

ARCHITECTURE AND THE MOTION OF LIFE

by

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of

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Katherine Elizabeth Carey

November 2009

DEDICATION

For the instigator, the dreamer, and the creator.



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ABSTRACT

We experience our world through the mobile unit that is our body. As we move through space we are experiencing the riches that make up life. We meet new friends, travel new roads, and see wondrous sights. If architecture is used as a tool to encourage these movements it stands to be conceived that architecture can promote the enrichment of life.



INTRODUCTION

The word movement is very versatile. It can be defined in a multitude of ways. In understanding how movement impacts architecture I have defined movement with three different terms. I did this so that I could break down a complex idea into more simple components. For this thesis, I have defined movement with the words “motion,” “energy,” and “motivate.”

Many aspects of our environment are in motion, for example the earth and the sun. All movement has a very strong impact on how we live and interact in a space. However, I have focused my thesis on the movement of the human form. I believe that there is a very intimate relationship between a person and a space. It is this relationship that I am most interested in exploring.

A Finnish architect named Juhani Pallasmaa once wrote, “A wise architect uses his/her entire body.”¹ As we move through our space; we touch, see, and feel our environment. As architects we need to design spaces that respond to and encourage the user to experience their space. In the following thesis I will express in more detail how and why these ideas should be implemented and explored in architectural design.

¹ Pallasmaa, Juhani, *The Eyes of the Skin: Architecture and the Senses*. London: Wiley and Sons, 2005, pg. 12.

MOTION

1. A physical change from one point to another over a period of time.
2. The act of moving the body
3. A meaningful movement; gesture

“Sometimes it is not the destination but the motion itself which needs to be stated. This may be movement away from a previous position or state or toward a focal point. This category also includes movement along a particular path for which no destination is stated. Such motion emphasizes change and allows freedom of interpretation and concentration on the act of moving rather than on the result of reaching a specific goal.” –Ann Hutchinson

“The astonishing structure of the body and the amazing actions it can perform are some of the greatest miracles of existence. Each phase of movement, every small transference of weight, every single gesture of any part of the body reveals some feature of its inner life.” – Rudolf Laban



Movement is a force on which we all depend. It is constant and it shapes our world. Like a footprint in the sand, our movements have a direct impact on our environment. If we desire to transport ourselves to the next town, we build a road. The road becomes a change in the terrain in response to our movement. If our motion can change our environment, can our environment change the way we move? How will this concept impact the way we view architectural design?

Architecture is the definition of space. To demonstrate this point, let's look at a polar extreme of the built environment, a flat open stretch of land. The land appears boundless. It has no illustrated beginning and a seemingly infinite end. When architectural elements, such as adjoining walls, are introduced to the land, suddenly we have defined a singular space. Through design, a point has been visually established and boundaries for that point have been demonstrated by the use of walls. We can further define the space by creating openings. By the use of openings we have given the user in the space the choice to move to a new space. Through the placement of these openings we can control the direction and area where the user leaves. Through architecture, we have set up the rules for movement within the space.

Motion is how we engage with our environment. Because of this, it is important to understand how the built environment defines movement. Although most spaces are not designed to literally move, we experience architecture from the mobile center which is our body. Our perception of environment transforms along with our changing position in space. A set of stairs may be viewed as offset vertical blocks from a distance. Once we engage with the stairs, they become a rhythmic pattern of horizontal lines and shadows passing beneath our feet. Motion has allowed us to view our built environment from a different perspective, creating a space that is responding.

If, as illustrated previously, architecture is the definition of space and motion is the experience of space, then it can be inferred that architecture defines motion. To demonstrate this, let's return to the open stretch of land in the previous example. The land provides an endless continuum of choices for movement. Once we introduced the walls, a space had been established creating the limits of our movement inside that space. We may move in a number of ways inside the space but once we reach the wall we will be forced to stop.

When designing for movement, it is important to understand how people move. Rudolf Laban was a dance artist and theorist who developed a movement analysis called Laban Movement Analysis (LMA).² LMA is a symbol based system that is used to transcribe different forms of movement. Laban used his theorist background to interpret and document human movement through four main aspects: Body, Effort, Shape, and Space.

The term Body in LMA is used to describe the structural and physical characteristics of the human form while it is moving. Body is formed by the skeleton which is a composition of lines and connection points. Where these connections occur is where the potential for movement begins. No single unit of the skeleton frame has the potential for movement unless connected by a joint. Once connected at a joint, a portion of Body is allowed to move, or change position in relation to the rest of the frame. Often,

² LMA is also known as Kinesiology and Labanotation.

one movement influences another movement. In other words, once a segment of the body is moved another will follow. This understanding is the underlying concept of Body. Body describes which part of the human form is moving and how that movement influences other sequences of motion.

When the body is moved there is a certain amount of physical exertion or strength that is needed to control the movement. These movements can be either voluntary or involuntary. A movement that originates from an inner intention is what is referred to as Effort by LMA. With Effort, attention is given to the strength, control, and timing of the movement. It can mean the difference between a person reaching forward and a person punching forward. Each scenario describes a forward movement, but with a very different intention.

When demonstrating effort, we simultaneously explore Shape. Shape, in reference to LMA, is how the body responds to or defines its space. When we discussed Body, an emphasis was given to the understanding of the connections within the human form. In Shape we take that idea a step further and explore the connection of the human form to its surroundings. A movement can portray Shape through the body's interactions with itself, such as a person curled in a ball, or by establishing a relationship between the body and environment, such as the circle and square overlay of Leonardo da Vinci's *Vitruvian Man*.

Through the understanding of Shape, we may begin to appreciate LMA's definition of Space. Space parallels Shape in many ways. Both are categories that integrate motion with the environment. However, Space develops the idea further to involve multi dimensional patterns. The *Vitruvian Man* is a two dimensional drawing which depicts movement in a two dimensional Shape.³ However, we are three dimensional beings and we make three dimensional motions. Like a mime trapped in a box, the human body in motion forms geometric based structures, or Space.

The Laban Movement Analysis has very interesting implications for architectural design. As earlier illustrated, LMA's Space is the four-dimensional result of the human form moving in its environment. In architecture, space is the three dimensional result of a person's need. Both definitions integrate a multi-dimensional aspect with response to a person. However, LMA's Space introduces the fourth dimension of time. As people move, an action is completed over a sequence of multiple moments. In an architectural space, only one moment is represented. The aspect of time is a compelling variation between the two definitions of space.

LMA's Space and architectural space seemingly differ in another aspect, the reference to origin of the space. In LMA, Space is demonstrated through Body in motion. Therefore, Space originates from a person's movement. In architecture, it often originates from a person's need. For example, requiring a space to bathe may result in a bathroom. These two definitions for space may appear to differ greatly; I argue that they are more alike than different. Movement is a force on which we all depend. It is a constant need. Therefore, when Space is defined as originating from a person's movement, at the core, it

³ Da Vinci used the Vitruvian Man to depict the relationship between the orders of architecture and the proportion of the human figure.

is also originating from a need. Therefore, if movement is a need and architecture is meant to respond to people's needs, architecture can respond to movement.

Thinking of architecture as a responsive element is not a new idea. Arguably, the most blatant display of the concept is Ron Herron's 1964 Walking City. Herron designed a large mobile dwelling structure that could wander the earth. The design was almost creature-like in concept, constructed of movable legs that connected to a large pod where the city was housed. The legs allowed the design to physically move across the landscape, free to roam in search of resources. The design also had extendable arms that allowed multiple Walking Cities to connect and exchange people, materials, and resources, creating large Walking Metropolises.

