Rethinking the Role of Urban Freeway:

A Remediation of the I-5 Freeway in Downtown Seattle

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Abstract

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Three major problems related to the urban freeway are discussed in this thesis. Firstly, the impact of air and noise pollution on people's health has been increased by having freeways in cities. Secondly, urban freeways impede social and economic equity since they are most likely to be placed in low-income communities and minority neighborhoods in American cities. Lastly, urban freeways create voids generating disconnected spatial experience.

The goal of this project is to activate the space around a part of the I-5 freeway in Downtown Seattle, and form a safe, clean, transparent, and sustainable urban environment. In this case, the design will respond to air and noise pollution to help reduce health risks. The design will also address the issue of socio-economic equity by providing multi-use and sustainable developments. Furthermore, by keeping a high level of penetrability, accessibility, and visibility, the site experience will be altered and improved along the I-5 freeway.

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Chapter 1. Introduction

1.1 Problems

"30% to 45% of people living in large North American cities live" within 1000 feet to 1600 feet to the freeway, which largely increases the health risk to have respiratory illnesses, heart disease, and stroke (HEI, p.9). Also, many studies have shown that people could get insomnia, hearing loss, emotional imbalance, and mental health disorders due to long-term exposure to air and noise pollution. When living in cities, people tend to live much closer to traffic ways. In some places in Seattle, apartments and houses are even built within 100 feet of the freeway (Figure 1), which is far below a safe distance. Secondly, having freeways in cities impedes social and economic equity since freeways are most likely to be placed in low-income communities and minority neighborhoods in American cities, such as Miami, St. Paul, and Los Angeles. As a result, many great cultures were destroyed, and people's lives were affected. Lastly, urban freeways create voids generating disconnected and uninviting spatial experiences. These abandoned spaces also provide places for negative activities and events, which are harmful to the urban environment in almost every aspect.

Figure 1. Aerial View of I-5 Freeway along 5th Ave. NE, Google Maps, 2019.

1.2 Claim

The thesis will focus on identifying and analyzing problems freeways cause in cities and explore theories and methods of using architecture to rethink the role of urban freeway and activate the forgotten and dead urban space they form. The impact of having freeways in cities has always been controversial. Some cities have decided to tear down the freeways while others have plans to expand them. The general trend indicates that more and more cities have started to think of the future of their freeways. Tunnels, boulevards, parks, and squares are all common approaches to remove or transform urban freeways. It is also important to note that different cities with different types of freeways require varying approaches to solve their own problems. In this case, interactive installations and mixed-use buildings will be proposed to activate a part of the I-5 freeway in the downtown area of Seattle.

Chapter 2 Problems, Theories, and Case studies

2.1 Problems Caused by Urban Freeways

2.1.1 Health Problems

Living near freeways can be extremely dangerous and causes a variety of health problems or diseases due to long-term exposure to air and noise pollution. But what should make people more concerned is "[n]early one half of all Americans—an estimated 150 million—live in areas that don't meet federal air quality standards" ("Vehicles, Air Pollution, and Human Health."). The major issue is traffic-related air pollution. Some of the pollutants include carbon dioxide (CO2), carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOX), particulate matter (PM), and substances known as mobile-source air toxics (MSATs) (HEI, p.7). Of the chemicals mentioned above, the fine PM is harmful enough to kill 100,000 to 200,000 people every year in the United States and more than 3 million people all over the world (Brugge, p.8).

A UCLA atmospheric chemistry professor pointed out in her study that the risk of getting cancer, chronic respiratory illnesses, heart disease, and stroke is extremely high if one lives within 500 feet to 1000 feet to the freeway (Barboza 2017). Besides physical damages to human bodies, living near freeways or major roads also increases the risk of developing dementia, or symptoms of memory loss (Senthilingam 2017). "Previous research has suggested that exposure to air pollution and traffic noise could increase nerve degeneration within the brain. And one recent study found that certain particles common to air pollution could enter the brains of people who breathe them in" (2017).

Another major impact caused by having freeways in cities is noise pollution, which also has negative impacts on people's physical and psychological health according to many studies and researchers. Of course, living in cities sometimes requires people to be less sensitive to noise,

and the assessment of noise can be really subjective. However, living near freeways often leads to long-term and high-frequency exposure to traffic noise, which might cause someone to lose their hearing permanently. The worst part is, "[unlike] many other injuries, hearing damage is irreparable" (Wanger 2018). In addition, living close to freeways might increase the stress level and trigger panic attacks, anxiety disorders, and many other mental health disorders (Olson 2019). Furthermore, some other problems generated by living close to freeways are losing sleep and emotional imbalance due to the high level of stress induced by traffic noise pollution (2019).

2.1.2 Social and Economic Equity

In the 1950s, the freeway was thought of as one of the best tools to bring prosperity to a city's economy. In the same era, the former British Prime Minister Winston Churchill said, "America at this moment stands at the summit of the world" (Luce 2015). Automobile culture has dominated American's lives since then, as the demand for transportation infrastructure became unprecedentedly high. More and more freeways were being placed in or on the border of the downtown area in American cities, such as I-5 in Downtown Seattle, I-90 in Downtown Boston, I-4 in Downtown Orlando, I-95 in Downtown Miami, and the list goes on. The freeway can be a double-edged sword even if the urban planners know how to wisely use it. Unfortunately, the urban planners' best solutions back then were putting the freeways in the low-income communities and neighborhoods, where minorities often lived. Their plans have been exposed as using the freeway to get rid of the slums while attracting investments. In this case, lots of these communities and neighborhoods, often believed as the dark side of a city, were translated into public projects. Some facts are: I-95 was placed in "the heart of Miami's historic black neighborhood"; I-94 in St. Paul, Minnesota cut the "city's historic black neighborhood" into pieces; and one of the largest Mexican American neighborhoods in East Los Angeles was ruined to make room for

six major freeways in 1960 (Alivia 2014). The intention of reducing poverty or slums in cities while attracting investments was not wrong, but the methods needed to be well considered. It was socially, economically, and emotionally overwhelming for people, especially the poor and minorities, to leave the place they had called home for generations. Considering the culture and history destroyed in the process, regaining a sense of belonging in a completely strange place could take a few years or even generations.

2.1.3 Urban Voids

Urban freeways were not only able to leave mental scars on people's minds but also cause physical scars in the city. And these scars are experienced every day by city dwellers as voids on their way home or to work, generating disconnected and unsafe spatial experience. According to Trancik's book *Finding Lost Space*, "urban voids are undesirable urban areas that are in need of redesign, anti-space, making no positive contribution to the surroundings or users. They are ill-defined, without measurable boundaries and fail to connect elements in a coherent way" (1986, p.3). It is not surprising that neglected areas are attractive to undesirable activities and events, which can be extremely harmful to a city's economy, health, safety, environment, and even reputation. In Seattle, it is so common to see the homeless camping under the freeway. Of course, homeless people do not willingly occupy these voids but have few choices. The issue is very complicated when it comes to the homeless, given the origin, trends, and solutions. However, the damages are very clear. Travis Phelps, the spokesperson of the Washington State Department of Transportation, says it needs to spend at least $250,000 a year just to "clean up and clear out the homeless camps" (Kerns 2015). If the economic losses are not seen as a serious problem, underpasses littered with trash and used syringes are powerful enough to leave a bad impression for tourists when they're driving through it. But the homeless should not feel ashamed but

instead the city's government and its urban planners and designers. These groups today seem helpless when dealing with the leftover space or space in-between. The reasons for this difficult situation we are facing today could be varied. Maybe it is hard to envision every possible emerging problem, given the current limits of our thinking in building multi-programmed transportation infrastructure. Maybe the currently adopted urban planning theories constrain our way of thinking.

2.2 Theories and Case Studies

2.2.1 The Influence of the Modern Movement in Urban Planning

The urban planning theories in this century are dominated by the Modern Movement in architecture. Under its influence, "the spaces between buildings are rarely designed", which might be the reason why the fabric of most Americans cities is fragmented (Trancik 1986, pg.8). Unlike the planning in the 17th and 18th centuries focusing on creating "total composition and organization", the planning since the 19th century has been more concerned with the internal space than exterior relationships, especially when it comes to the notion of function (1986, p.8).

Thanks to the rapid development of construction technology, the low-rise and mid-rise buildings have been replaced by skyscrapers, and communications and social interactions used to take place on streets have become interior events in isolated buildings. As a result, planners and designers have started to pay more attention to the vertical direction and neglected the public connections in the horizontal dimension. As stated in the book *Finding Lost Space*, "with the loss of a collective sense of the meaning of public space, we [...] also have lost the sense that there are rules for connecting parts through the design of outdoor space" (1986, p.11). With such a background, it is no wonder that the urban planners in the 50s and 60s were not able to come up with plans that considered the context and public connections when placing freeways in cities. In their

minds, the freeway, like buildings, would be able to function well just by itself. However, understanding the purpose of a structure is equally important as learning its relationship with the surroundings. And when structures and buildings are being placed in an urban context, a more complex situation should be taken into consideration. As stated in Burns and Kahn's article "Why Site Matters", "[urban] planning, given its concerns beyond the purely physical, tends to construe location more broadly, incorporating social, economic, and political concerns" (p.8).

2.2.2 The Single Use of Massive Structures in Cities

What is being criticized in this thesis is not the urban freeway itself, but the use of urban freeways as defined by urban planners and policymakers. As written in Jane Jacob's book *The Death and Life of Great American Cities*, "[massive] single uses in cities have a quality in common with each other. They form borders, and borders in cities usually make destructive neighbors" (2011, p.257). In an urban context, all the massive structures, not just limited to freeways, have an inherent quality to make problems when they are not used in multiple ways. The emerging borders, as one of the consequences, will easily lead to voids. And when hundreds of voids are grouped together, city ruins appear. "...[By] oversimplifying the use of the city at one place, on a large scale, they tend to simplify the use which people give to the adjoining territory too and this simplification of use – meaning fewer users, with fewer different purposes and destinations at hand – feeds upon itself" (Jacobs 2011, p.259) Some efforts have been made to improve the conditions around the freeways, such as placing vegetation in the underpass. But such a single design is not sufficient to make people stay even it does swiftly change the experience.

