
CINCINNATI
UNION
UNDERGROUND

CINCINNATI UNION UNDERGROUND

A Design Thesis Submitted to the
Department of Architecture and Landscape
Architecture of North Dakota State University

By

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In Partial Fulfillment of the Requirements
for the Degree of
Masters of Architecture

Primary Thesis Advisor

Thesis Committee Chair

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Abstract

How can a transportation hub go beyond just serving the communities transportation needs of a city and create a center of activity. This project looks to explore the transportation hub and how it can become more than just a hub for travel. During travels to many European Cities I had found that many of these cities have a transportation system that incorporate many amenities and become an epicenter for activity. Cincinnati, Ohio is a city which is in the process of being overhauled along the riverbank of the Ohio River. This area called “The Banks,” is already becoming a great place of activity in the city with both the Bengals and Reds stadiums along it as well as farmers markets on the weekend. The Cincinnati Union Underground Hub will be the center of activity. This transportation hub will use the existing infrastructure from the failed Cincinnati subway system which was never opened and create a way for people in the suburbs of Cincinnati an easy way to get into the city and avoid traffic on the roads. This will also create an epicenter of activity for the whole city.

Narrative

How can a transportation hub go beyond just serving the city’s transportation needs and create a center of activity? During travels through Europe, I found that the center of most dense cities are the train stations and transit centers. Every day thousands of people travel through these buildings which combine multiple forms of transportation, retail, restaurants, and more.

Currently, Cincinnati is going through an urban renewal in multiple neighborhoods. The Banks is one of these neighborhoods right along the Ohio River. Its master plan includes a riverside park, residential developments, retail, hotels, and offices. The area also includes two sports complexes and a museum. The neighborhood already has so much to offer but does not have a way, besides driving, to get to the neighborhood. Creating a transportation hub here will bring people from the suburbs of Cincinnati and Kentucky, and even from other parts of the country.

The project will also bring the abandoned Cincinnati subway project to life by the reuse of the existing tunnels as well as boring additional tunnels. The failed project is currently unused and crumbling away. The reuse of this previously attempted project could bring people from all around Cincinnati and the surrounding suburbs. This will aim to bring the city back to life and significantly cut down on traffic on the now overcrowded highway system.

Ultimately, this will not just be a transportation hub, but also a hub for people in the city. With amenities such as grocery stores, restaurants, conference rooms, and retail stores, transportation hubs can be the destination. The thesis will explore the notion that communities come together through travel, whether by train, subway, bus, or car, or bike.

The typology of this Thesis is a transportation hub. This transportation hub will include ticketing spaces, platform spaces as well as common areas for waiting and gathering. Being a transportation hub, the typology will also include a variety of retail, food services, and public spaces. This ties back to the building being an epicenter of the city. The project will aim to capture how European cities use transportation hubs as more than just transportation. The Brussels Metro as well as the London Underground does a great job of capturing the mentality of the aim of this thesis.

Case Studies

Grand Central Terminal, New York City, NY, USA

Figure 1.0 http://architizer.com/blog/in-photos-grand-central-terminal-through-the-years/

Figure 1.1 http://upload.wikimedia.org/wikipedia/commons/7/71/Image-Grand_central_Station_Outside_Night_2.jpg

Grand Central Terminal is an iconic multi-modal transportation center not only in New York, but also the United States. Built in 1913, the terminal has been in service for over one hundred years and services 273 million people a year. It also attracts 21.6 million tourists a year. This high volume transportation hub is designed in such an innovative way that

even newer transportation centers are still being inspired by its design. The terminal houses multiple rail lines as well as subway on the lower levels. It also houses a variety of shops, restaurants, as well as bars. An expansion to the terminal is currently being built underneath the building to connect with Long Island transportation services. This multi-modal transportation center is very important to the history of transportation in the United States and continues to be important for the development of future transportation centers.

