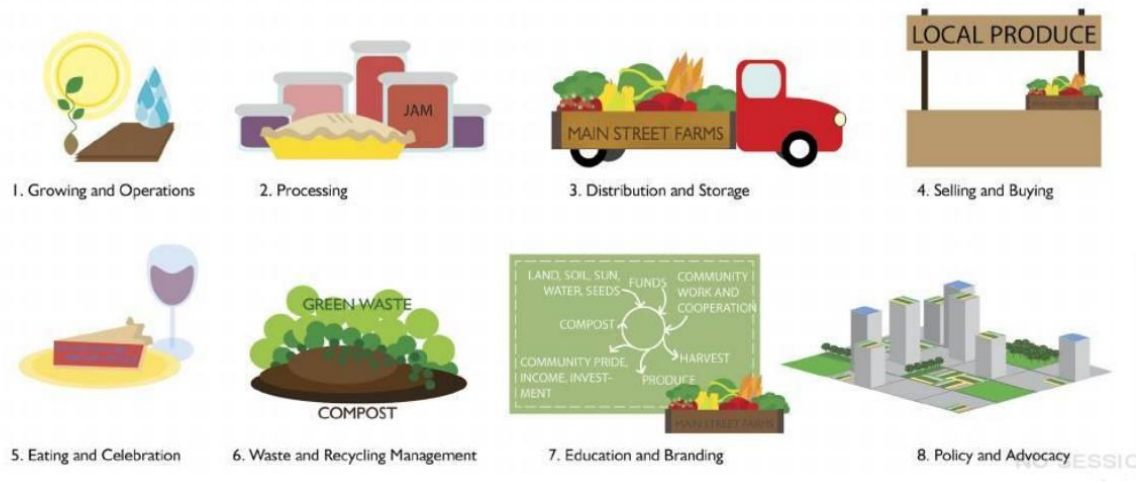


Figure 29 Sustainable food system

Integration of advanced landscape design methods into landform architecture design is an essential part in this building/land integrated design mode. By choosing right local plants for landscape development can help the soil protection, which benefits the building at the same time

because the soil serves as a critical part of the foundation establishment for architecture. The other issue which requires further exploration is how to recycle material on the site to reduce the expense for waste removal and the need for virgin resources. Since the building is merged into the land, close relationship between physical construction and landscape leads to high possibilities that waste in the building can be transformed into useful materials for vegetables, flowers, and trees' growth. Moreover, it is possible that dead plants can be taken into experimentation in the building and reused to develop building materials or fuels, etc. How to achieve energy recycling through capturing, storing, and using energy on site is an issue deserves investigation with exploration towards landform architecture. A living system can be established and leads to sustainable way to handle the energy on site and incoming energy to realize energy recycling (Figure 29). Through involving land in the building's development process, people are able to have more chances to get closer to the natural world and be creative when they are exposed to the influence from their surrounding environment which conveys information about innovative architecture and landscape design to them.