Speaking of modifying the use of the freeway, the Freeway Park, sitting on I-5 in Downtown Seattle and designed by landscape architect Lawrence Halprin, is believed as the first park ever built on the freeway. The intention of stitching the urban fabric was good but the result was not

as expected. Firstly, the design is oversimplified in terms of its program. There is nothing else in the park besides landscape features to attract different users at different time periods. Secondly, people find it is too difficult to access and the existence of the park is barely noticed from the outside. From a distance, what can be seen is nothing but bushes and trees covering the freeway. The internal experience is extremely confused as well. Especially at night, people feel unsafe to be there. Freeway Park is a public space, and providing places for different activities and connections is fundamental to make a public design succeed. Unfortunately, the essence of the design of Freeway Park is just putting one urban void on top of another.

2.2.3 Sustainability

The concept of sustainability or sustainable development has been all over the place and is being emphasized in almost every industry nowadays. And the emerging Green-city Movement has influenced the trend of urban planning for many cities in the world. Numerous well-known global cities have come up with their own green plans, which are dragging more and more cities into this competition of being the greenest. But being green or sustainable is not an easy task as it was thought to be since it is way more complicated than just adding more trees. When it comes to the application of a sustainable approach, economic prosperity, environmental quality, and social equity need to be well managed simultaneously (Hough 2006, p.5). Barcelona, as one of the most populated cities in Europe, has set a goal of becoming one of the greenest cities in the world (Jessop 2017). Not only has the green infrastructure, such as public parks, permeable pavements, and vegetable gardens, been planned, but also the conversation has been made between the ecology, economy, and society (2017). The book *Cities and Natural Process: A Basis for Sustainability* points out that there are two different landscape systems, “the formal and the natural”, or “the pedigreed and the vernacular”, coexisting in cities and experienced by city dwellers every day

(Hough 2006, p.6). The formal landscape is the planned landscape feature that "has traditionally been held in high public value as an expressexpression of care, aesthetic value and civic spirit" (2006, p.6). The natural landscape is the wild urban plants growing in paving cracks or wall gaps or any vacant and abandoned lands in cities (2006). The formal landscape is totally functional and reflects, to some extent, the social and cultural values of a place. However, this kind of landscape usually demands high levels of economic and technological inputs while the natural landscape "provides shade and flowering groundcover and wildlife habitat at no cost or care" (Hough 2006, p.6). The point is the conversation between the two existing landscape systems in cities needs to be made so that the advantages of each can be kept and weaknesses can be eliminated. A new modified landscape system, considering the economy, environment, and society simultaneously, will facilitate the process of achieving sustainability in an urban context.

The Freeway Park, for example, is not a sustainable solution since it only looks at environmental equality and social equity without thinking about economic prosperity. With the same intention to stitch the urban fabric, the Capitol Hill Park proposal, designed by the Patano Studio Architecture, contains a two-mile-long park located on the top of I-5 with a convention center, cultural center, sports arena, retail, and affordable housing to provide a multi-use and sustainable solution when rethinking the role of the urban freeway ("Seattle C.A.P.itol Hill Park." 2017).

2.2.4 Accessibility, Visibility, and Penetrability

One of the problems mentioned before of the Freeway Park is its low level of accessibility. But the discussion of accessibility sometimes cannot be separated from the discussion of visibility in urban planning. Kevin Lynch believes, in his book *The Image of the City*, that by increasing accessibility, visibility is increased (1982, p.100). But high visibility does not necessarily lead to a high level of accessibility. For instance, assuming the design of the Freeway Park was very

noticeable no matter near or far, people still would not be able to get in the park without having proper entrances. However, with a high level of accessibility, being noticeable can encourage the use of the park. The principle is that visibility is an essential requirement; but being easily accessible is the key to ensure the park will be used in a better way. Moreover, to keep a place well used, the design needs to be attractive so that people's attention can be drawn even from a distance, and the senses and experience of users when passing through can be fully stimulated. As stated in the article "Penetrable Landscape as Democratic Form", "the penetrability is achieved there […] by heightening the awareness and pleasure of crossing the lines" (O'Brien p.58). One of the examples is *Rain* designed by Thurlow Small and NIO Architecten. (Figure 2) It is a light installation "[featuring] cascading LED lights hung inside 4,000 polycarbonate tubes that bathe the space in soft blue-white light and pulse in response to vehicular traffic in the underpass, giving the effect of a gentle rain shower" ("M Street NE Underpass: Rain." 2019).

Figure 2. "Rain", photographed by Sam Kittner and Designed By Thurlow Small and NIO Architecten.

2.3 Conclusion

When rethinking the role of urban freeway, it is crucial to identify the problems presented and understand their historical and theoretical origins. What can be seen, after studying the influence of the Modern Movement, is the theoretical framework of urban planning since the 1950s. The explanations given by Jane Jacob regarding the massive structure in urban contexts points out the issue of single-use, which helps the next generation of urban planners and architects avoid designing any massive structure in cities without giving it multiple functionalities and programs. Furthermore, it is imperative to apply the concept of sustainable development in urban planning since the links of nature, cities, and sustainability is inseparable due to the massive impact of human activities on the ecosystem and vice versa (Hough 2006, p.5). And accessibility, visibility, and penetrability should be considered at the beginning of a design since they play fundamental roles in shaping the design outcome. It is necessary to apply all these theories just mentioned to come up with a readjustment of the urban freeway.

Chapter 3 Method and Program

3.1 Thesis Goal

The thesis will examine the site through numerous case studies and site analyses and apply principles derived from theories discussed in the previous chapter. The goal for doing the thesis is to activate the space around a part of the I-5 freeway in the downtown area of Seattle and respond to significant places or buildings that are adjacent to the site. As mentioned in the introduction, different cities with different types of freeways require varying approaches to solve problems. This is also true when choosing programs for a specific site. In this case, efforts will be made to form a transparent, safe, and sustainable urban space.

3.2 Design Principles

Firstly, the design needs to respond to the problems of air and noise pollution. One of the conventional ways to reduce air and noise pollution is by installing noise barriers with vegetation. Green walls (Figure 3) will be widely used in this program particularly because they cannot only help regulate carbon dioxide and block noise but also filter greywater and reduce the urban heat

Figure 3. Living Wall, Photographed by Garry Belinsky and Designed by Snøhetta Architect, San Francisco, CA, 2015.

island effect (Wilkinson 2018). Vernacular plants are preferred; environments and conditions facilitating the growth of vernacular plants will be created to reduce the cost and need for maintenance. Antimicrobial and depolluting materials are also considered to fight against traffic-related air pollution. This type of material, such as titanium dioxide, can "[react] with urban air pollutants and [break] them down into less noxious compounds like carbon dioxide and water [...] when hit by ambient ultraviolet light" (Winter 2013). A technology called Prosolve370e (Figure 4) has already turned such materials into a building facade (Figure 5) of a hospital in Mexico City. "According to recent studies of the technology, the facade [...] is reducing the pollution of 1,000 cars per day" ("Project: Mexico City.").

Figure 4. Prosolve370e Prototypes for Torre de Especialidades, Ulm, German. 2012 <http://www.prosolve370e.com/home>. Digital Image.

Figure 5. 2500m2 Facade at Torre de Especialidades, Mexico City. 2013
<http://www.prosolve370e.com/home>. Digital Image.

Secondly, the design must pay attention to the penetrability by providing easy accessibility and high visibility. All the public areas are open and transparent, accessible in multiple directions, and easy to navigate. Also, the design should not only be visible for the internal users but also external users, such as the car drivers under the cap or pedestrians in a distance. One of the most important principles is to increase awareness and pleasure when users cross the site (O'Brien p.58). Therefore, different kinds of spaces and installations will be created to stimulate the sense of sight, sound, smell, taste, and touch. For example, views rendered with technologies can elevate visual excitement while the sound of water and birds can enhance acoustic enjoyment.

Lastly, as mentioned before, three components need to be considered simultaneously when applying the concept of sustainability. In this case, the design needs to help produce economic prosperity, ensure environmental quality, and promote social equity. Architects and urban planners are responsible to create a space or environment encouraging economic activities connected closely with housing and natural elements. Any efforts made in a single direction in terms of the functionality, use, and purpose, will lead to the failure of this project.