Circulation

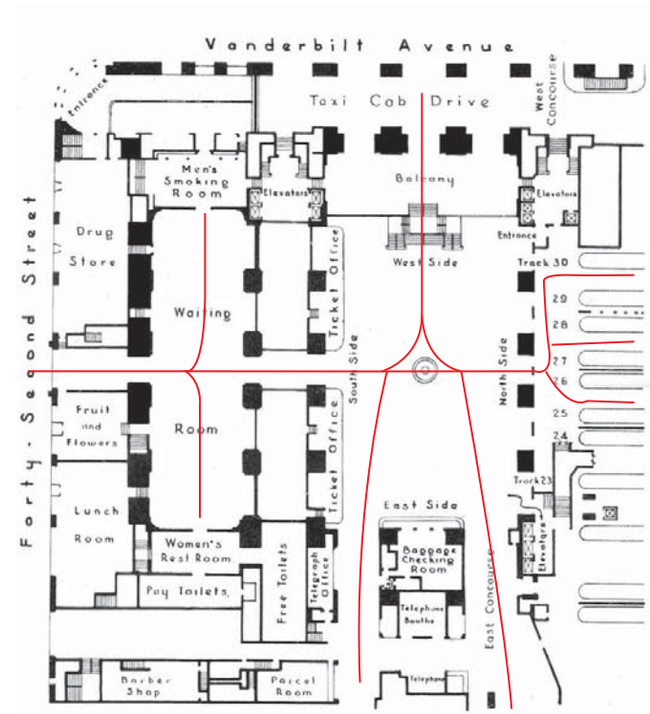


Figure 1.2 wikipedia.org

Plan to elevation

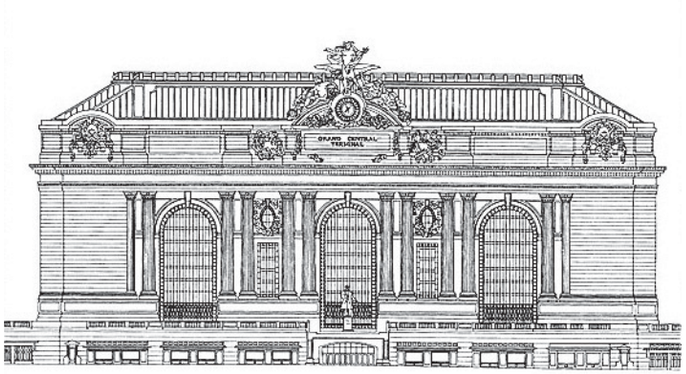


Figure 1.3 wikipedia.org

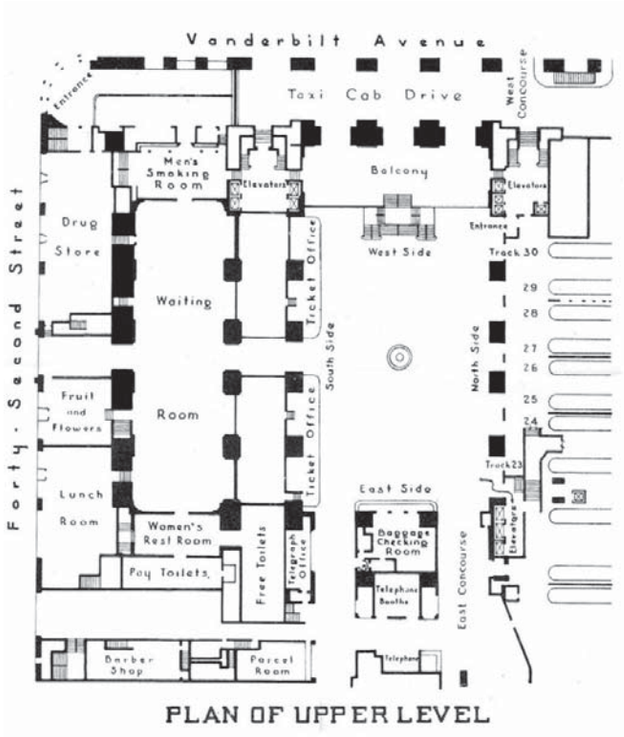


Figure 1.4 wikipedia.org

Natural light

Figure 1.5 http://www.cnn.com/2013/01/30/travel/gallery/grand-central-terminal-100-years-gallery/index.html

Geometry

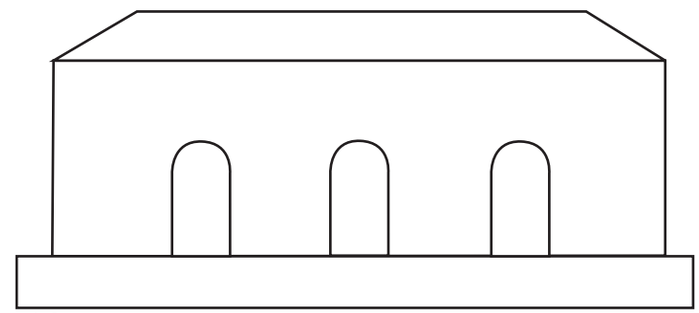


Figure 1.6

Structure

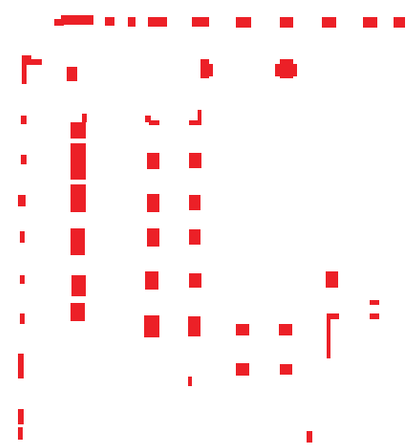


Figure 1.7

HIERARCHY

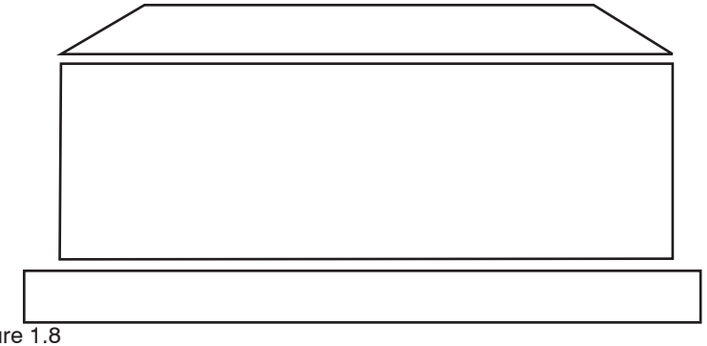


Figure 1.8

MASSING

Figure 1.9

Figure 1.10 http://www.yurtopic.com/travel/destinations/nyc-places.html

Typological Research

Figure 1.11 http://www.metropolismag.com/Point-of-View/February-2013/Grand-Central-Terminal-100-Years-of-a-New-York-Landmark/

This project is a very successful version of a transportation hub. So much so, that it is still being used for inspiration. The building has a fairly simple form above ground, but it is the inter-workings of the building that makes it innovative. The building shares the idea of being a hub for people, with thousand of people either traveling through or visiting a day.