This example of mobile architecture was not a serious proposition, but a commentary on how constant change and motion dominate our world. The Walking City provides the ultimate example of movement in response to environment. As the needs of the landscape changed, the inhabitants move in response.

Motion is a constant. We are always moving and always experiencing our environment from our mobile bodies. As our bodies move they create a rhythm of forms and shapes. These shapes are intricate in their connections and expressions. If architecture could establish a method for responding to human movement, spaces could redefine the way people move and the decisions they make. This would create architecture that could change and react with people and society. Architecture could become more than a space we inhabit, it could become an interactive response to our lives.

ENERGY

1. Ability to do work
2. A source of power
3. To be in action, implying ceaseless motion, work, production, change.



The word energy was first coined by Aristotle in the 4th century B.C. in a written piece entitled *Nicomachean Ethics*. He joined the words εν meaning “in” and εργον meaning “work” to form the word ενεργεια or “energeia.” The word eventually evolved into the English term “energy.” Aristotle defined energeia as “identified with motion.”⁴ Energy eventually became synonymous with the words motion and change. Even from their birth, energy and motion have been joined naturally. Therefore, it seems a familiar thought that as people move and change in their environment that they would simultaneously release energy. I argue this idea a step further and propose that architecture that promotes motion simultaneously has the potential to promote energy.

To demonstrate this idea, I will reference back more than a hundred years to 1905 when physicist Albert Einstein published a paper titled “*Does the inertia of a body depend upon its energy-content?*” In this paper Einstein derived an equation that proved that mass and energy were interchangeable, an unfamiliar concept at the time. This revolutionary equation is referred to as the energy-mass equivalence formula, or simply inscribed as $E = mc^2$. Energy is denoted as E, mass as m, and the speed of light as c. The equation demonstrates that very small amounts of mass may be converted into a very large amount of energy and vice versa.⁵

Mass is a value that is measured by calculating the weight of an object in correspondence to the force of gravity. On earth, where gravity stays at a constant, our mass is equal to our weight. If we have established that our bodies are a form of mass then it can be inferred from the mass equivalence equation that our bodies are also a form of energy. As our bodies are mobile masses in the built environment, we are simultaneously mobile capsules for energy.

In fact, it has long been known that people are a form of energy. Even as a person sits passively in their environment, internally their organs and other muscles move and produce heat, a form of kinetic energy. However, this heat is hard to harvest and usually dissipates back into the environment. Only recently with the advancement of technology, has the idea of harvesting energy produced by people become a realistic endeavor.

One example of this is a generator backpack designed by Lawrence C. Rome of the University of Pennsylvania at the request of the U.S. Office of Naval Research. Each military personnel serving on the field must have a power supply for their equipment, often in the form of heavy batteries or bulky generators. Therefore, a device that could efficiently replace these power supplies would greatly reduce the load carried by service members. To accomplish this, Rome decided to design a backpack that extracted energy from the simple act of walking.

Rome and his colleagues did a study and found that an average individual’s hips move 1.6 inches to 2.7 inches up and down when walking. To take advantage of this natural movement, Rome developed a suspended load backpack. A load is suspended by

⁴ Smil, Vaclav. *Energy in Nature and Society*. Cambridge, Mass: MIT, 2008. pg. 2. In the same work, Aristotle wrote that he believed every object’s existence is maintained by energy.

⁵ Bodanis, David. *E=mc²: A Biography of the World’s Most Famous Equation*. New York, NY: Walker and Company, 2000. Einstein was not the first to propose a mass–energy relationship but he was the first to derive an equation for it.

springs from a ridged frame that straps onto a person's back. As the person walks, the load pushes the springs up and down. This movement turns a small generator which produces an electrical current. The energy can then be either directly used or stored.

The idea of harvesting energy from human movement is slowly progressing, and ideas on how it can be implemented in architectural design have already been proposed. One example of this forward thinking design comes from MIT graduate architecture students James Graham and Thaddeus Jusczy. The students won first place in the 2007 Holcim Foundation for Sustainable Construction Competition with their plan to harness the energy of a city and its everyday movement. They called their plan the Crowd Farm

According to Graham and Jusczy the force from an average sized person's single step can power two 60watt light bulbs for a flickering second. While this is a start, both students decided to take their idea to a larger scale. If the Crowd Farm was applied in an urban setting, energy could be harnessed from a whole city in movement. If a crowd of less than 29,000 people was in motion, each person's single step combined would be enough to power a train for one second. At an even larger scale, 84 million single steps would equal enough energy to power a launch of a space shuttle.⁶

To gather this amount of monumental energy, Graham and Jusczy devised a plan to create a new type of urban landscape. The city's pedestrian paths would be refurbished with a responsive tiled flooring system. This new floor would harness the energy from people as they walked on their daily commute. This idea is possible through the use of piezoelectricity; this is the ability for some materials to produce electricity in response to a mechanical stress. As a person stepped the force from their weight would depress a tile slightly. Each tile moved independently from its neighbor. As they moved and slipped past each other, the tiles would create a mechanical energy. This energy would then be used to power other systems in the urban environment such as traffic lights.

The Crowd Farm was meant to demonstrate the potential for a built environment to be molded through the promotion of movement. To demonstrate this idea the students built a chair that deflected upon the weight of a body. This would set off a chain reaction of switches and spinning wheels that would light four LED lights. The chair was placed in a subway station. As people sat in the chair they become intrigued by the response of their actions. They repeatedly stood up and sat down in the chair to watch the lights flicker on and off, thus promoting movement.

As stated in the previous chapter, architecture has the potential to promote movement. We can now understand that movement produces energy. Now, that idea is progressed further to understand that architecture can promote energy. As designers we can see the beauty and possibilities in capturing the energy that is dispersed in our built surroundings. The energy gathered from one person's movement may be small, but through architecture, energy can be gathered from the movement of the masses. Thus, realize that promoting movement today may be an answer for tomorrow.

⁶ *Crowd Farm: A Prize Winning Plan to Harness Human Power*. July 2007. MIT. 9 November 2008
<sap.mit.edu/resources/portfolio/crowd_farm>

MOTIVATE

- 1) To stimulate action and motion
- 2) Imparting inspiration
- 3) To give vitality and energy

“...architecture relates, meditates and projects meanings. The ultimate meaning of any building is beyond architecture; it directs our consciousness back to the world and towards our own sense of self and being. Significant architecture makes us experience ourselves as complete embodied and spiritual beings.” -Juhani Pallasmaa



The laws of thermodynamics state that energy can neither be created nor destroyed. It does, however, have the ability to transfer from one body to another and manifest in different forms.⁷ If this idea is extracted from the traditional application of physics and reapplied in the area of psychology it can be conceived that through interaction one person can transfer energy to another. Simply stated, one person can inspire or motivate another. If the encounter is encouraged further, that one person can advance and motivate another. Just like a drop of rain making ripples in a pool of water, one impact influences another. The pattern repeats and harbors a continuous development of ideas, shared experiences, and gained knowledge.

Through architecture we can design spaces that enlighten and motivate people. Using the arts to inspire is a time-honored expression. A notable art movement, in term of inspiring change, is Futurism. This movement was started in the early 20th century by a young group of Italian artists. These artists all shared a desire for the renewal of the arts; they relinquished anything traditional and welcomed the new, innovative, and progressive. Many art movements throughout history have shared this desire and have had the power to inspire people. However, Futurism is unique in its relation to this thesis because Futurists not only wanted to inspire movement but they also used their art to portray and study movement in a time when society was rapidly changing.