3.3 Study Site and General Ideas for Programming

The site is located in Downtown Seattle, a section of I-5 defined by Seneca St. and S Jackson St. (Figure 6) The northern part of the site is adjacent to the Freeway Park, and the significant buildings along the site include Town Hall Seattle, US Appeals Court, Seattle First Presbyterian Church, Seattle Public Central Library, Downtown Seattle YMCA, Columbia Tower, and Harborview Medical Center. The general building heights are higher in the north and west and lower in the south and east while the terrain is in the opposite. As shown on the context map (Figure 7),

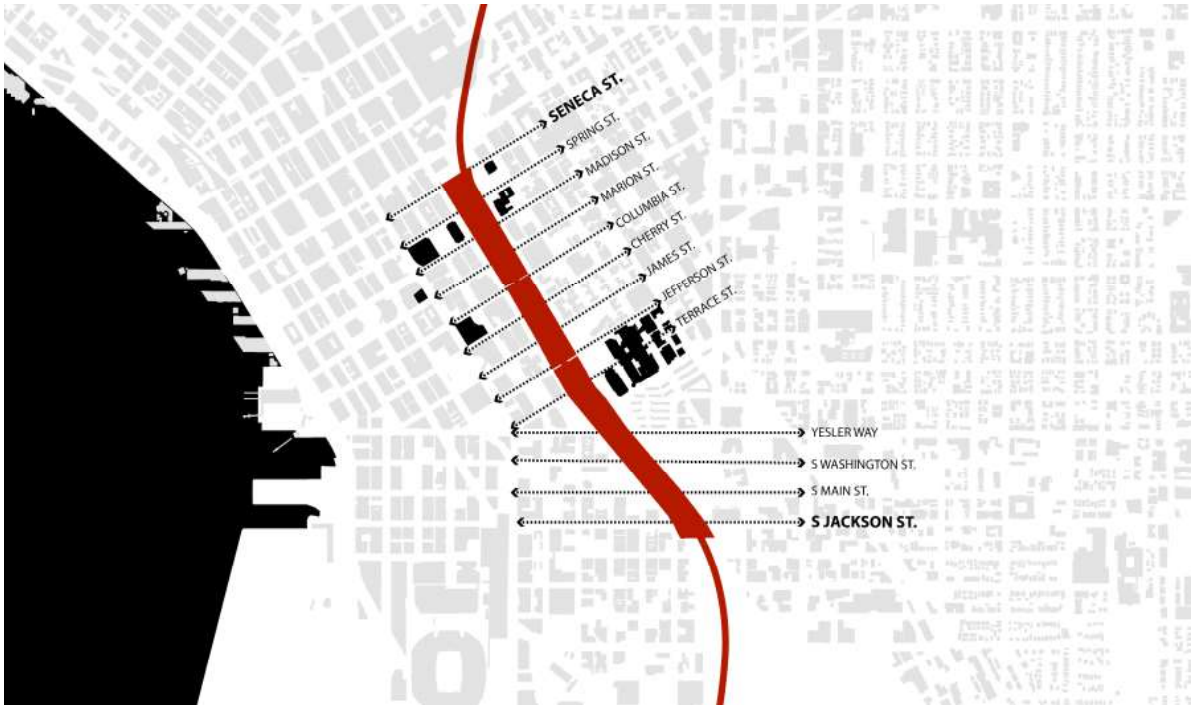

Figure 6. Crossing Conditions along the Study Site

parks, schools, hospitality, residential buildings, and grocery stores are identified within the area since they are all relative elements in this project. Also, 0.25-mile and 0.5-mile radii are displayed to provide a rough idea of how far these elements are from the site and each other.

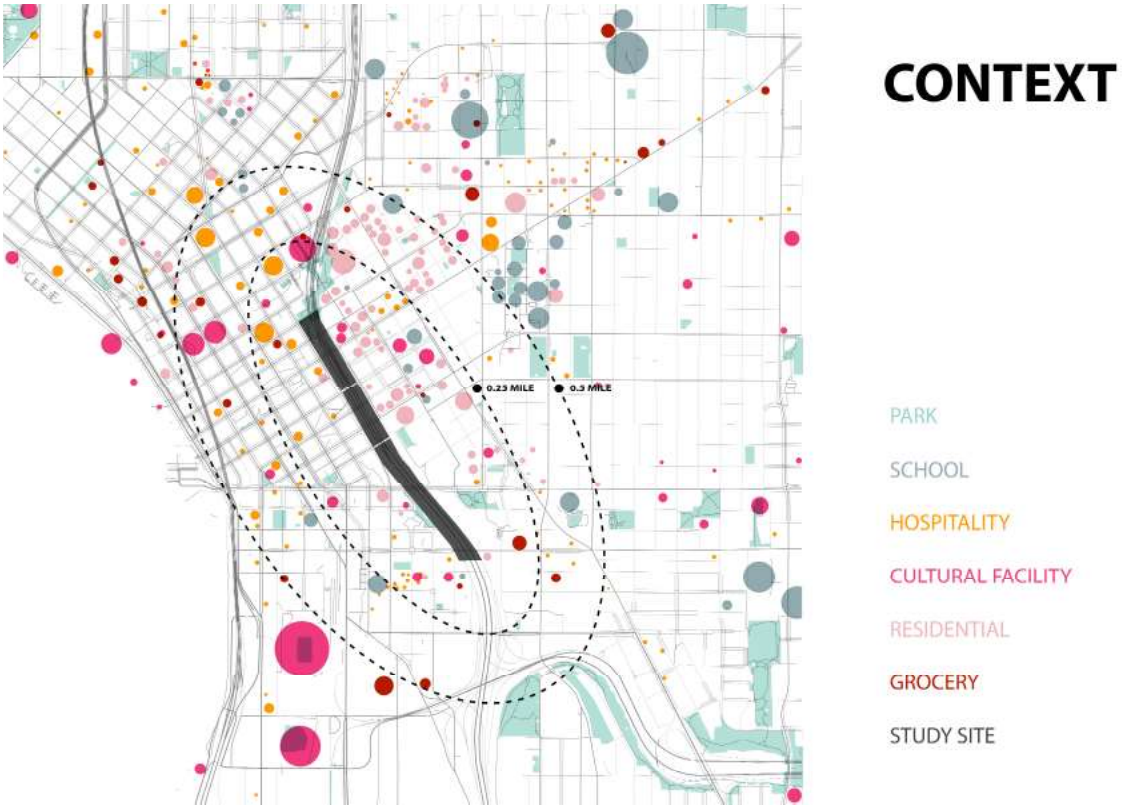

Figure 7. Context Map

The site is composed of three groups of blocks. The first group or group A is on the top of the I-5 freeway and covers the blocks from Seneca St to Columbia St. A public park with hardscape and water features is proposed on the first block in group A to accommodate the needs of people around the downtown area of Seattle for outdoor green space. It also serves as a gateway aimed to reveal the entrance and celebrate the existence of the Freeway Park on its south end. The second block in group A, defined by Spring St and Madison St, is planned to have one or two mid-rise buildings with a public school, residential, and retail space. As seen on the context map, apartments, schools, parks, and retail are dispersed within the area. However, there are no links

or connections formed between them to enable a sense of community, which is essential for people to be attached to certain places. To foster a sense of community, the program is designed to fulfill the needs for people to live, work, learn, play, and explore in a more sustainable way. Because of this multiplicity in functionality and use, the level of privacy on the second block ranges from the public and semi-public to the semi-private and private. Another public park with an I-5 overlook is proposed on the last two blocks, which are on the south end of group A, to help remind people of the true quality of the site. It can become a new Seattle landmark in the downtown area to attract visitors and investments, as one way to ensure economic prosperity. And such a design will not only enable a connection in the horizontal direction but also the vertical direction. Also, since the I-5 freeway reaches the street level between Madison St. and Marion St (at the contour line in Figure 8), these two blocks together will serve as a transitional area between the space on the freeway and under the freeway.

Figure 8. Site Grouping.

The second group or group B is under the freeway and covers the blocks between Columbia St. and Jefferson St. These three blocks are only being used as parking lots right now and have presented many issues. Firstly, such a large area of open land used in a single way is uneconomic and unsustainable. Every piece of land in the downtown area of Seattle is extremely valuable in today's market. According to the NeighborhoodX, a real estate research and analytics firm, the average price per square foot in Downtown Seattle is $868 (Lloyd 2017). Calculating the area of the two blocks, which is about 292,005 square feet, the value of this piece of land exceeds $250 million. And this is the value for the land only, not mentioning the potential profits generated by different kinds of economic activities if the land could be well developed.

On the other hand, the parking lots have made huge negative impacts in the surrounding areas, especially 6th Ave. There are several parking garages standing across the avenue, passively fighting against the presence of the poorly managed parking lots. As a result, the near area has been turned into a dead space with few economic activities and even pedestrians. There are only two bail bond stores on Cherry St. and James St. where they intersect 6th Ave. The worst part is the lifelessness on 6th Ave. has spread to Columbia, Cherry, and James St. One can easily tell the street edge becomes harder and less transparent or permeable when approaching 6th Ave. from these three streets. (Figure 9,10 ,and 11) It is not hard to imagine how desolate these streets will be during the nighttime, and the walking experience must be extremely uncomfortable. On 7th Ave., the condition gets a little better. There are several retail spaces and some apartment buildings facing the parking lots. However, there are no connections formed between these buildings and the parking lots or garages on 6th Ave. What can be seen is trash piled up around the homeless tent camps. The only effort that has been made to activate the area is the textured columns, but this seems helpless. (Figure 12 and 13) Merely visual excitement is simply not powerful

enough to make people stay and enjoy the area. In this case, the five senses need to be stimulated as much as possible when people are passing by. Spaces for bars, restaurants, cafes, food trucks, night markets, indoor and outdoor performances, galleries, and interactive art installations including light installations should be all considered to fully activate the space. Green elements and water features also need to be included to benefit the well-being of humankind and provide habitats for urban animals at the same time.

Figure 9. Street View at Columbia St. and 6th Ave., Google Maps, 2019.

Figure 10. Street View on Cherry St., Google Maps, 2019.