Centraal Station, Rotterdam, Netherlands

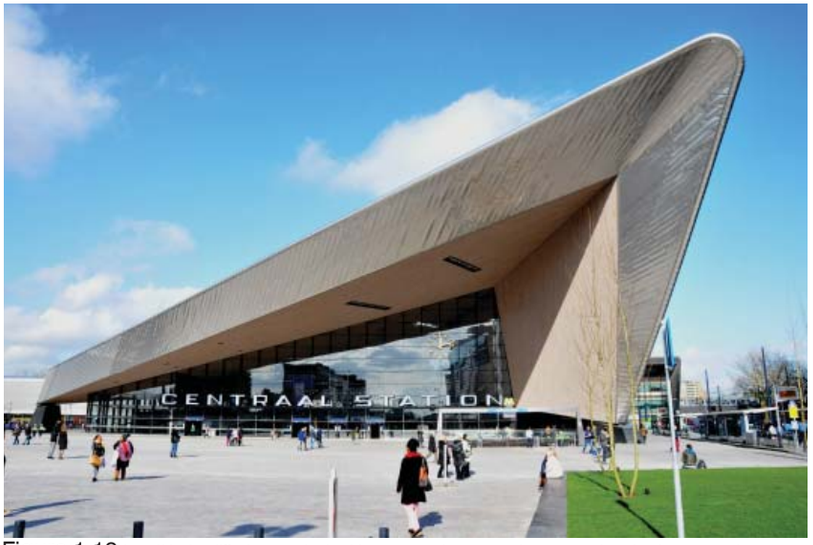


Figure 1.12 http://designdiffusion.com/en/architecture-eng/new-rotterdam-centraal-station-by-team-cs/

Figure 1.13 http://designzoom.ru/2013/11/21/stantsiya-rotterdam-centraal/

Rotterdam Centraal Station is a very modern transportation hub in Europe completed in March 2014. The hub features massive irregularly shaped grand hall to draw people in from the city featuring stainless steel and glass cladding and a wood interior. The new Centraal Station ties back elements from the previous station including the original sign

on the South facade and two granite sculptures. The building includes a 5,200 bike parking garage underneath and 750 car parking garage connected to it. There are also metro connections as well as tram connections outside. It also features two supermarkets as well as other shops and food choices. On the sustainability side, it features an array of 130,000 solar panels. This is one of the largest solar arrays in Europe. The station currently has 110,000 people passing through it daily and is designed to handle up to 323,000 people, expected by 2025.

Circulation

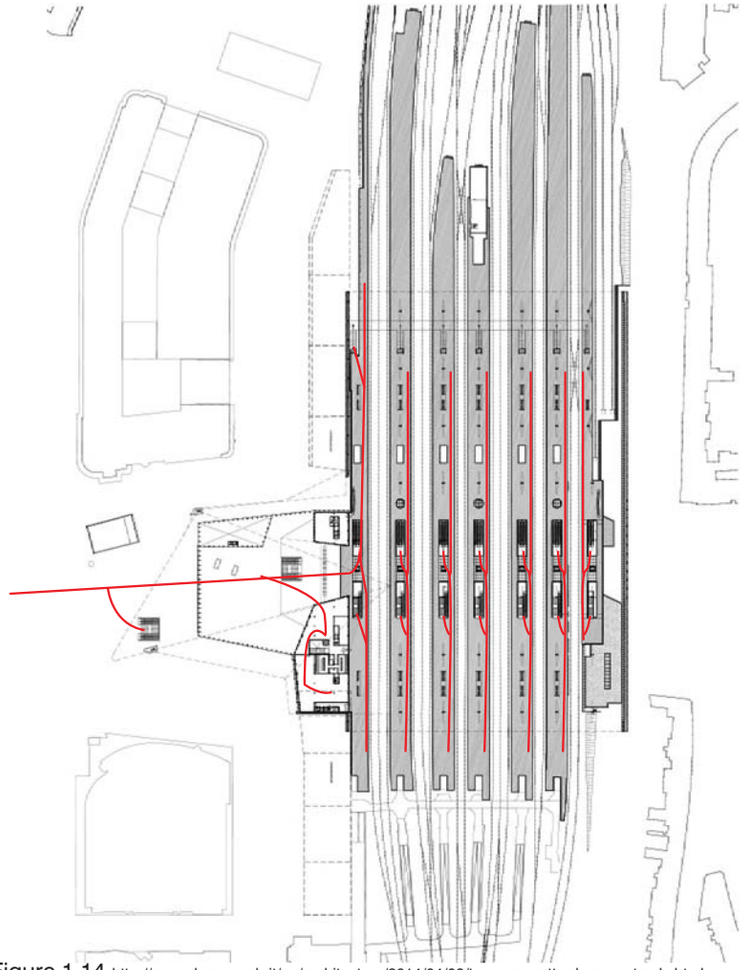


Figure 1.14 http://www.domusweb.it/en/architecture/2014/04/03/team_cs_rotterdam_centraal_.html