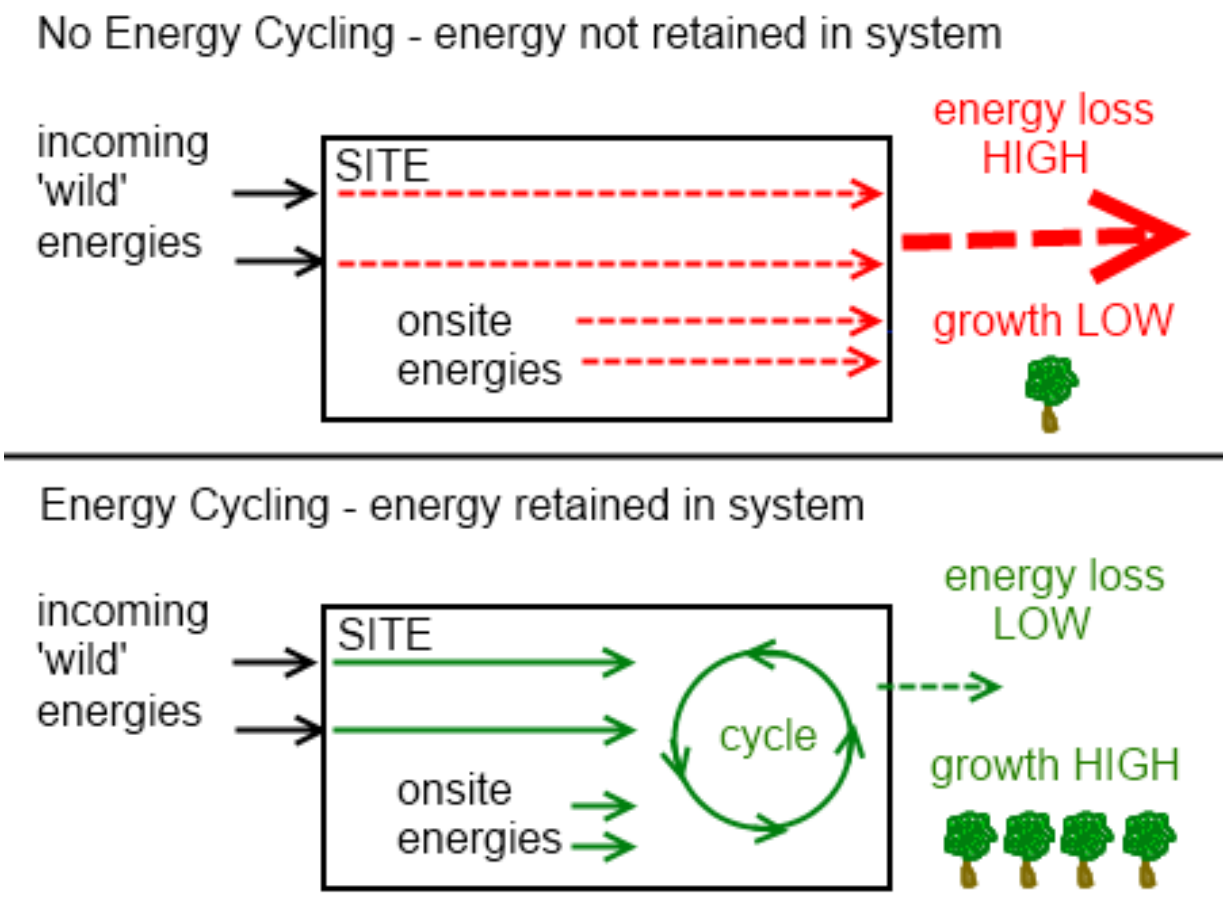


Figure 30 Energy recycling

4.2 Permaculture Design

Permaculture design's approach towards designing adaptive human settlements based on ecological principles that restore and renew natural systems helps exploration about landform architecture moves forward and evolves (Figure 30). Innovative integration of permaculture design concept into landform architecture is to inspire creative thinking towards creating multifunctional building space and landscape, making it possible that the whole building system represents much more possibilities when it comes to daily usage.

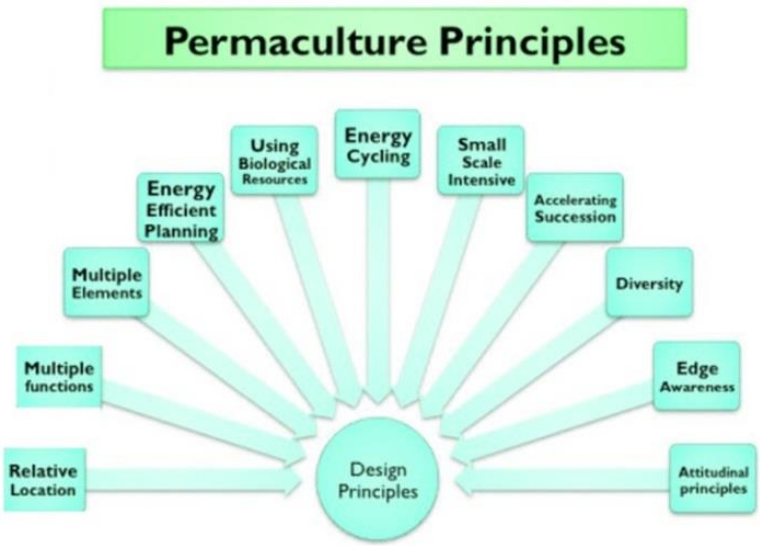


Figure 31 Permaculture principles

Permaculture garden idea involved in this campus complex design not only benefits the research about sustainable agriculture on campus, it also encourages integrative thinking towards growing, building, and landscaping. The knowledge about permaculture design can be applied in the planning of the site and organization of interior building space to stimulate creative implementation of cross field technologies and methods during the practice.