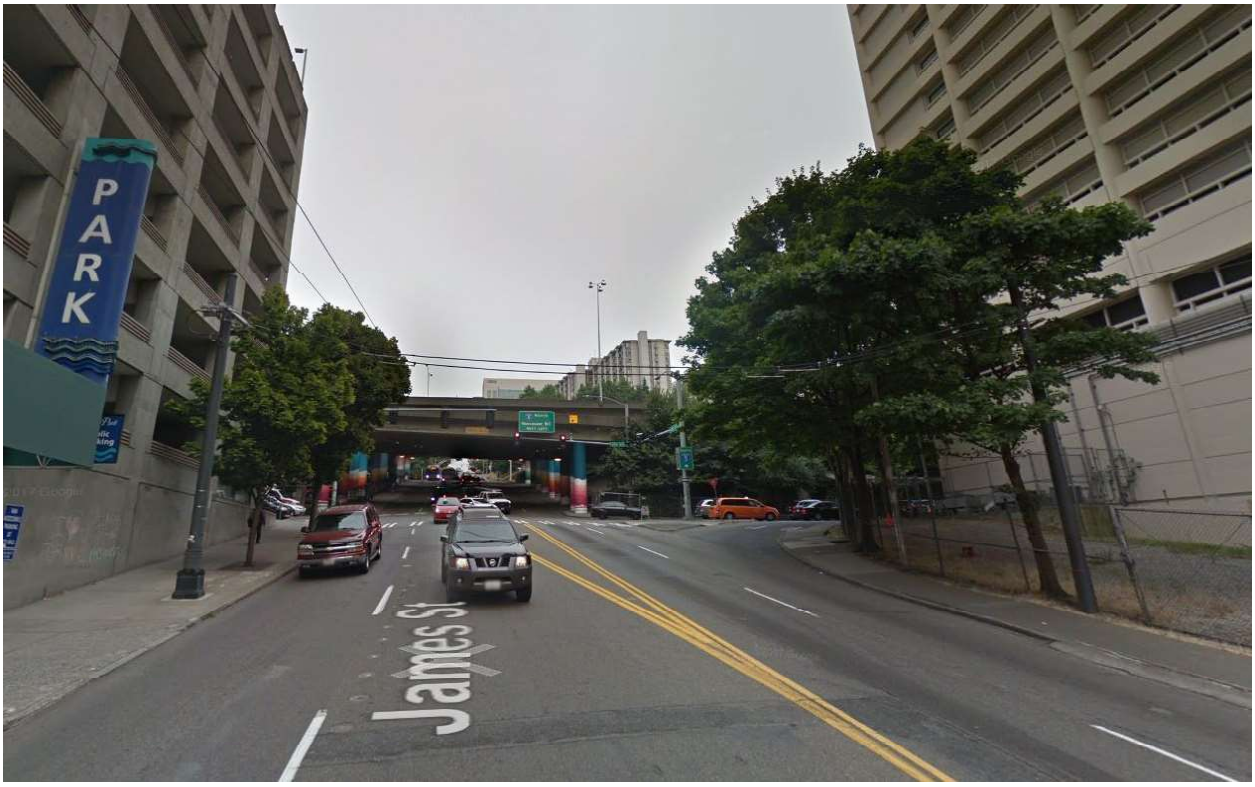

Figure 11. Street View on James St., Google Maps, 2019.

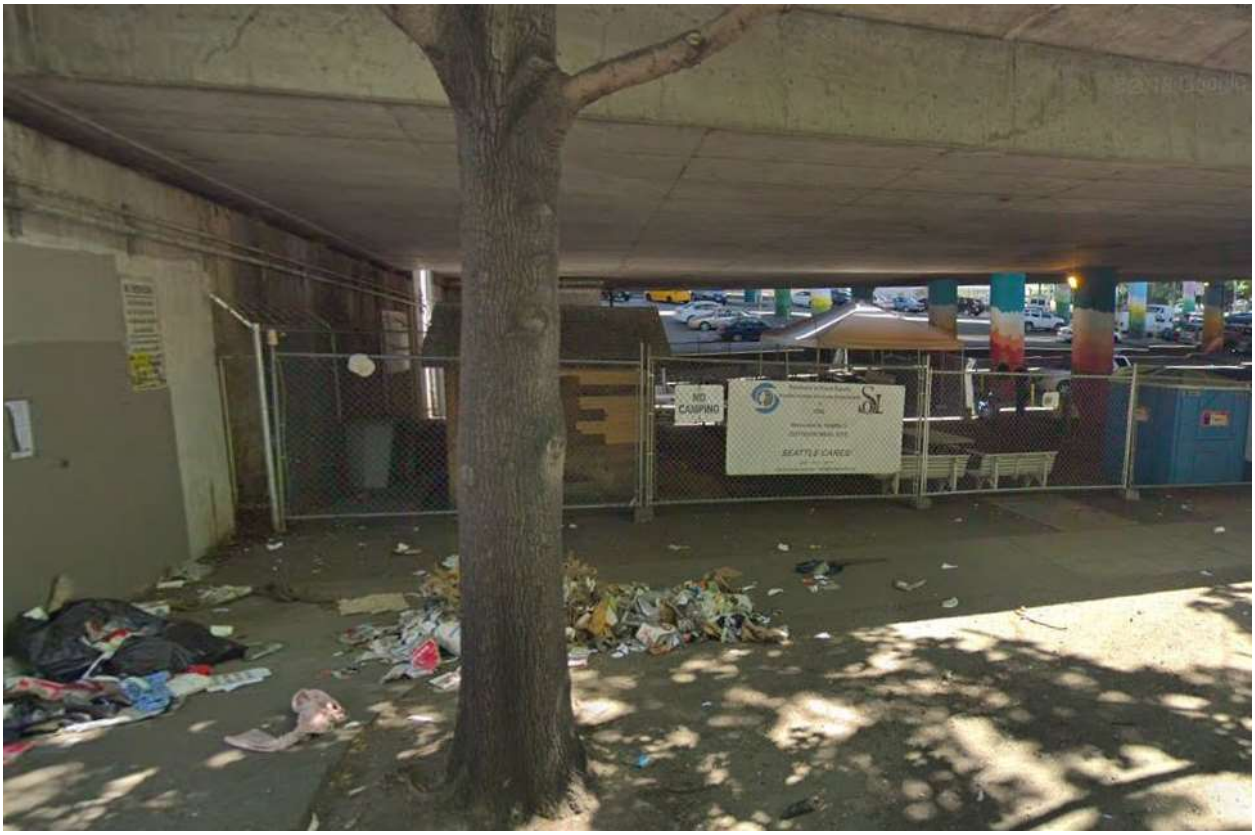

Figure 12. Street View on 6th Ave, Google Maps, 2019.

Figure 13. Entrance of the Parking Lots on 6th Ave, Google Maps, 2019.

The third group or group C covers the blocks on the south of Jefferson St. and north of S Jackson St. and has a more complex site condition. Due to the change of topography, some parts of the freeway can be capped, and some others can be treated as transitional zones. A mixed-use development, containing retail, affordable and market-rate residential, offices, hotels, cultural facilities, parks, and open spaces, is proposed to cap the part of I-5 on the south of Jefferson St. and S Main St. There are several green spaces existing near the site, such as the Harbor View Park, Kobe Terrace, Yesler Playfield, and Yesler Terrace P-Patch Community Gardens, which can be integrated with the mixed-use development and planned with similar characteristics and clearer functions. For example, the P-Patch garden should be kept and even increased in size. And a piece of land nearby can be designated to place farmer's stands or markets. The two blocks located at the north and south end of this group, on the other hand, will function as transitional space,

enabling a balanced visual and physical experience. One notion is that some cultural characteristics of Asian American Communities should be presented in the design of the block on the very south end, defined by S Main St. and S Jackson St., due to its adjacency to the Chinatown-International District.

To form a close connection within the site and coherent walking/biking experience, a green promenade, starting from the Freeway Park to S Jackson St., will run through the entire site. Studies have shown a positive relationship between walkability and good economy, and mixed-use development is thought of as one of the best strategies to promote walkability, which "can help increase private investment, […] promote tourism," "[reduce] the impact of cars", and "lead to active lifestyles and a [smaller] incidence of chronic obesity and related diseases" ("Benefits of Mixed-Use Development.").

3.4 Conclusion

In conclusion, three leading principles will be applied in this program, which is reducing health risk, increasing penetrability, and achieving sustainability. The relationships between each of them are not parallel but closely integrated. Reducing health risk is part of ensuring environmental quality. Spaces with different levels of privacy are created to meet different requirements in different activities. Structures with multiple programs and functions will be built in order to form a lively site experience, and connecting each part of the program will enhance continuity. After all, it is more important to foster a sense of community than create isolated places.

Chapter 4 The Design

4.1.The Experiential Section Study

One of the first steps in the design process was to develop an experiential section (Figure 14). This section was made to help further the understanding and development of the site, design ideas, programs, and spatial conditions.

Figure 14. Experiential Section Drawing.

During the process of generating this section, sensations, emotions, and spatial experiences were used as the major measurements. Supposing a person is walking towards the international District starting at the Freeway Park on the site, one of the questions would be: what kind of events, feelings, and spatial qualities will the site need to provide for the person to finish his or her journey smoothly? Firstly, the site needs to offer a safe walking condition. As discussed above, a green promenade with two lanes, one for pedestrians and one for bikers, is proposed to connect the whole site all the way from the Freeway Park to S Jackson St. On this designated pathway, people can feel confident to walk and bike, knowing their journey are not going to be fragmented and interrupted by either traffic or buildings. Also, having an open and transparent entrance is

essential to increase the sense of safety on the site. Since the site is totally open to the public for anyone at any time without many limits in use, it is crucial to avoid enclosed space and ensure eyes on the street or eyes on the people. In order to achieve that, programs and events need to be diversified as much as possible to make sure the site provides varied places or destinations at different time during the days and nights.

4.2 Site Design

After further studying the three groups on the site, it appears that problems are more concentrated on the blocks in group B. It is the only group that has an underneath condition, which naturally makes the blocks in this group influential in shaping people's experiences on the streets. Therefore, improvements are demanded more urgently, which is why these blocks have been chosen as the final site.