geometry

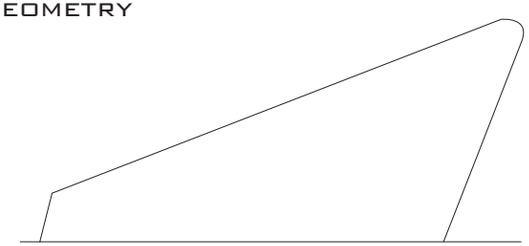


Figure 1.15

massing

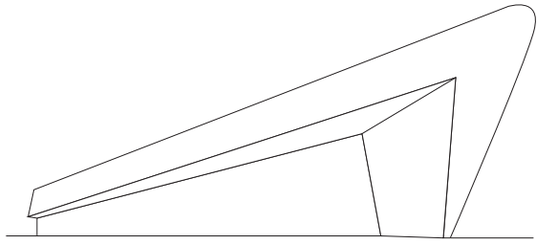


Figure 1.16

structure

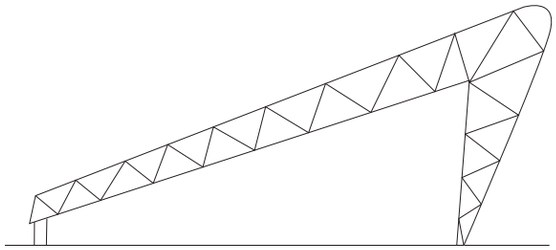


Figure 1.17

hierarchy

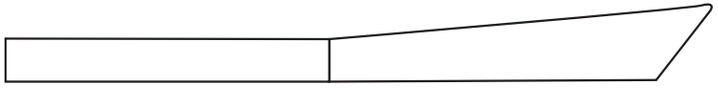


Figure 1.18

Natural Light

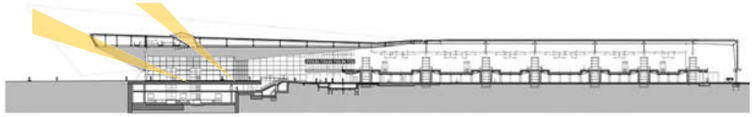


Figure 1.19 http://www.domusweb.it/en/architecture/2014/04/03/team_cs_rotterdam_centraal_.html

plan to section

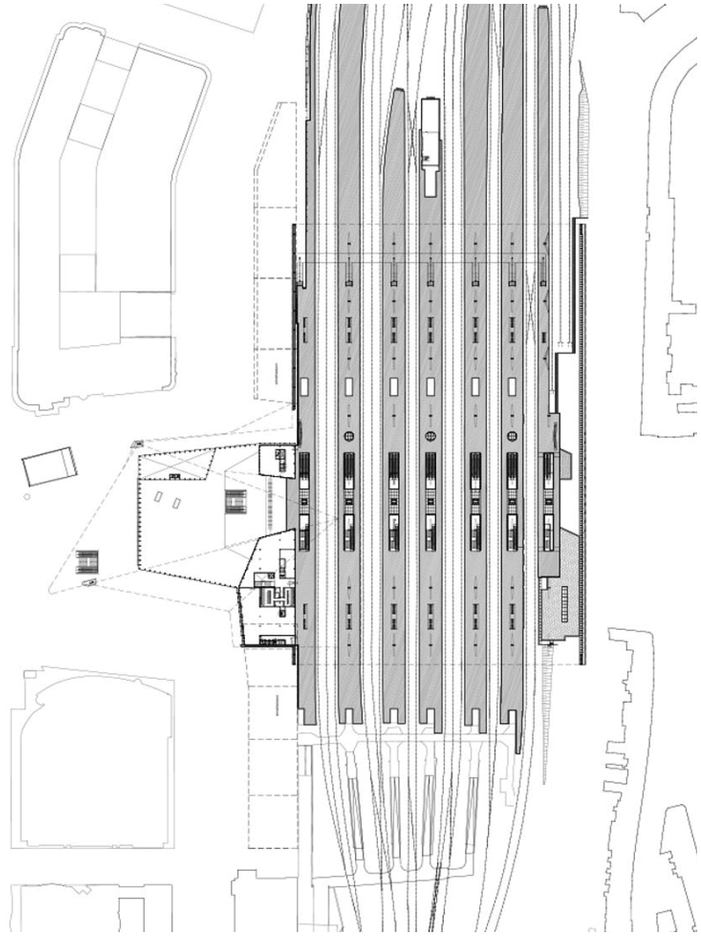


Figure 1.20 http://www.domusweb.it/en/architecture/2014/04/03/team_cs_rotterdam_centraal_.html

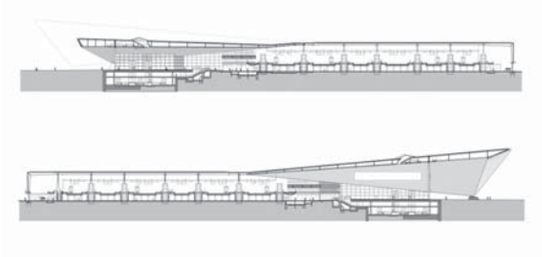


Figure 1.21 http://www.domusweb.it/en/architecture/2014/04/03/team_cs_rotterdam_centraal_.html

Figure 1.22 http://designdiffusion.com/en/architecture-eng/new-rotterdam-centraal-station-by-team-cs/