The early 20th century marked a time of speed and progress. Often known as the machine age, automobiles adorned the roads and skyscrapers scattered the horizon. There was an interest in anything that portrayed speed and motion. The Futurists noted this and enveloped the ideas of the time into their work, creating two dimensional pieces of art that portrayed four dimensional motions.



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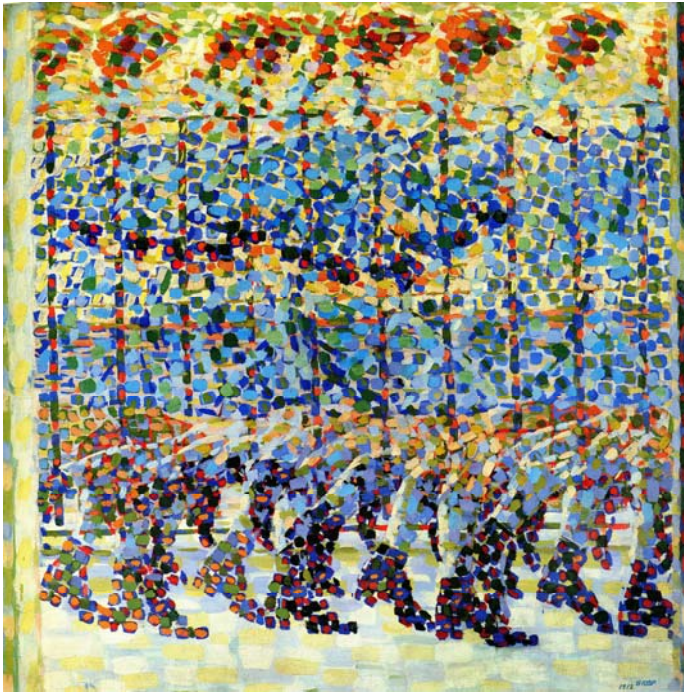


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⁷ Van Ness, H.C., *Understanding Thermodynamics*. New York, NY: McGraw-Hill, 1969. pg 1. Statement is in reference to the First and Second law of Thermodynamics.

⁸ Gino Severini, *La Chahuteuse (Dynamism of a Dancer)*, ca 1912, Oil on Canvas, 60cm x 45cm. Civico Museo d'Arte Contemporanea, Collection Riccardo Jucker, Milan

⁹ Carlo Carrà, *Red Horseman*, ca 1913, Tempera and Ink on Paper, 26cm x 26cm. Civico Museo d'Arte Contemporanea, Collection Riccardo Jucker, Milan



10



11

Futurists used more than just paint to teach their ideology. They wrote many manifestos which were publicized. These manifestos were written to encourage people to live in motion. The first Futurist manifesto written by Filippo Tommaso Marinetti reads, “We must break down the gates of life to test the bolts and the padlocks! Let us go! Here is the very first sunrise on earth!”¹² He wanted to inspire society, push people to reject the past and make their future. Soon Futurism progressed beyond canvas and paint; it infiltrated music, theater, and sculpture. It helped to create and inspire the culture of the time.

In fact, Futurism helped to inspire many renowned architects we know today. Santiago Calatrava, who is known for his studies of human movement in his designs, has referenced futurism in his work. Also Le Corbusier is often known for his strong embrace of Futurism. His appreciation for the Futurist art movement may have inspired him in his work as a Modernist architect.

Modernism and Futurism have strong ties. The movements took place around the same time and paralleled in many theories. Modernism is based on the ideology that people have the power to create, improve, and shape their environment. Architecture was

¹⁰ Giacomo Balla, *Girl Running on a Balcony*, ca 1912, Oil on Canvas, 125cm x 125cm. Civica Galleria d'Arte Moderna, Milan

¹¹ Marcel Duchamp, *Nude Descending Staircase, No 2.*, ca 1912, Oil on Canvas, 57 7/8" x 35 1/8". Philadelphia Museum of Art, Louis and Walter Arensberg Collection

¹² Marinetti, F.T., *Futurist Manifesto*, 1909. The printing of the Manifesto marks the start of the Futurist movement.

included in this thought. Modern architecture was seen as a design that encouraged enlightenment and progress.

An important work by Le Corbusier, in terms of spaces that enlighten and promote growth, is the Notre-Dame-du-Haut in Ronchamp, France. Serving as a place of worship, the building is a pilgrimage where people gather for spiritual guidance. Light floods into the interior of the building through small holes that are punched through the thick concrete skin. The interior is composed of a simple white pallet but complexity is created as sunlight paints the curved wall interior. The intricate play of light in the building is often referenced as a tool for spiritual illumination. In true Modernism style, Notre-Dame-du-Haut is designed to be a space that inspires emotion and prosperity.

Architecture can be used as a tool to motivate growth and progress through movement. Architects have the ability to create spaces that enlighten and motivate, creating an instrument to breathe life into people and communities. While paintings can portray to us an emotion or an idea, architecture has the ability to envelope us in emotions and ideas. People are creatures of the senses. We can touch and feel our surroundings. A painting is something we experience as an audience; we look at the art from distance. Architecture is a theater art; we can interact and play with its shapes and forms. Good architecture will progress this idea further and become a place that stimulates and encourages us mentally and physically.

CONCLUSION

“Movement not only speaks through an object; a living organism owes its final form to it. Movement leads to growth and structure.” -Rudolf Laban

Architecture has become the stage for life. While we live out our comedic drama the built environment becomes the backdrop to our life. But, architecture should take center stage and envelope us in beautiful shapes and forms and encourage us to feel, play, and think. Our environment will no longer be spaces that we blindly move through but instead will become a tool to inspire us mentally and physically. Through architecture we can design spaces that enlighten, motivate, and provoke people to evolve their worlds.

PROPOSAL: THE GREENWAY STATION

The city of Madison has shown tremendous population growth in recent years. This large scale growth has intensified problems in the region's existing transportation system. This expansion has been especially hard for the transportation between the Mendota and Monona Lake, or the Isthmus. The Isthmus is home to the state capital and the University of Wisconsin campus. As a result the safe travel for a high volume of pedestrians and cyclists has become a major concern.

The 2007 report by the Wisconsin Department of Administration showed that Madison's Dane County has grown quicker than any other Wisconsin county. The 2002 census showed that there were more than 400,000 residents and 285,000 jobs in Dane County alone. The population is projected to grow past 600,000 by the year 2030 with an increased employment of 382,000 workers.

Many people from communities nearby Madison commute to the city for their employment. Likewise, the lower housing costs outside of Madison have created a giant leap in people commuting to work in city. According to the Madison Department of Transportation, in 1990 there were 16,000 employees commuting to Dane County from nearby counties daily. In 2000, that number nearly doubled to 30,000 commuters.

The University of Wisconsin Madison Campus, located in downtown Madison had nearly 85,000 students and staff in the year 2008. However, parking on campus is largely shared with the public making space very limited. There are currently no plans to build extra parking space on campus or the Isthmus because land has been argued to be too valuable.

Madison has always shown a high quality of life. There are many theaters, symphony halls, historic landmarks, a beautiful downtown campus, art centers, and other community attractions. With the growth projected for the city, if an improved transit system is not implemented mobility in the region could become obsolete. This can have detrimental effects on the economy and the aesthetics of the city.