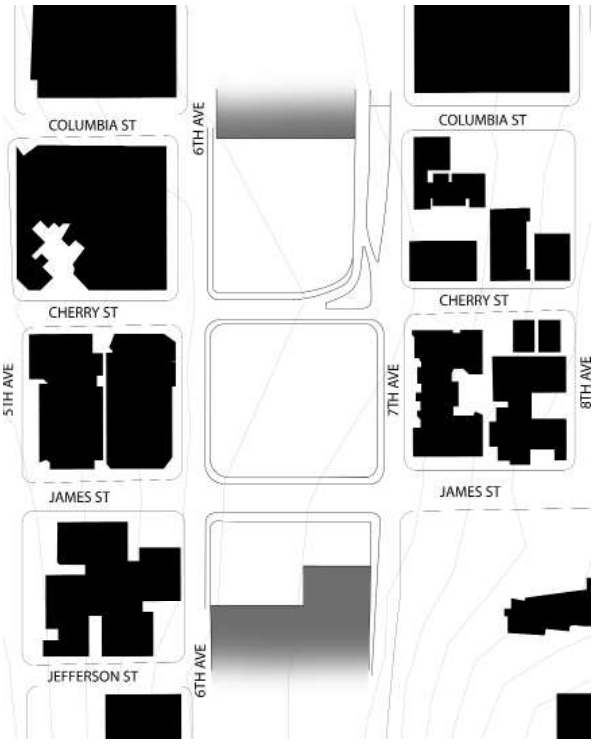

Figure 15. Site Condition.

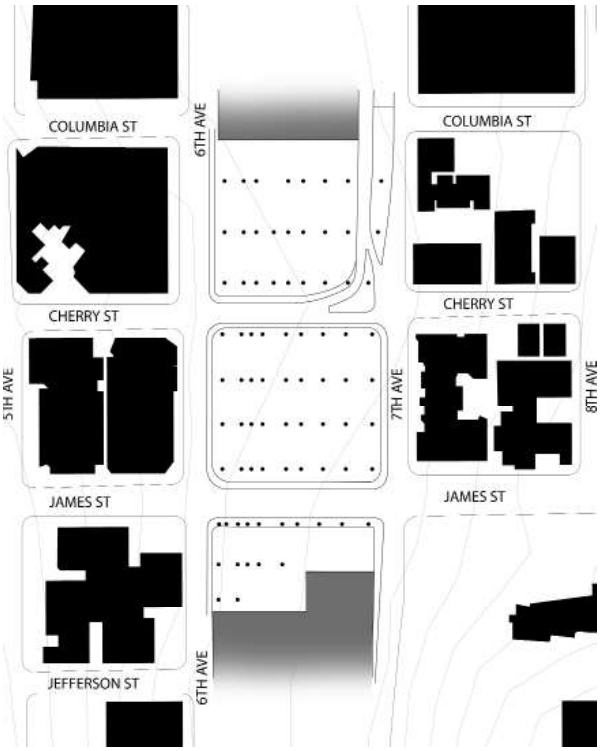

Figure 16. Columns.

As roughly introduced in chapter three, the site is in a very unpleasant condition. It is empty and underutilized during the day and dark and dangerous at night. Nothing much is happening there except the large parking lots, which are extremely difficult for people to relate to any other attractive and useful human-scale events or activities. (Figure 15) The height of the space underneath the freeway ranges from 20 feet to 35 feet. There are ten rows of columns in total to support the freeway, and each row has nine columns except the last two rows. (Figure 16)

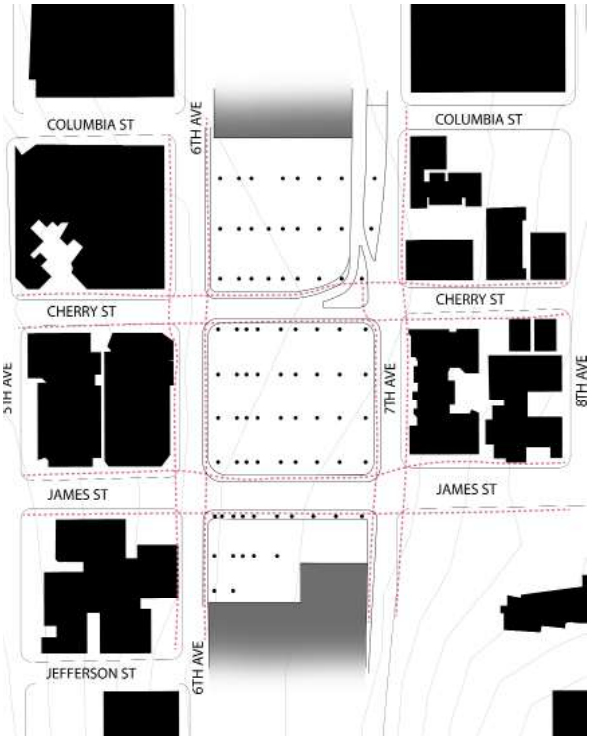

Figure 17. Pedestrian Movement.

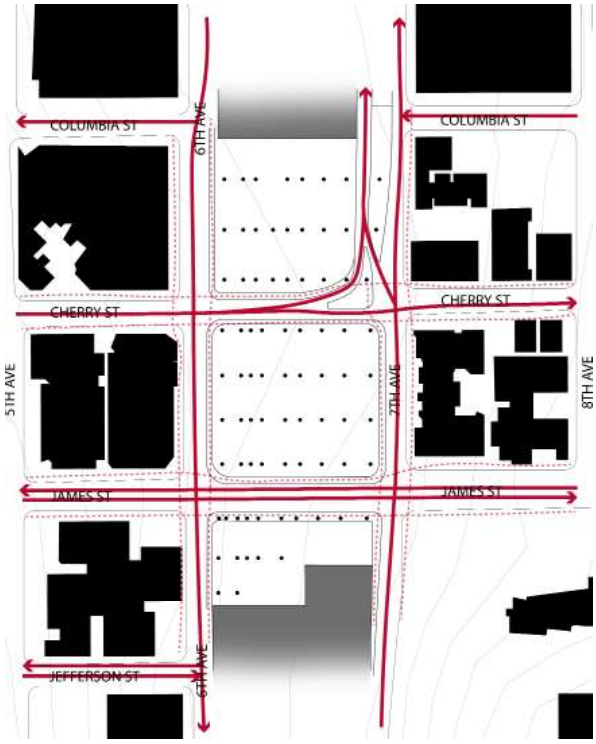

Figure 18. Traffic.

Sidewalks are provided in two directions on all streets and avenues around the site except the northeast corner which is right above the intersection of Cherry St. and 7th Ave. (Figure 17) Another important site condition is traffic flow. As shown in Figure 18, only James and Jefferson St. are two-way streets. Traffic on 6th Ave. allows drivers to go straight, turn right onto Columbia

St., turn left onto Cherry St., turn either left or right onto James St., and turn right onto Jefferson St. On the other hand, cars on 7th Ave can go straight, turn either left or right onto James St., turn right onto Cherry St., and slightly turn left to get on the I-5 freeway. Analyzing the movement of pedestrians and cars helps to understand and design the edge conditions of the site. Moreover, the largest tree canopy cover is located near the intersection of James St. and 7th Ave. (Figure 21), which could suggest a lower amount of stormwater run-off when combining with the topography. (Figure 19 and 20) This helps one decide if water features aimed to collect runoff are necessary.

The last and the most influential site condition would be the overhead freeway. (Figure 22) There are six traffic lanes in total. The two of them in the middle are attached to each other so there is no space left between. In addition, there are gaps, ranging from five to ten feet wide, between the rest of the lanes, which creates a unique relationship of light and shadow for the space underneath. Overall, the site does not get much natural light and even darker if it is not on a sunny day.

Figure 19. Site Condition On Cherry St. Seattle, WA.

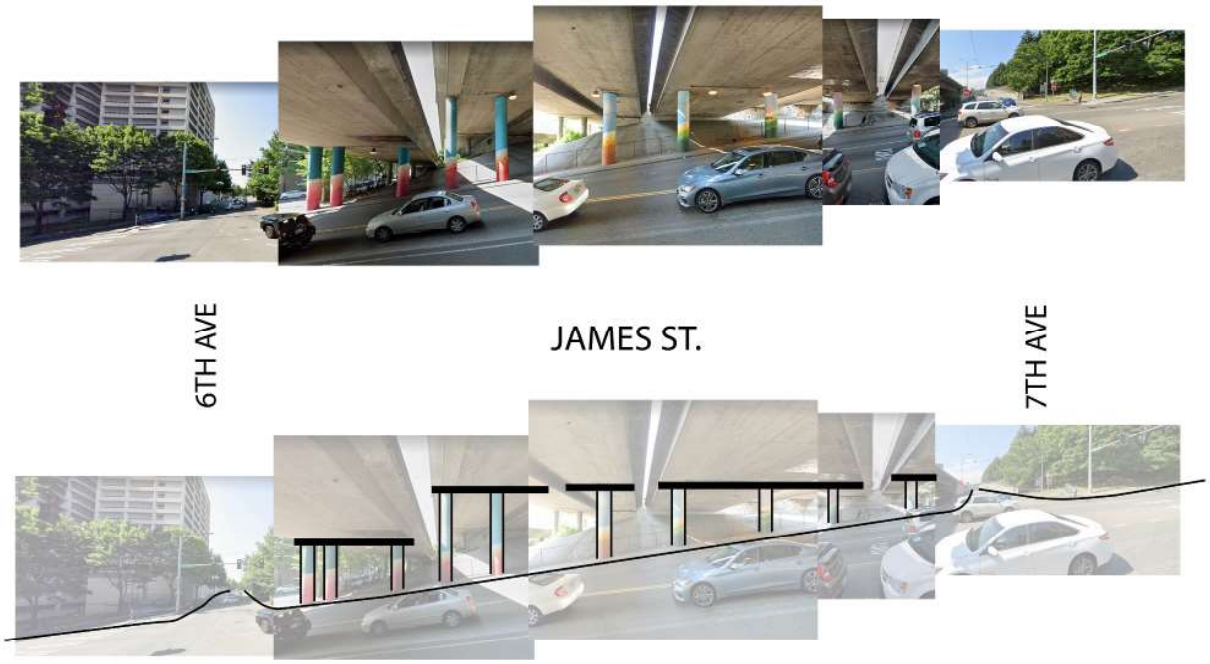

Figure 20. Site Condition On James St. Seattle, WA.