Figure 1.23 http://designdiffusion.com/en/architecture-eng/new-rotterdam-centraal-station-by-team-cs/

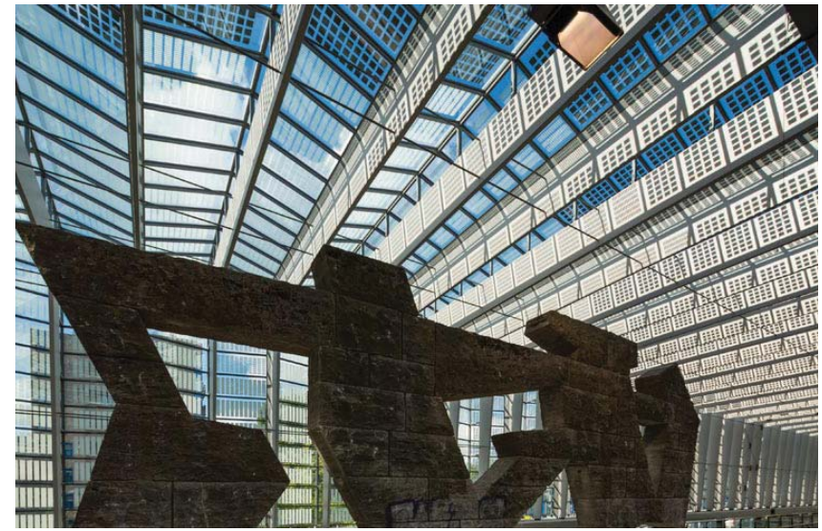


Figure 1.24 http://designzoom.ru/2013/11/21/stantsiya-rotterdam-centraal/

The Rotterdam Centraal Station shows that a very simplistic high designed building can function very well. The circulation and form of the building are very simple geometric distortions. This makes the building very easy to navigate and understand while staying interesting to the observer. These are very important qualities to a transportation center. The buildings sustainable features are also very impressive and should be used in other transportation centers which have large awnings over the platforms. The integration of bike parking and car parking underneath the building is a good way to get them out of the way and focus the main levels on people using the space. Overall this design is very clean and concise and handles large groups of people very well.

Transbay Terminal, San Francisco, CA, USA

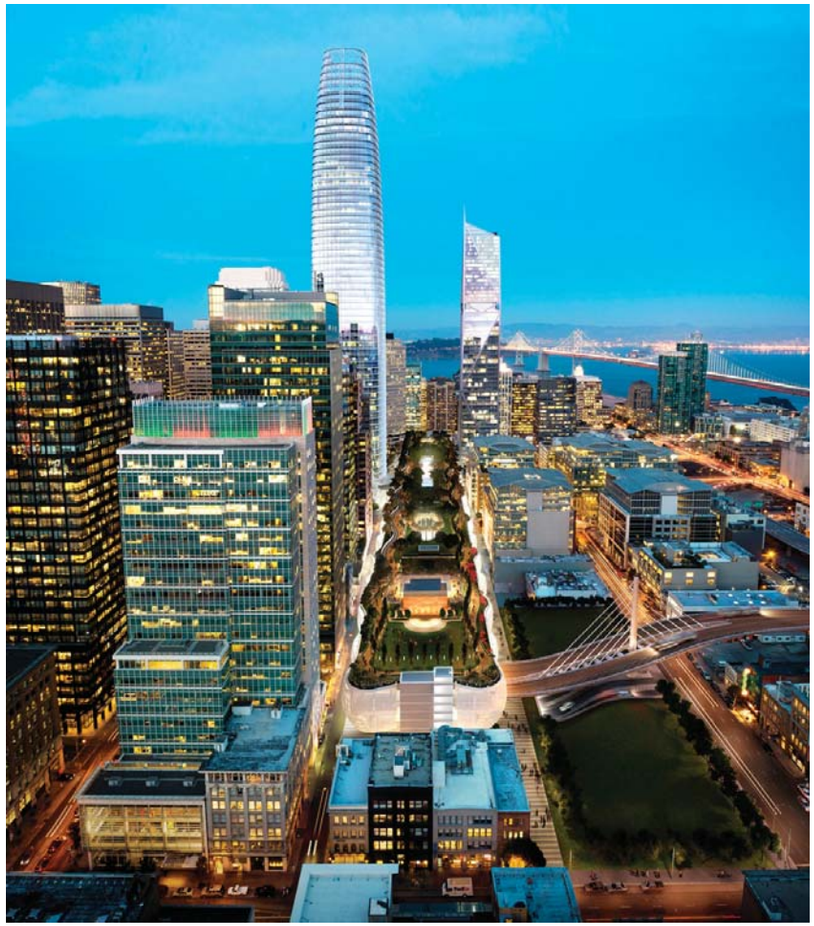


Figure 1.25 http://www.fastcodesign.com/1672224/a-first-look-at-the-grand-central-terminal-of-san-francisco

The Transbay Terminal is a multi-modal transit center for the City of San Francisco and the state of California. The near million square foot building will bring together rail and bus travel as well as create a 5.4 acre park on the roof for the community and new retail spaces. The building is a superstructure which takes up four city blocks and is part of a larger master plan to create seven new housing towers to become part of the new Transbay neighborhood. This Building exemplifies how to bring together transportation and the community all under one roof.