Therefore, I am proposing a transportation station for Madison. The city has always been a place of movement. The Chicago, Milwaukee, St. Paul and Pacific railroad has made stops in Madison since 1847. While a few of the rail tracks have been paved over some are still in use. While the trains that move through Madison today are used to carry goods and materials, the tracks follow many busy roads and popular destination points for Madison and commuters. I purpose that the historic transportation systems in the area be revitalized to relieve congestion in the city.

The system will run through a central locale located next to Lake Monona where two train lines converge. The site measures about 1,000 feet long and varies between 200ft at its widest and 60ft at its narrowest. With such a narrow site in close proximity to the beloved lakes, I am proposing a multi-use greenway.

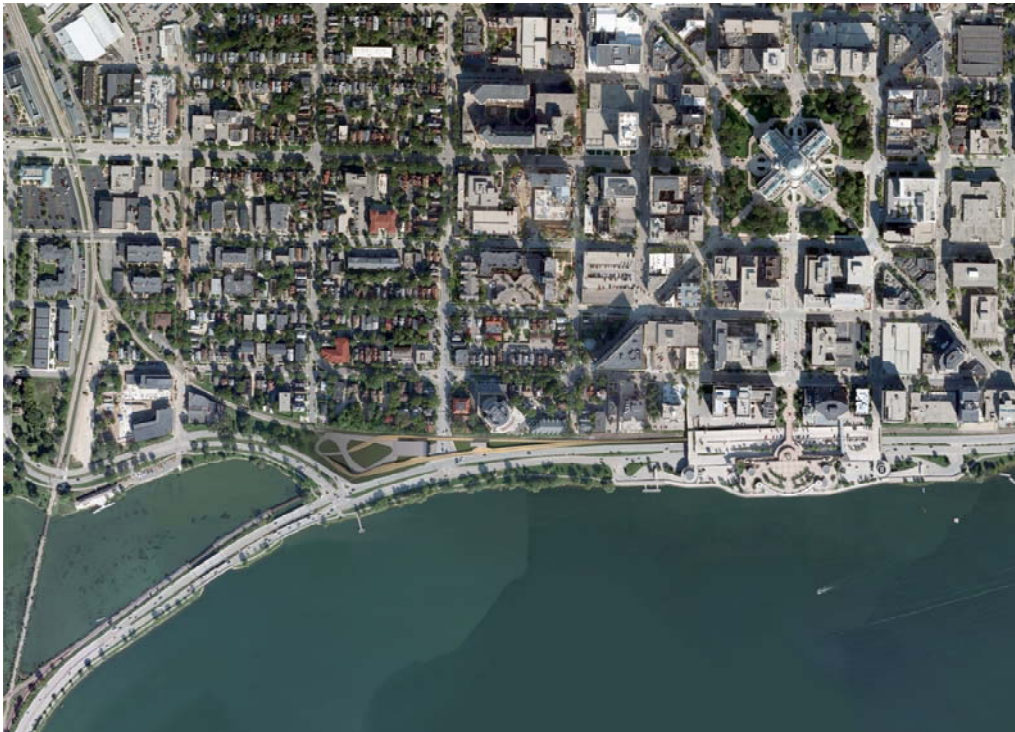
Design emphasis will be placed on the movement of pedestrians and bikers. The greenway will create new pathways that merge with existing nearby pathways, creating a unified urban route that promotes safety for all travelers.

Along the greenway, design elements will be created that encourage the interaction, play, and participation of the users. Thought will be given to protection of the users from the changing climate of the Midwest.

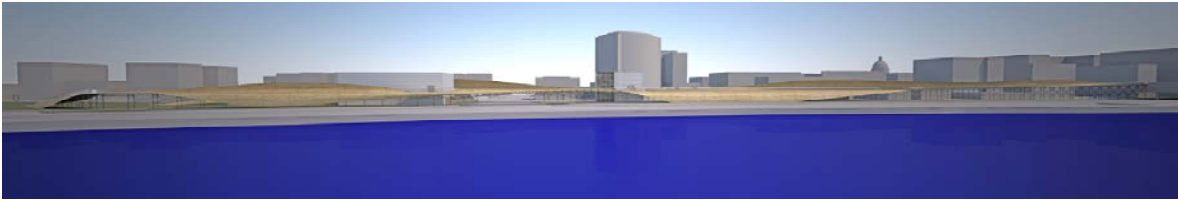
PROGRAM

Ticket Counter: 200sqf
Waiting Area: 500sqf
Exhibit Space: 1000sqf
Information Desk: 100sqf
Restroom: 2@ 200sqf
Office: 5@ 100sqf
Storage: 3@ 100sqf
Security: 200sqf
Mechanical: 300sqf
Platform: 10,000sqf
Outdoor Park: 20,000sqf
Pedestrian Bridge: 30,000sqf
Total Interior Program: 3,500sqf
Total Exterior Program: 60,000sqf