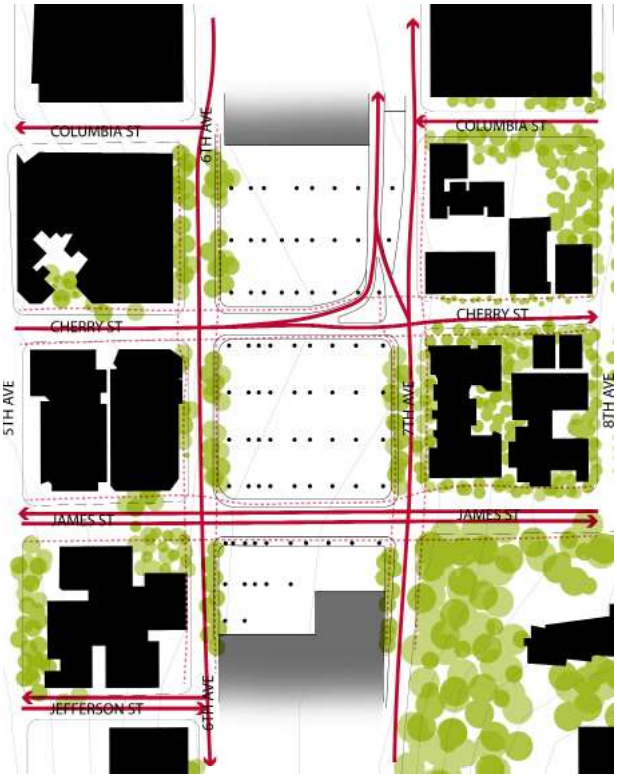

Figure 21. Tree Canopy.

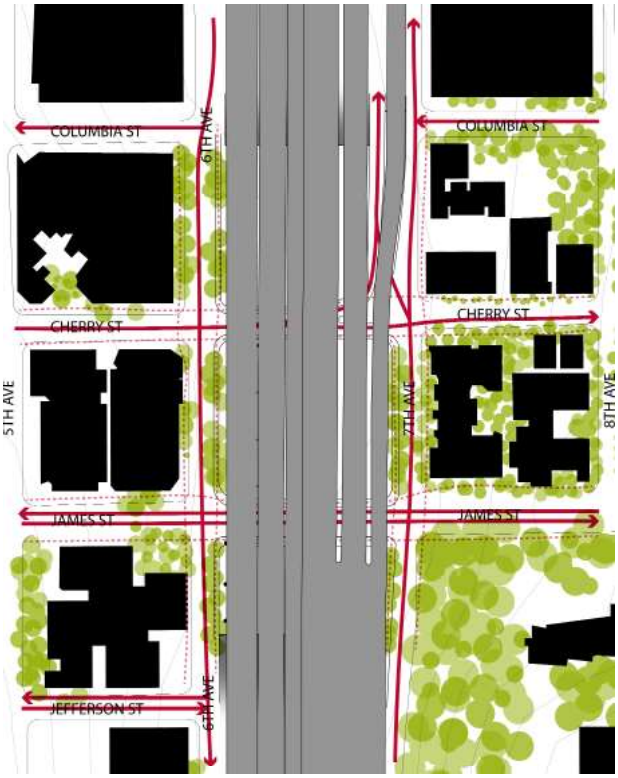

Figure 22. Overhead Condition.

4.3 An Integrated Design

4.3.1 Spatial Quality, Accessibility, and Programs

The overall spatial quality (Figure 23 and 24) throughout the site is open and transparent. However, the west side is more open than the east side while the middle block is more open than the other two blocks. The transparent building skins for the first block on the south and west sides create a soft edge condition, which enables a clear visual connection between the interior and exterior. (Figure25) For pedestrians, they are not only drawn to the activities taking place in the building but maintaining a certain level of interaction with the people on the other side of the glass as well. For occupants, they will experience the exterior as part of their indoor experience which helps to increase the awareness and safety of the site. On the east side, there is a decorative wall standing next to the art studio space (Figure 24) to block the view of the on-ramp traffic. It can either be a media wall or a green wall or a combination. In terms of accessibility, the major entrance is located at the southeast corner while the other two are on 6th Ave and Cherry St. (Figure 27) As shown in Figure 24 and 26, the block is programmed with a water treatment facility, retail, arts & crafts studio, water feature, and subsurface wetlands.

Figure 23. Site Plan.

Figure 24. Section I.

Figure 25. Ground Floor Plan.

Figure 26. Program.

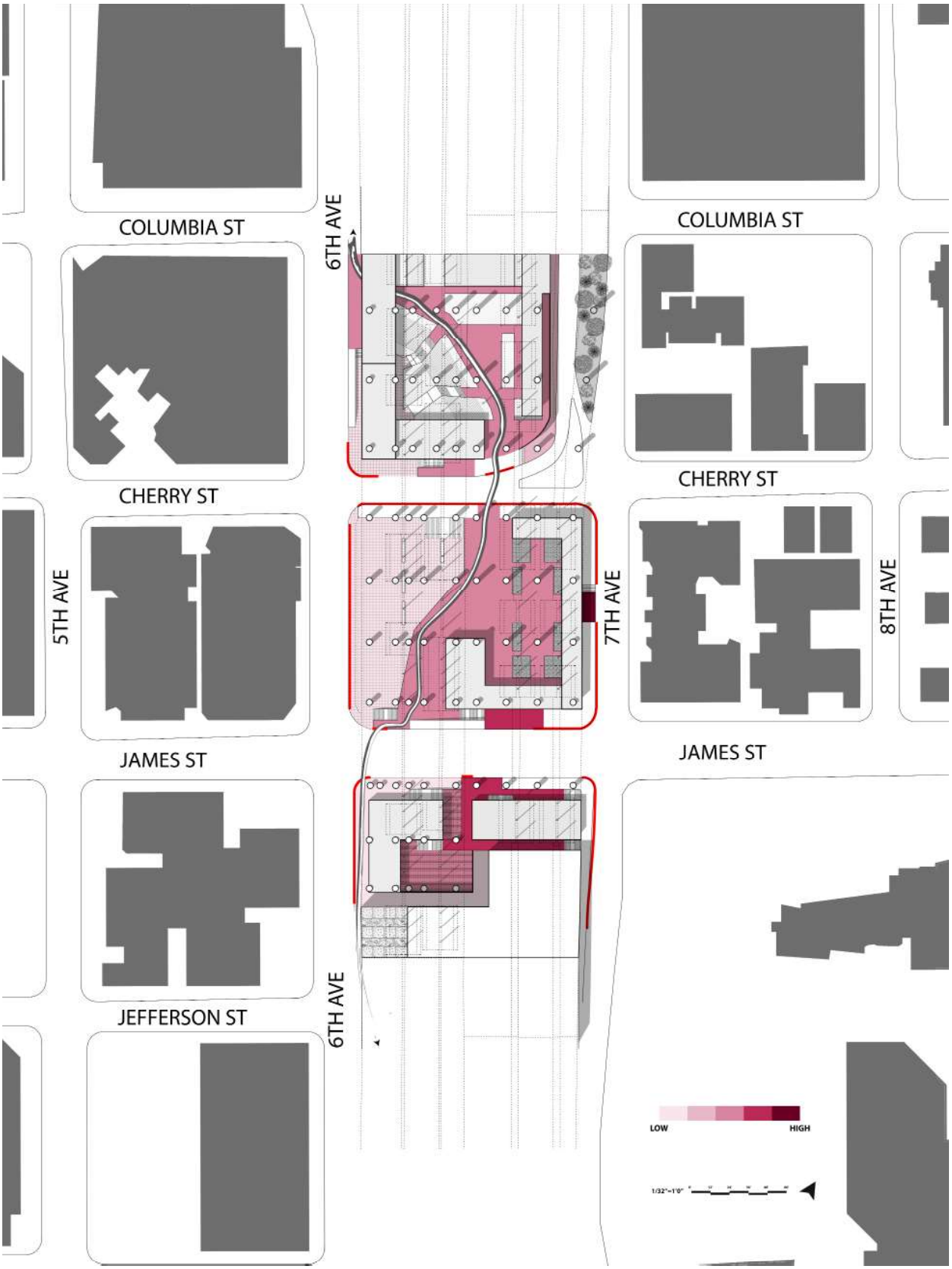

Figure 27. Circulation.

The middle block is comprised of two levels of plaza space. The lower level, which is in color of light pink (Figure 27), will draw people into the site by creating a very open and transparent space that is mainly used to hold night markets, food trucks, art installations, or other public events. The higher plaza, on the other hand, is programmed with two-story retail space and sub-surface wetlands. The facade materials for the building on this block are mainly glass and steel to ensure a high level of interaction between the interior and exterior space. Occupants will not only feel physically connected but visually attracted. (Figure 28) In general, this block has the highest level of visibility, accessibility, and penetrability.