Figure 1.26 http://www.fastcodesign.com/1672224/a-first-look-at-the-grand-central-terminal-of-san-francisco

Geometry

Figure 1.27

Natural Light

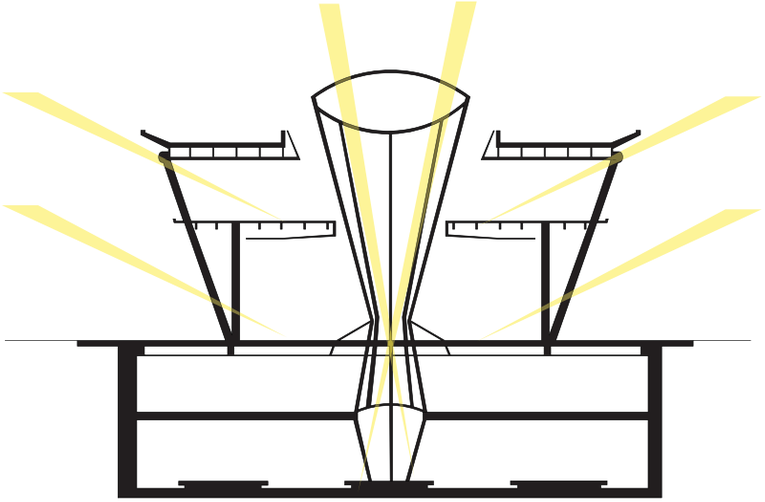
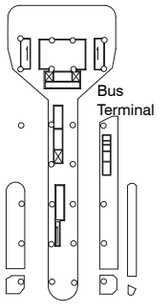
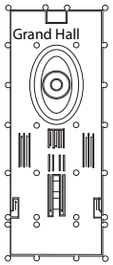
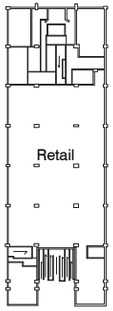


Figure 1.28

Transbay Terminal, San Francisco, CA, USA







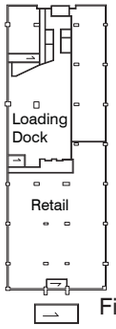


Figure 1.29

Plan to section

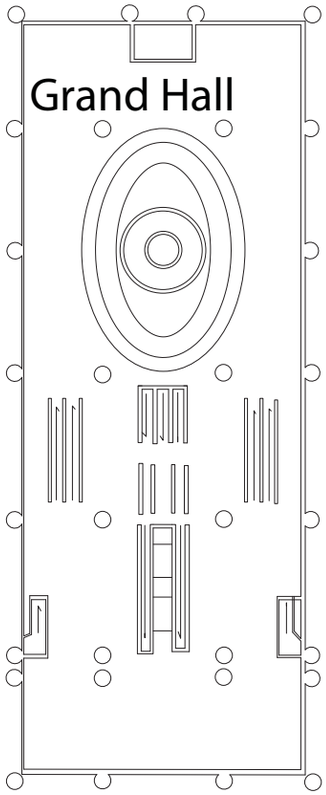


Figure 1.30

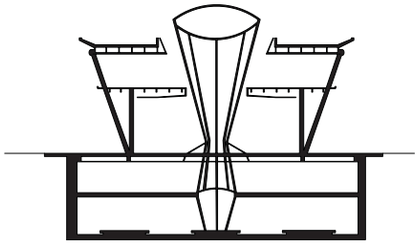


Figure 1.31

Figure 1.32 http://www.fastcodesign.com/1672224/a-first-look-at-the-grand-central-terminal-of-san-francisco

Hierarchy

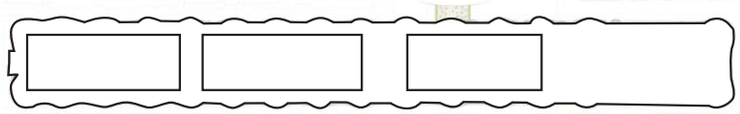


Figure 1.33

Massing

Figure 1.34

Structure

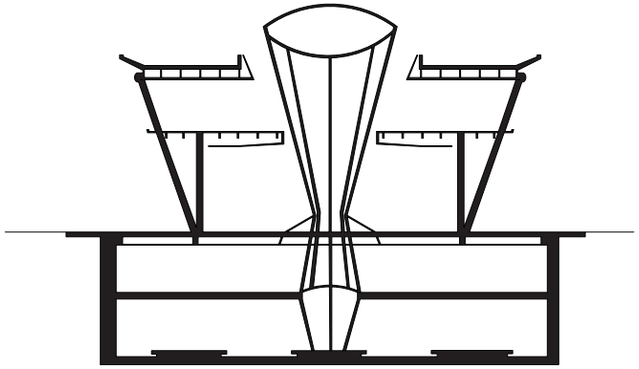


Figure 1.35

Figure 1.36 http://www.pwpla.com/projects/transbay-transit-center/&details

The Transbay Terminal identifies with the problem this thesis is trying to solve very closely. It combines multiple forms of transportation and other services very well. It also includes great green spaces which provide the community with spaces they can come together. When completed in 2017, the building will meet the requirements for LEED Gold certification. The building also acts as part of a larger master plan to improve the Soma downtown neighborhood. Included in this master plan is a mix of office, residential, retail, and parks. This identifies with the idea that a transportation center becomes a sort of hub for a community of people.