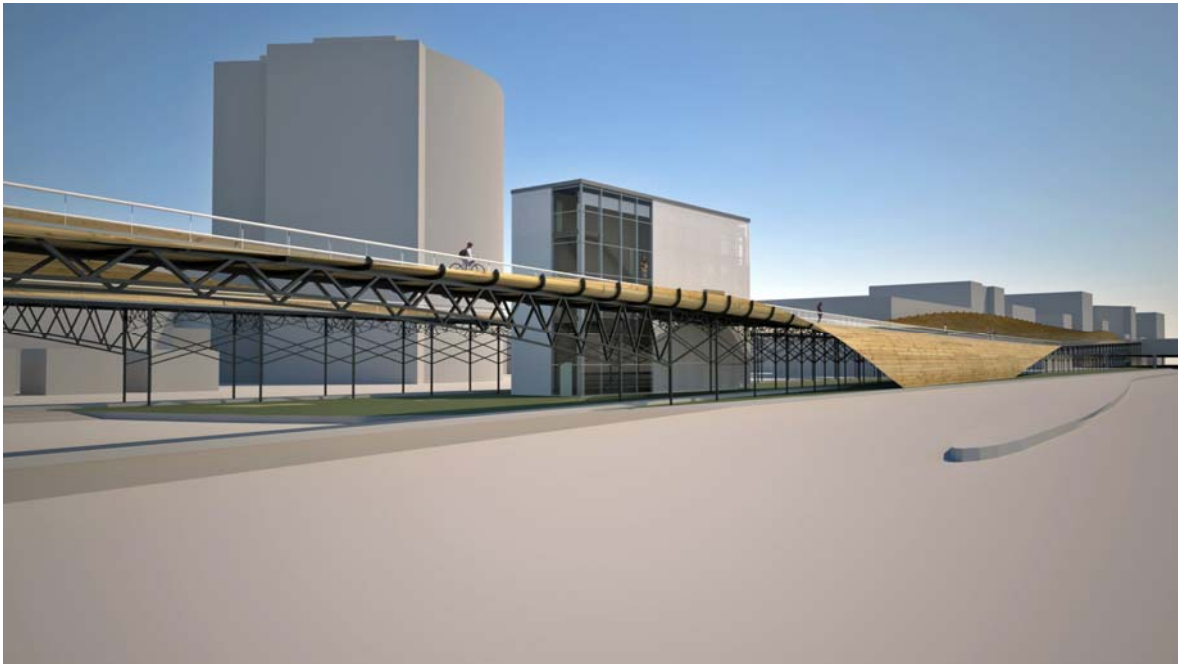
THE DESIGN



Roof Plan



Elevation



Exterior Perspective



Exterior Perspective



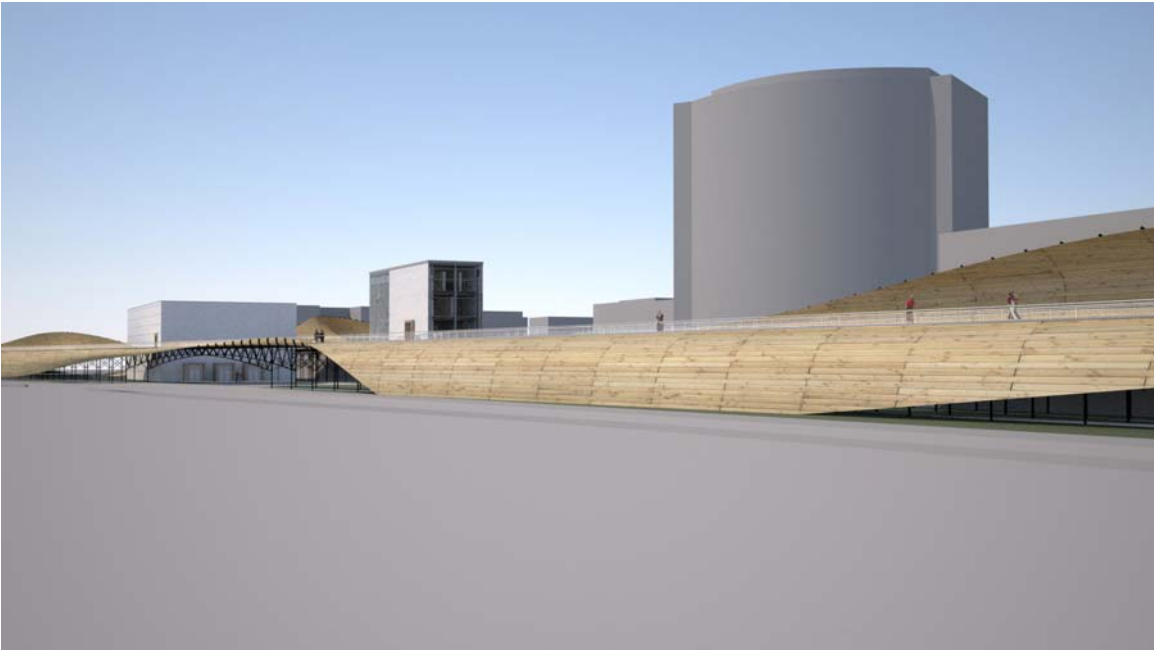
Exterior Perspective



Exterior Perspective



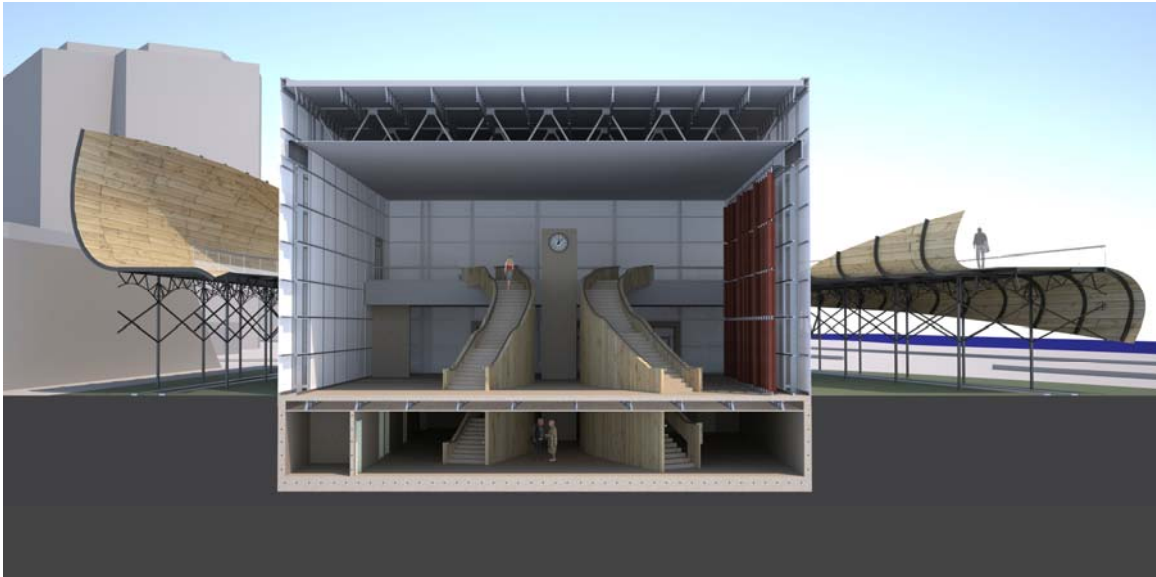
Long Section



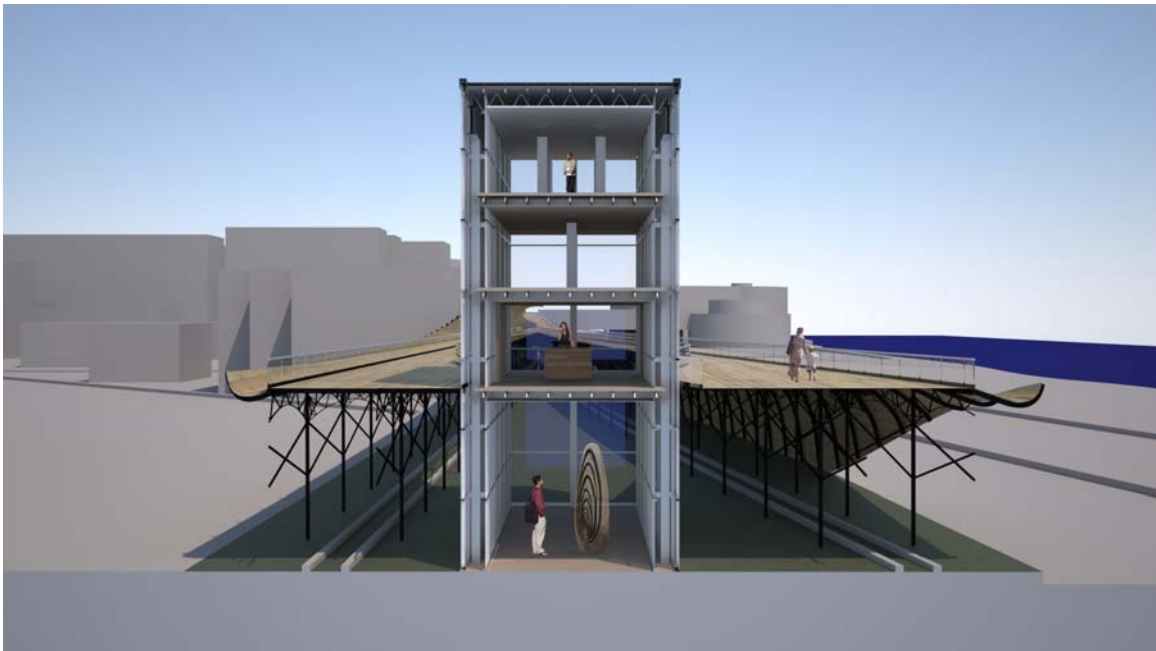
Exterior Perspective



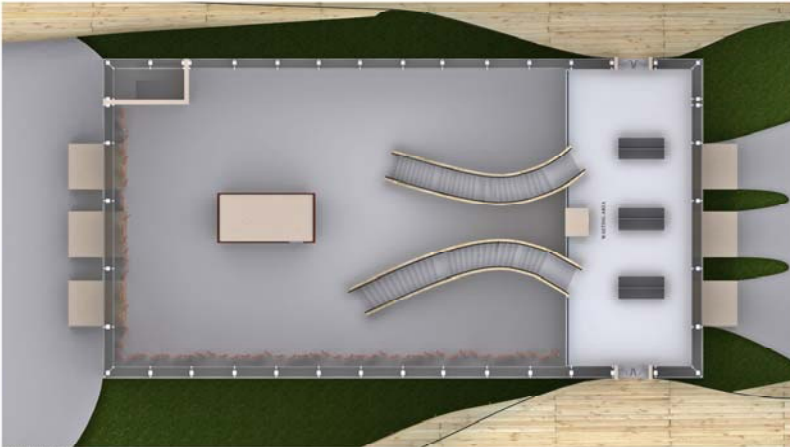
Exterior Perspective



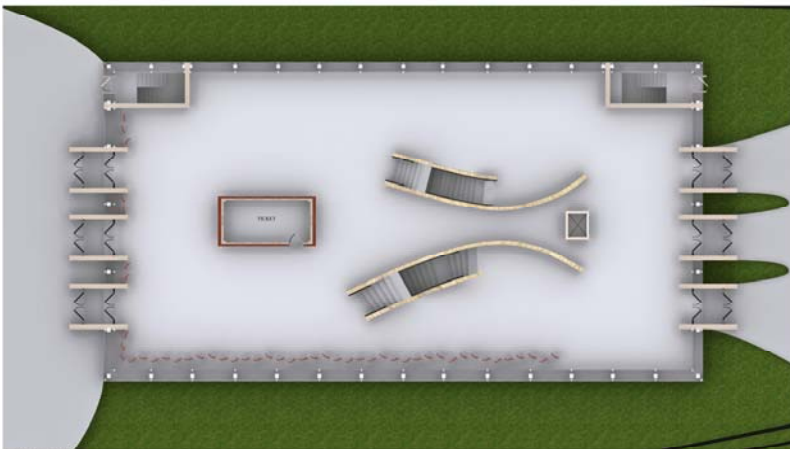
Train Station Section



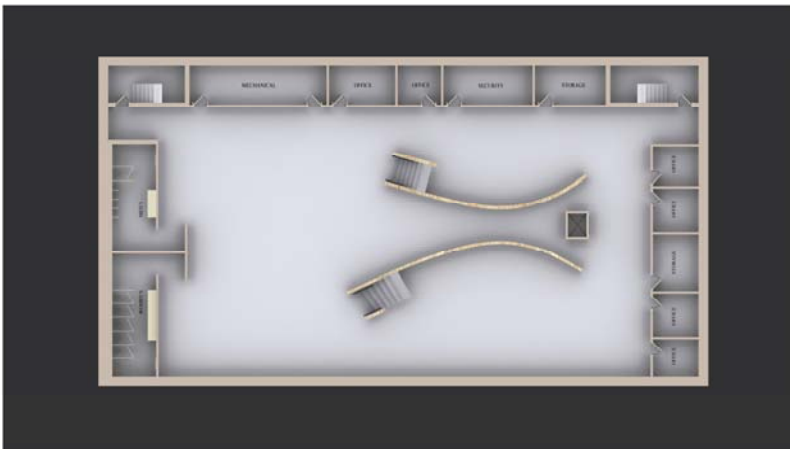
Gallery Section



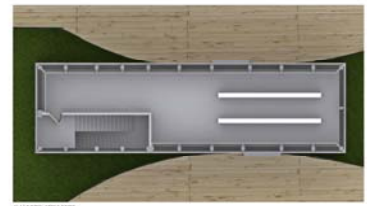
STATION MEZZANINE



STATION GROUND FLOOR



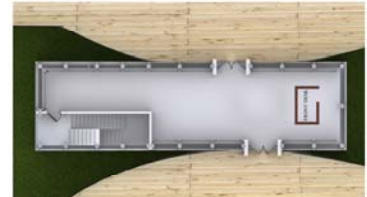
STATION SUBTERRANEAN



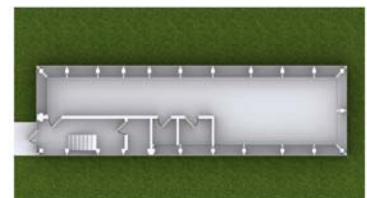
GALLERY 4TH LEVEL



GALLERY 3RD LEVEL



GALLERY 2ND LEVEL



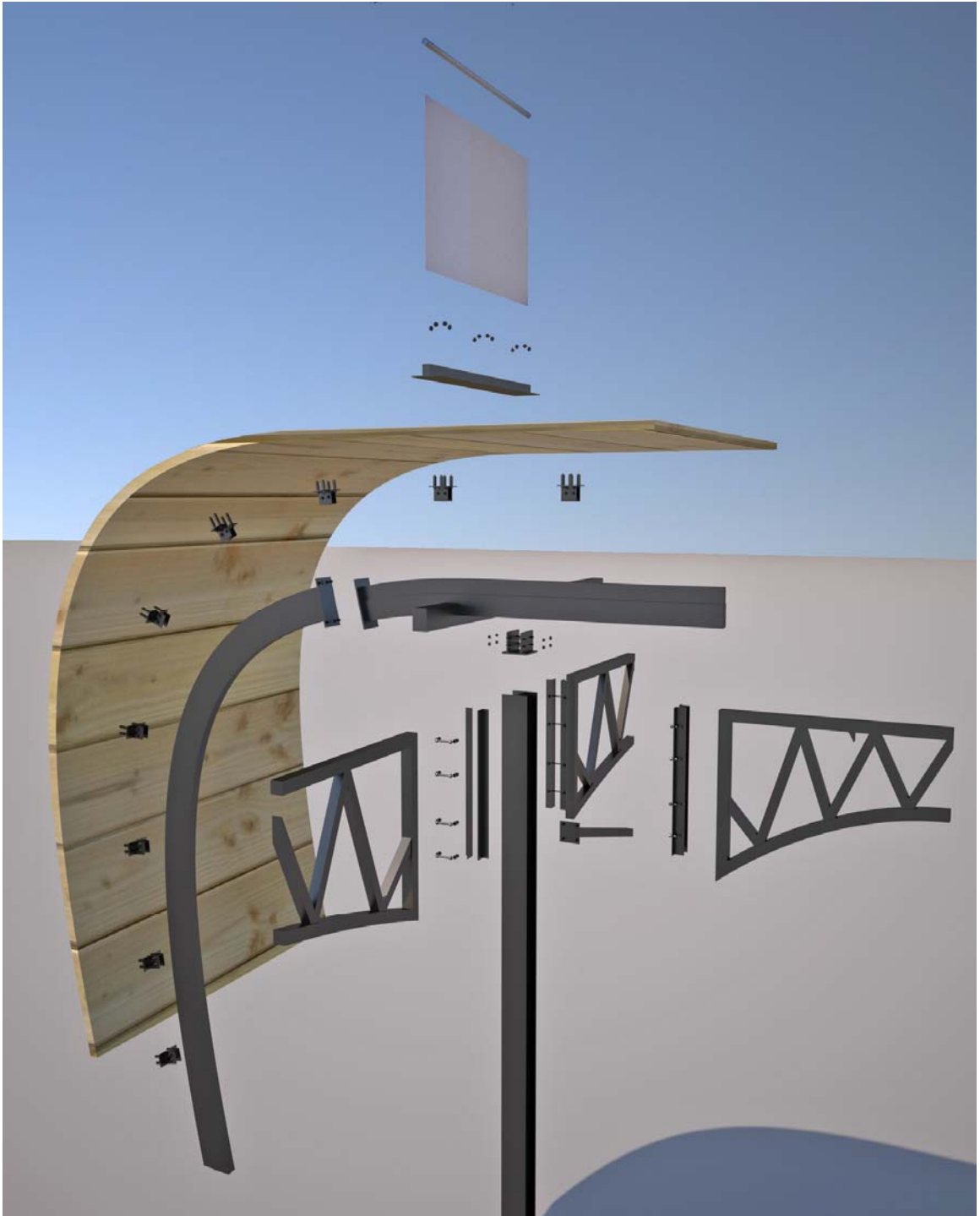
GALLERY GROUND LEVEL



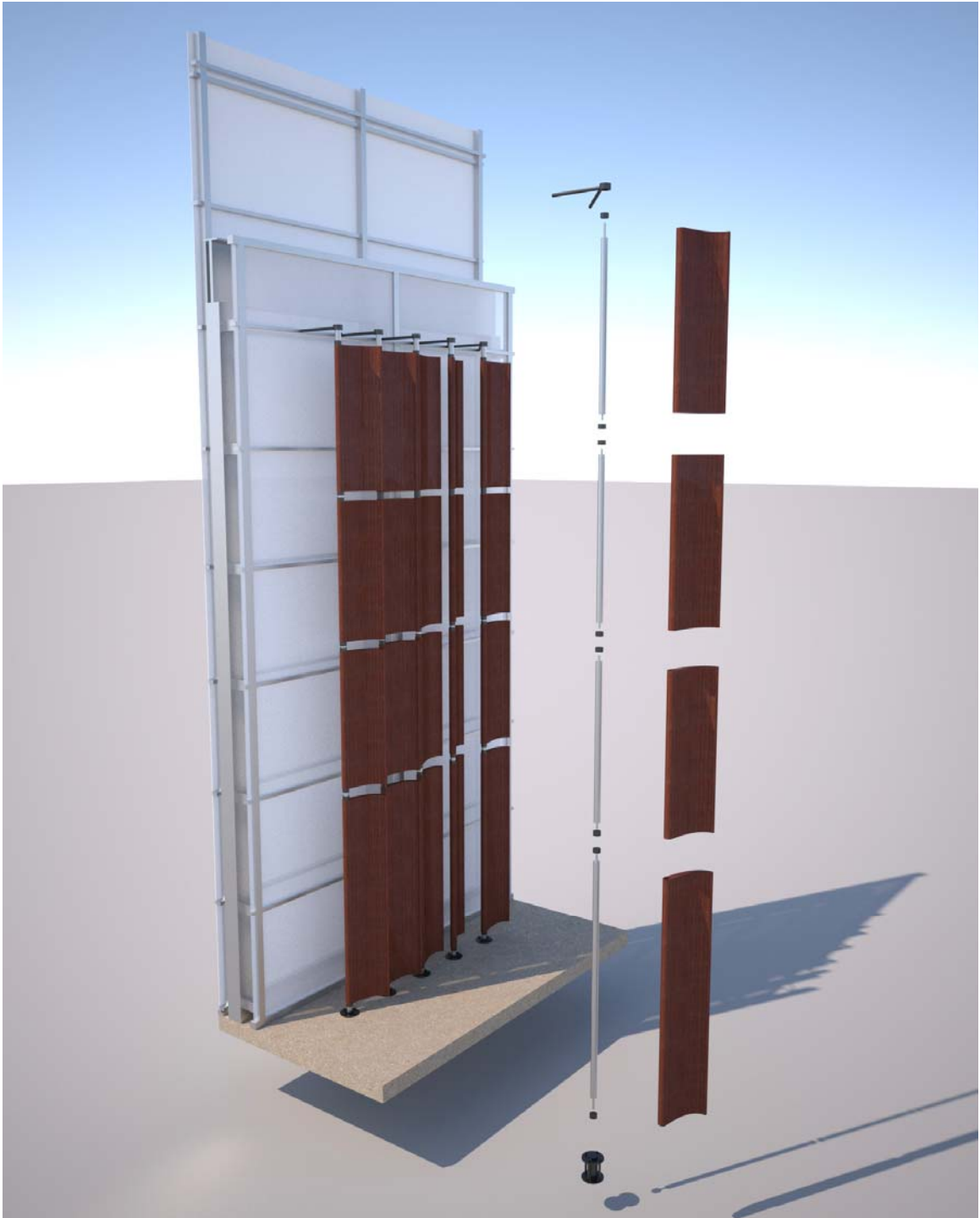
Gallery Interior Perspective



Station Interior Perspective



Bridge Structure Detail



Louver Structure Detail

PRECEDENT: NEW YORK GRAND CENTRAL TERMINAL

“As a bullet seeks its target, shining rails in every part of our great country are aimed at Grand Central Station, heart of the nation's greatest city... Grand Central Station! Crossroads of a million private lives, gigantic stage on which are played a thousand dramas daily.” –Excerpt from NBC Radio Show “Grand Central Station” ca 1937