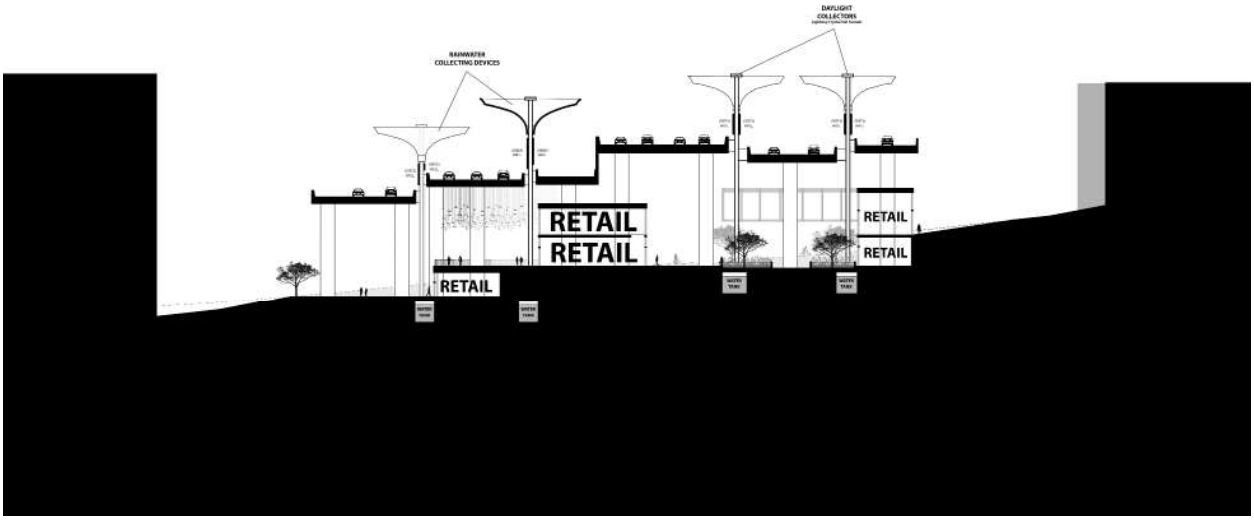

Figure 28. Section II.

The last block has a similar edge condition, level of accessibility, and architecture style as the east side of the first block. (Figure 29) And it is programmed with retail and social service, which is a donation distribution center for the homeless. The homeless issue in Seattle has become more and more serious. It is important to address the homelessness when doing a public design, especially an underpass. With no intention to look for a final solution, the design simply offers a perspective. The donation center will provide water, food, clothes, and healthcare services to

homeless people when they are in need. A small portion of the profits produced by the economic activities taking place on the site will be used to run and maintain the donation distribution center.

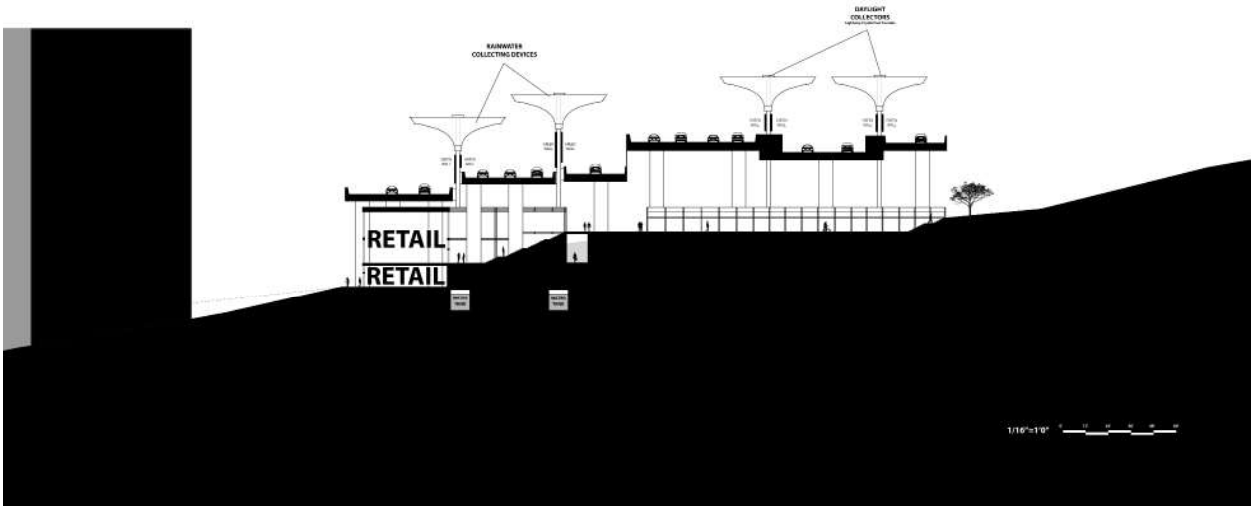

Figure 29. Section III.

4.3.2 Rainwater and Daylight Collecting System

A rainwater and daylight collecting system (Figure 30) is introduced to harvest rainwater and natural light for water usage and illumination throughout the site. The system has four major components, which are the rainwater collecting device, the transparent PV cells, the crystal sun tunnels, and the green wall system. The rainwater collecting device is inspired by an in-use technology called Ulta Chaata (Figure 31), a rainwater and solar energy collecting system invented by an Indian couple (Singh 2017). How it functions is that the rainwater will go through a filtration process within the device right after being captured. After being filtered, the rainwater will be either temporarily stored in the water tanks underground or directly distributed to the water treatment facility for further filtration before it becomes part of the potable water system on site.

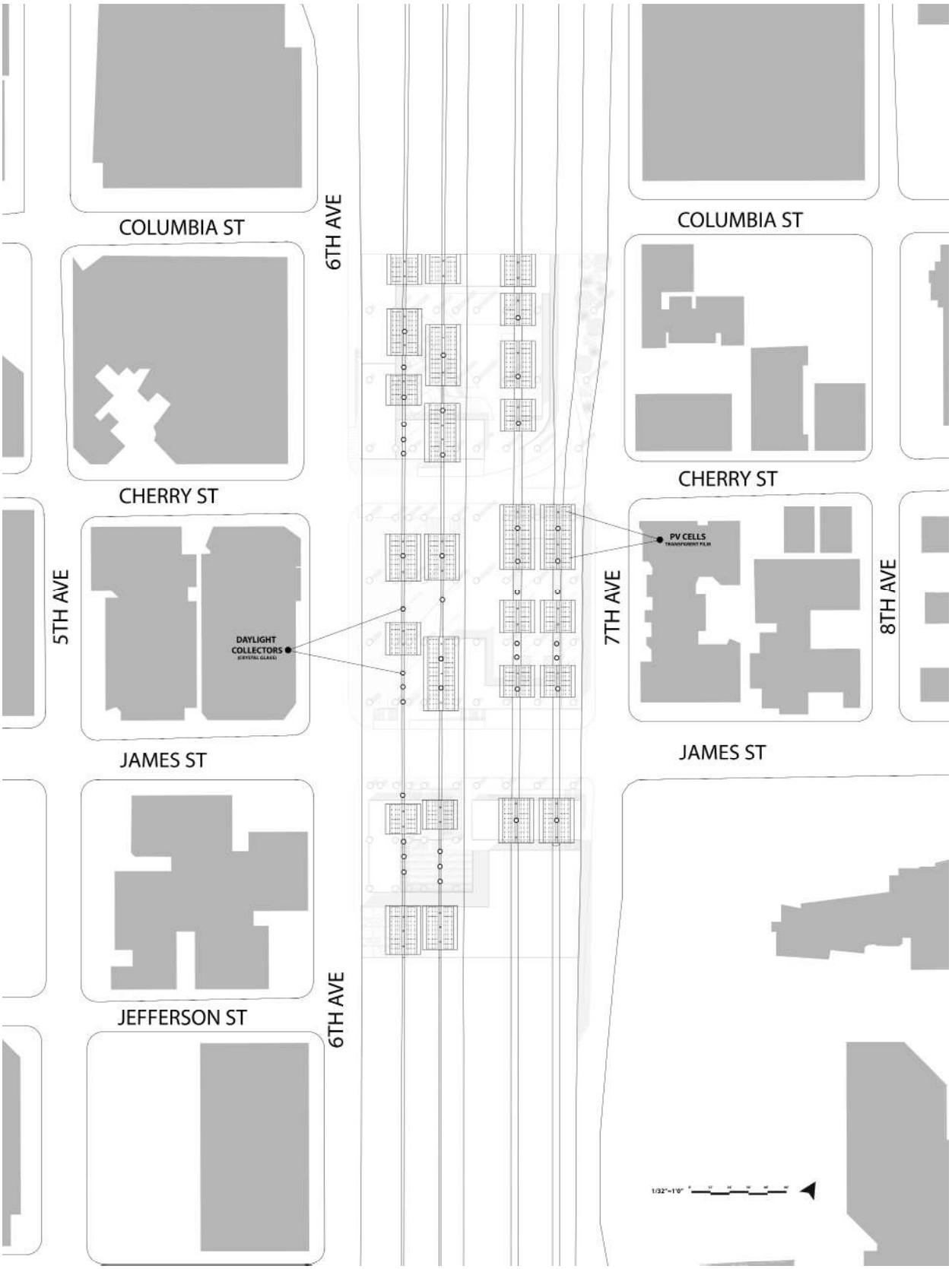

Figure 30. Rainwater and Daylight Collecting System.

Figure 31. Ulta Chaata. 2017.
<https://www.thebetterindia.com/91624/thinkphi-ulta-chaata-rainwater-solar-energy/>. Digital Image.

There are two ways of collecting and using natural sunlight in the system. One way is that solar energy is harvested by the transparent PV cells, located on the top surface of the rainwater collectors, and mainly used to light the rainwater collecting devices at night. It can also be used to power the artificial lights on the site if there is any excess. The other way daylight is collected is by *Lightway* (Figure 32), a daylight collector and diffuser, to reflect the natural light to the site during the daytime. “Lightway brings daylight … with its [two] main parts: [...] a crystal glass dome or daylight collector” and “the daylight diffuser column, made from crystal glass, effectively spreading daylight around the room” or any dark space (“Lightway - Lord of the Daylight” 2015). Furthermore, some Lightway columns are freestanding while others are placed in rainwater collectors. (Figure 33 and 34) The last component would be the green wall system (Figure 33 and 34), which mainly helps filter air pollutants and absorbs noise generated by the freeway traffic.