Figure 32 Permaculture garden view

The plants which are planned to grow in each experimental permaculture area is based on the consideration towards the plants' habit and the ecosystem for their growing. Diversity is an essential issue involved in this selection and layout process. For the rooftop part, growing containers will be

used for plants which need more care and management, so lettuce, spinach, and cucumber will be planted on the rooftop area. When it comes to the slope next to Eastman lane, fruit trees such as apple trees, pear trees, and peach trees will be planted to provide wonderful view for the road during flowering season (Figure 31). Also, these trees allow birds to find places to stay, thus contributing to build dynamic and diversified ecosystem on the site. The planting area near the building entrance is designed for spring perennials and roots vegetables. These plants are easy to be maintained and can be harvested consistently will be proved appropriate choice for the areas on the site which need to be exposed to the outside impact a lot. The courtyard in the building will be dedicated to flowers and herbs, so the lavender and rosemary can bring occupants great view and fragrance, offering campus cohort and community members attractive public place to gather together and interact with each (Figure 32).

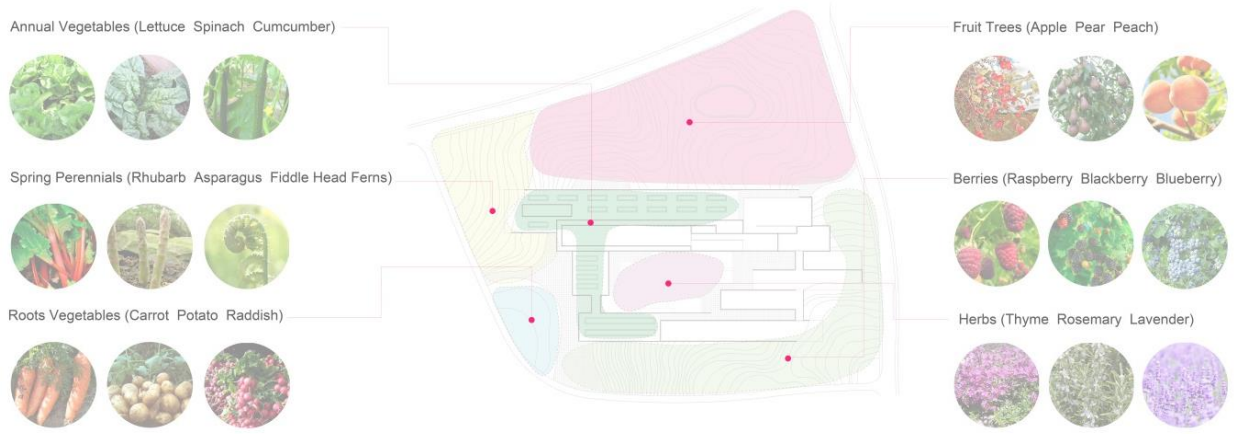


Figure 33 Permaculture garden plants

CHAPTER 5

CONCLUSION

Integrating land into architecture is a way to improve building performance and facilitate involvement of nature in the representation of architecture. By developing landform architecture which combines land into architectural representation to generate another “hot spot” for UMass Amherst, innovative thinking can be further encouraged and fulfilled. Most importantly, it is a way to explore how to build harmonious relationship between human beings and nature in the real world. This concentration towards reconnecting local context, culture, traditions, and modern technologies enables environmental design methods to be integrated into phenomenological presence, stimulating new ideas to be generated during practice. Emerging sustainable design strategies can shed light on the future development of landform architecture, thus allowing more productive and efficient systems to be integrated.

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