New York City Grand Central Terminal is the largest train station in the world with 44 platforms and 67 tracks amongst them. More than half a million people visit the station in a single day. With such a popular record, the station has become deeply imbedded in the life the people and the city fabric.

The station is not only a place for people to move through but it has also become a place for people to be at leisure and play. Grand Central is the host to many numerous restaurants, newsstands, gourmet markets, over forty retail shops. It is also connected to the New York Transit Museum. Further expanding the stations many uses, it once exhibited a U.S. Redstone Missile and was home to the CBS Television station for nearly 30 years.

One of the most inspiring spaces in Grand Central is the main concourse. At 275 feet long by 120 feet wide with a 125 foot tall ceiling the colossal space could appear to dwarf a single visitor. However, the space is always filled with the bustle of thousands of travelers and the space quickly fills up with the energy of the every day traveler. A mystical celestial painting occupies the large ceiling in this space. The scene was painted in 1912 by a French artist named Paul César Helleu.

With such an awe-inspiring atmosphere, it is almost forgotten that Grand Centra's main purpose is not to inspire visitors with its beautiful art but to aid in the act of movement. The design of the station was very innovative for its day and it continues to influence modern designs. The most noteworthy was the integrated use of gently sloping ramps. Staircases were the standard of the time but ramps were used to aid the traveler not only in their movement but the transportation of luggage.

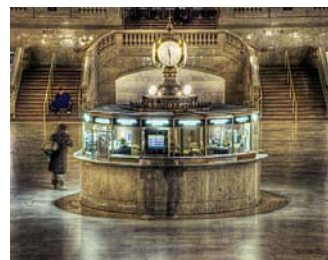
Grand Central is an innovative look at city planning as well as an engineering marvel for transportation architecture. It is a historical marvel that brings an invigoration of planned movement into the bustle of a busy city.



i05



i06



i07

PRECEDENT: THE HIGH LINE PROJECT

The original High Line was a system of elevated rail roads built in the early 1930s to increase pedestrian safety and speed up freight service amongst New York's warehouse district. The railroad system lasted until 1980 when it became an obsolete transit. The line was left to be overtaken over by wild grasses and small trees and was eventually scheduled for demolition.