Figure 32. Lightway. 2015 < https://www.theartofdesignmagazine.com/lightway-lord-of-the-daylight-2/>. Digital Image.

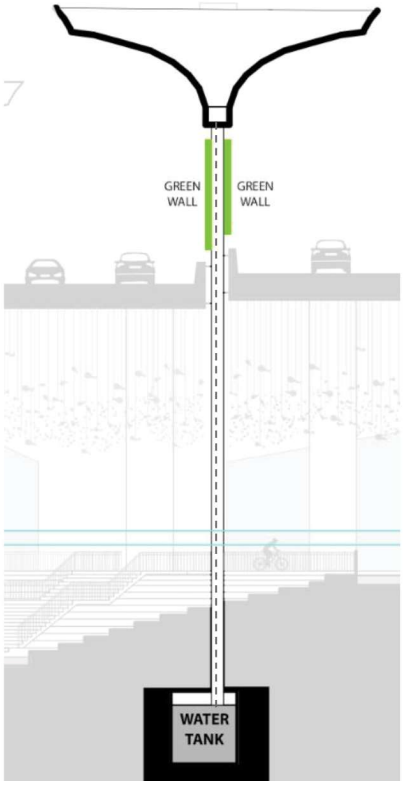

Figure 33. Rainwater Collector without Lightway Columns.

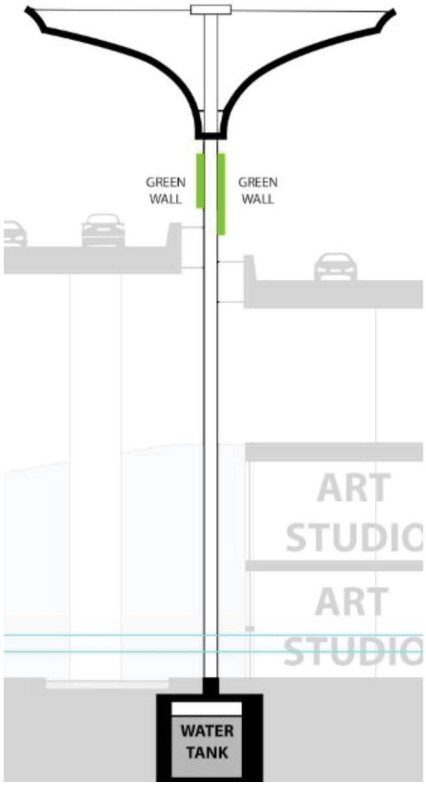

Figure 34. Rainwater Collector with Lightway Columns.

4.3.3 Water Feature and Subsurface Wetlands

There are many other features including water ponds and subsurface wetlands are introduced to the site to help manage stormwater runoff and improve the overall site environment. A stepped waterfall and water ponds, which are part of the water treatment facility, are placed on the first block (Figure 35). The purposes of having such features are multiple beyond water management. As the essence of life, water naturally attracts all kinds of animals. To achieve sustainability and the ecological balance in a city, providing habitat for urban animals is just as important as taking care of people's wellbeing. In addition, the sound of the water movement can not only bring a sense of calmness, but also it can help improve air quality and cancel out some of the traffic noise. The subsurface wetlands are also beneficial in terms of attracting human activities, nursing urban wildlife, filtering pollutants, and buffering stormwater ("Top 10 Benefits of Wetlands." 2015).

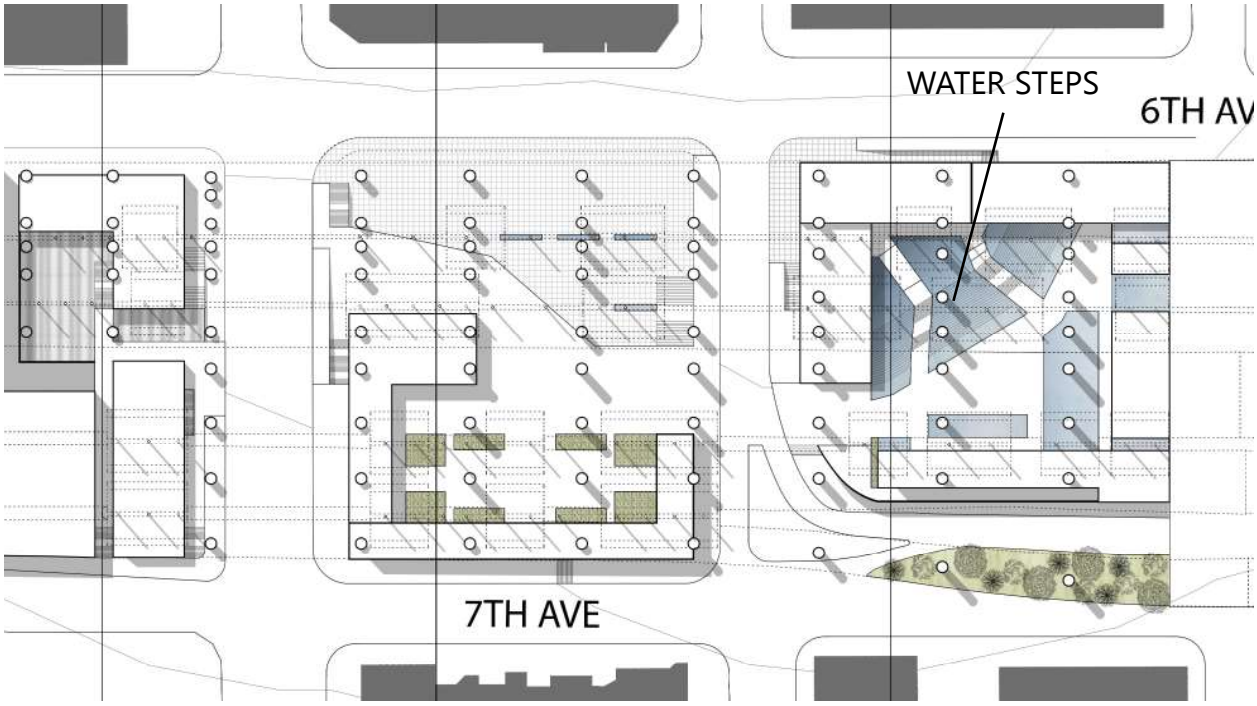

Figure 35. Water Feature and Subsurface Wetlands.

4.3.4 Lighting Design

Based on Richard Kelly's theories of lighting design, three types of artificial lights are used to alter and enhance the experience of the site. (Figure 36) Firstly, two groups of columns on the site, the existing columns and the water tubes of the rainwater collecting system, are backlit with different sets of colors. This type of light, known as Focal Glow in Richard Kelly's lighting theories, can "[draw] [people's] attention, [pull] together diverse parts… [separate] the important from the unimportant, [and] [help] people see" (McIntosh 2018). A celestial lighting canopy, comprised of thousands of suspended light bulbs, will be located above James St. and Cherry St. with linear lights extending to the east and west directions to lure people from far at night to come to the site before they are visually pleased by the real light show. A meandering canopy of the same type of lights, only with a smaller scale, will be placed above the Green Promenade to show its connection throughout the site. This light, known as Play of Brilliants, "excites the optic nerves, and in turn stimulates the body and spirit, quickens the appetite, [and] awakens curiosity...." (2018). The last type of light is Ambient Luminescence used to provide overall illumination and increase the sense of safety on the site (2018).

Figure 36. Lighting Plan.

Chapter 5. Conclusion

In conducting this research, this thesis has identified three major issues related to urban freeways and analyzed the causes, origins, and impacts. It is impractical to immediately resolve these issues by keeping all buildings 1,000 feet away from the freeway or destroying the whole urban freeway system. But the health risks cannot be neglected, which makes remediating the impact of the urban freeway system an essential strategy for most cities.

Compared to the health risks, the issue of socio-economic equity is more complicated due to its varied historical and political backgrounds. In the case of Seattle, the two most challenging issues are probably the housing crisis and homelessness. As mentioned in chapter four, the thesis has no intention to come up with a final solution. It is unrealistic to think these problems can be solved by architects or urban planners alone. What is more realistic is that designers, architects, and urban planners should all take these two issues into consideration when undertaking projects in Seattle.

However, in responding to these issues architects and urban planners should take more responsibility for leaving so many unprogrammed spaces under the freeway. And the current design for this type of public infrastructure is too standardized and insensitive to the locality. The term "genius loci", the protective spirit of a place, has been emphasized throughout my entire architecture education. If architecture needs to be designed with such attentiveness to its context and uniqueness, why should freeways always look the same or have similar forms all over the place? Even in the same city, different areas have different cultures, histories, land values, and population densities. Therefore, the design and transformation of freeways, or any public infrastructure, should be made on a case-by-case basis.

This thesis has argued that design with a sustainable approach is crucial. As explained many times above, being sustainable is more than being green but to have an integrated system where environmental quality, economic prosperity, and social equity can be considered simultaneously (Hough 2006, p.5). In this design, the health problems and environmental quality are addressed by having green walls, water gardens, a rainwater and daylight collecting systems, and subsurface wetlands. Retail space, cultural facilities, and public outdoor spaces for events and exhibitions are provided for economic activities to take place. And the social service building addressing homelessness on the site will also help increase people's awareness of the importance of social equity.

In tackling the issues raised by this thesis on the future of the urban freeway, the final design response is to create an integrated system that involves architectural design, lighting design, rainwater and daylight harvesting, and stormwater management. It has shown the potential to turn a dull and wasted space generated by the I-5 highway into a lively and useful place people can feel safe and fun to stay, walk, or pass by even at night. It remains to be seen if cities like Seattle show the courage to undertake such a project in the near future. (Figure 37)

Figure 37. Rendering View at James St. and 6th Ave.

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