The tubular steel and concrete structure keeps the building as open to light as possible with curtain wall glazing around the entire building. This keeps the building light and transparent even though it takes up four city blocks. The interior of the building is also very open in design because of the buildings structure. The building locates the train and subway tracks underground to save on above ground space. This allows the building to use a large oculus in the center of the grand hall to let light into the lower levels.

Summary

The Typological Research looked at three different but somewhat similar buildings. The first of the buildings, Grand Central Station, is a great example of a successful historical building which continues to be successful in it old age. The second building, Rotterdam Centraal Station, is a great example of a brand new building which is already successful. The third example, Transbay Terminal, has not been completed and is being speculated on, however, modern software makes it easy to judge if the building will work. These three case studies were chosen to support the theoretical premise. The Transbay Terminal in particular fits the model of the theoretical premise almost perfectly and is therefore the most useful out of the three.

The buildings were looked at based on the general design first, then the similarity to the theoretical premise, and finally broken down into parts and analyzed further. The further analyzing included geometry, natural light, structure, massing, plan to section/elevation, and hierarchy.

The conclusions drawn on the series of buildings was that they all supported the theoretical premise to a certain extent. They were all high volume transportation centers which include spaces for interaction between community members. All three of the buildings are part of a dense urban setting. Grand Central Station and Transbay Terminal are built into the city better than Rotterdam Centraal Station. Being integrated into the city blocks gives the earlier buildings more connection to the city. The transportation building for this thesis will be more like Rotterdam Centraal because it will be off to the side of the downtown area.

All three of the buildings have very straightforward circulation patterns and spatial relationships. This will be something to strive for in the final design solution for Cincinnati. Both Transbay Terminal and Rotterdam Centraal have advanced sustainability features which should be easy to apply to the thesis project.

Major Project Elements

A. Grand Hall: to recieve passengers and other users of the space
B. Concoarse: to direct people to the different modes of transportation
C. Ticket Sales: administrative and ticketing for bus, subway, and train tickets
D. Waiting Areas: seating areas for waiting passengers
E. Platforms: area the trains and subway cars pick up passengers
F. Supermarket
G. Food Court: with fast food restaurants and a dining area
H. Sit Down Restaurants
I. Retail Spaces
J. Designated Performance Spaces: for the inevitable street performers
K. Parking Garage
L. Bike Storage
M. Lugage Storage
N. Restrooms
O. River Access
P. Mechanical Rooms
Q. Conference/Convention Spaces

User/Client Description

The users of this building will be residents of the Cincinnati and Northern Kentucky area. These users will be using this building to get to a major epicenter of activity in Cincinnati called The Banks. The user will also be looking to avoid traffic into the city. Among these users will be people who are coming downtown for a football or baseball game as the site is right in between the two stadiums.