By 1999 interest in the desolate High Line was renewed. Neighbors to the Line saw the unique potential. The community roused together to redevelop the linear route into a lively elevated park. Construction is still in progress but a portion of the new project was opened to the public in the summer of 2009.

A 1.5 mile long portion of the abandoned industrial rail is being converted into a public park. The park will eventually be host to everything from communal yoga classes, edible gardens, to walking tours. The park will also be home to a new extension of the Whitney Museum being designed by Renzo Piano. The museum will mark the Southern entrance to the High Line. The new Whitney will feature over 50,000 square feet of gallery space and is scheduled to open in 2012.

The heart of the design concept, imagined by architecture firm Diller Scofidio + Renfro, is a fusion between agriculture and architecture. Organic materials will be merged with building materials to create a space that accommodates the environmental and cultural needs of the area.

The long linear natural design creates a space for distraction from the usual commotion of the city while reviving an important part of the city's history. The racing freight trains of the High Line have been replaced by a slow paced place of leisure that rejuvenates a community.



PRECEDENT: MILLENNIUM PARK

Millennium Park is located in downtown Chicago in junction with Grant Park. Millennium Park covers nearly 25 acres of the city's green space. Since its conception in 2004 it has become a notable world class center for the arts where music, architecture, landscape design, and urban life intermingle. It has quickly become a hot spot amongst the people of the city offering interactive public art, dining, concerts, and ice skating.

The park was not always such a lively spot. The site was originally a portion of the Illinois Central Railroad. As plans for Grant Park were developed in the early twentieth century, the future Millennium Park site was left untouched. Therefore, Grant Park was developed around the site and soon it became a forgotten and abandoned corner of the city.

In 1998 a plan was conceived to reinvent the forgotten portion of rail road property. With the help of the city and the involvement of artists such as Frank Gehry the site blossomed into one of Chicago's mainstays.

Large scale art and sculptures give the park its inviting characteristic. One of the most beloved designs is formally known as Cloud Gate but is affectionately referred to as The Bean by the locals. The three story tall polished steel sculpture, designed by renowned artist Anish Kapoor, has become one of the most popular pieces at the park because of its curved mirror-like surface that creates interesting reflections.

Another popular piece is the Crown Fountain. The water sculpture was designed by Jaume Plensa and features a black reflecting pool between two 50ft tall glass brick towers. The towers display digital videos of local Chicagoans and create a space that encourages the interaction between visitors and water.

The signature design for Millennium Park is Frank Gehry's outdoor performance venue the Jay Pritzker Pavilion. The structure is built on top of the Harris Theater, a premier indoor performance venue for music and dance. Gehry designed a curving stainless steel ribbon-like skeleton that houses nearly 4,000 fixed seating and additional lawn seating for 7,000 for live outdoor concerts.

The park, which started as a forgotten corner of land, has quickly become the City's most popular public space. It is not only a part of the city fabric, but also an unprecedented design for public space that marries art and people.



i09



i10



i11

CODE ANALYSIS

Zoning

The transportation hub is located in a C (Conservancy) zoning district. According to the Madison Zoning Code section 28.07, the conservancy district is established to preserve and perpetuate certain open space land and water areas for multiple purpose uses consistent with the intent and purpose of the city ordinance, but also to protect the community from the costs which may be incurred when unsuitable development occurs in certain areas. Development in the conservancy district is limited in character, although certain agricultural, commercial, educational, and recreational uses are permitted. Civic development by the City of Madison is permitted without specific limitation where the benefit by such development of landshore and shoreline areas accrues to the community as a whole. In the conservancy district no building or structure, other than an auditorium complex, shall exceed 2 stories. In junction with my proposed program, some permitted uses for the conservancy district by the Madison Zoning Code are: recreational buildings, community centers, auditorium complexes, railroad right-of-ways, including rights-of-way for switch, spur, or team tracks, and parking facilities.

Use and Occupancy Classification

Section 302.1 IBC 2006

A-2: Assembly uses intended for food and/or drink consumption.

A-3: Assembly uses intended for worship, recreation or amusement and other assembly uses not classified else-where in Group A.

S-2: Low-hazard storage occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

B: Business Group occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts.

Construction Type

Section 602.2 IBC 2006

II A: Type I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in this code.

Allowable Height and Building Areas

Section 504 Table 503 IBC 2006

A-2: 3 stories at an area of 15,500sqf

A-3: 3 stories at an area of 15,500sqf

S-2: 5 stories at an area of 39,000sqf

B: 5 stories at an area of 37,500sqf

Automatic Sprinkler System Increase

Section 506.3

“Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the area limitation in Table 503 is permitted to be increased by an additional 200 percent ($I_s = 2$) for buildings with more than one story above grade plane and an additional 300 percent ($I_s = 3$) for buildings with no more than one story above grade plane. These increases are permitted in addition to the height and story increases in accordance with Section 504.2.”

Automatic sprinkler system increase

Section 504.2

“Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one. These increases are permitted in addition to the area increase in accordance with Sections 506.2 and 506.3. For Group R buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2, the value specified in Table 503 for maximum height is increased by 20 feet (6096mm) and the maximum number of stories is increased by one, but shall not exceed 60 feet (18 288 mm) or four stories, respectively.”

Areas without fixed seating

Section 1004.1.1 Table 1004.1.1

Assembly without fixed seats, standing space: 5 net
 Assembly without fixed seats, unconcentrated: 15 net
 Business areas: 100 gross
 Stages and Platforms: 15 net
 Kitchen, commercial: 200 gross

Exit or exit access doorways required

Section 1015.1 Table 1015.1

Two exits or exit access doorways from any space shall be provided for occupancy type A and B with an occupant load of 49 or more and for occupancy type S with an occupant load of 29 or more. The exit doors or exit access doorways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building with accordance of section 1015.2.1.

Plumbing Systems

Section 2902.1 Table 2902.1

A-2: 1 water closet is needed for every 40 men and for every 40 women.

A-3: 1 water closet is needed for every 125 men and for every 65 women.

S-2: 1 water closet is needed for every 100 men and for every 100 women.

B: 1 water closet is needed per 25 men for the first 50 and 1 per 50 for the remainder exceeding 50. 1 water closet is needed per 40 women for the first 80 and 1 per 80 for the remainder exceeding 80.

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Img 01: Harold E. Edgerton, *Dancer's Cartwheel*, ca 1940, Photography. (© 1987 Harold Edgerton).

Img 02: Photoshop by Katherine Carey

Img 03: *Operation Crossroads: Baker Test*, ca 1946, Time Lapse Photograph. (© U.S. Department of Energy).

Img 04: *Seedlings*. 15 April 2008.

<http://www.flickr.com/photos/tonyolm/2418014774/in/photostream> (23 October 2009)

Img 05-07: Bordwin, Andrew, *Grand Central Terminal*. London: Phaidon Ltd, 1996.

Img 08: © 2004 Diller Scofidio + Renfro

Img 09-11: *Millennium Park: Creating a Chicago Landmark*. Chicago, IL. University Of Chicago, 2006.