SITE

Figure 2.0 google.com

CONTEXT MAP

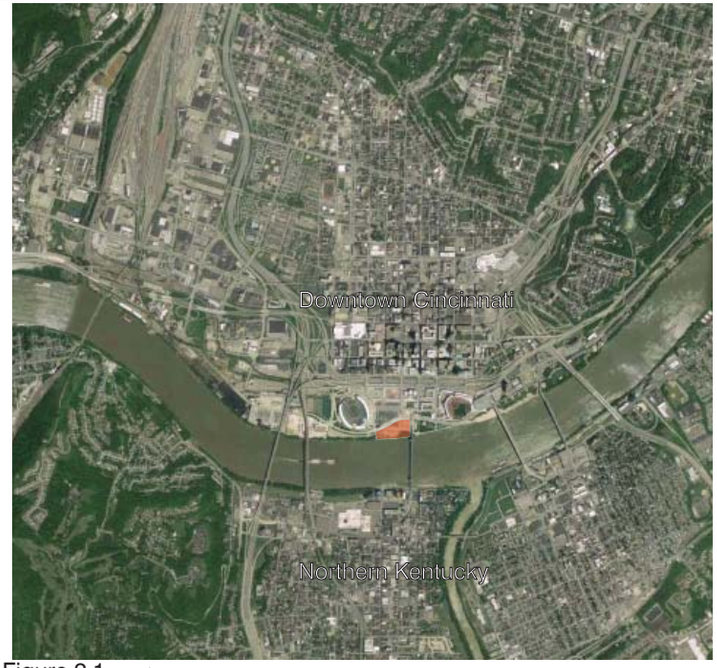


Figure 2.1 google.com

REGIONAL MAP

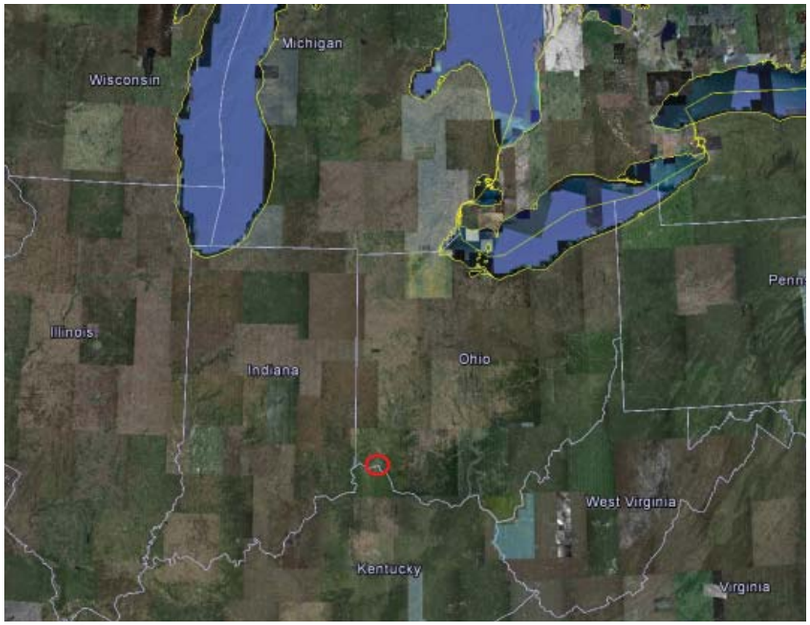


Figure 2.2 google.com

The site for the Cincinnati Union Transit Center is located in The Banks neighborhood of Downtown Cincinnati. This site was chosen for the proximity to Downtown, proximity to the Ohio River, and for access to existing infrastructure. The Banks neighborhood in Cincinnati is currently under going an urban renewal and quickly becoming a popular spot to be. The Site also lies in between the Paul Brown football stadium and the Great American Ball Park making this a great location for a transportation center and a hub for people.

Site Area: 7.21 Acres (314,211 Sq. Ft.)

LANDMARK MAP

Figure 2.3 google.com

A: Paul Brown Stadium
B: Great American Ball Park
C: Fountain Square
D: Ohio River
E: Carew Tower (665 ft.)
F: Great American Tower (574 ft.)
G: Roebling Suspension Bridge
H: National Underground Railroad Freedom Center
I: Smale Riverfront Park
J: US Bank Arena
K: PNC Tower (495 ft.)
L: Hilltop Ready Mixed Concrete
M: Fifth Third Center (423')

VIEWS

Figure 2.4

Figure 2.5

Figure 2.6

Project Emphasis

The emphasis of this project is to look at reusing existing infrastructure in the city of Cincinnati and continuing an abandoned project in tandem with a current city master plan project. From that, creating a hub for not only transportation, but also for people and activities in the neighborhood.

Goals of the Thesis Project

Academic

The academic goals of this thesis project are based on the idea of a fully comprehensive design. Many previous projects have only just touched on many parts of design. I plan to make develop structure, light, HVAC, sustainability, materials and passive systems more thoroughly and have them work well together. I also plan to take all the knowledge from previous studios and classes and apply them as best as I can to create a great design.

Professional

My professional goals for this thesis are based on the idea of creating a project that represents my skill set and design signature. This thesis project will aim bring together the skills I have learned through four years of college, as well as early drafting classes in high school. It is also a goal that this project reflects my experience gained in Europe during the semester abroad.

Goals of the Thesis Project

Personal

The personal goals of this thesis focus on my intrigue in architecture and why it interested me in the first place. I was originally interested in how buildings are put together and all the different parts come together. This comes back to the idea that the thesis project will be comprehensive. The design will help in the exploration of how a building works as a whole through individual parts.

Plan for Proceeding

research direction

Research will be completed in the following areas. The theoretical premise will be explored. The project typology will be explored through various case studies. The historical context of the site and the region will be taken into consideration. The site will be analyzed at a macro and micro level. Finally, the programmatic requirements will be explored for the project.

design methodology

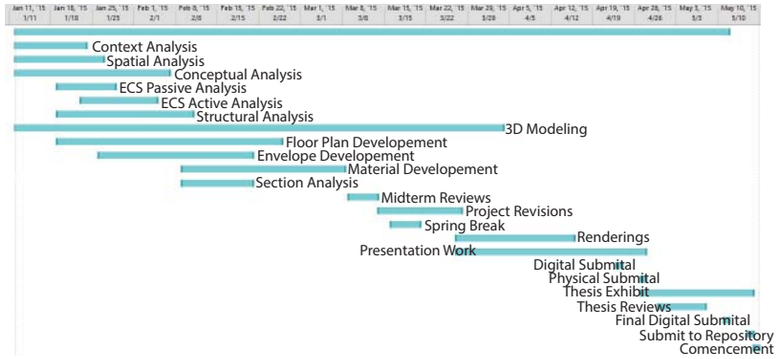
The research for the project will be a mixed method qualitative and quantitative analysis. This will use graphic analysis, digital analysis, software analysis, statistical data, scientific data, and direct observation. The data collected will be brought together and interpreted through graphics and text.

Process Documentation

The documentation of process will be compiled through photographs, text documents, and other digital and hand drawn graphics. The process documentation will keep track of dates the document was completed. The final thesis project will be submitted to and uploaded to North Dakota State University's Institutional Repository for review by other scholars and interested persons.

Plan for Proceeding

schedule



Task//Duration//Start//Finish

Process//120 days//Mon 1/12/15//Mon 5/11/15

Context Analysis//12 days//Mon 1/12/15//Fri 1/23/15

Spacial Analysis//15 days//Mon 1/12/15//Mon 1/26/15

Conceptual Analysis//26 days//Mon 1/12/15//Fri 2/6/15

ECS Passive Analysis//10 days//Mon 1/19/15//Wed 1/28/15

ECS Active Analysis//13 days//Fri 1/23/15//Wed 2/4/15

Structural Development//23 days//Mon 1/19/15//Tue 2/10/15

3D Modeling//82 days//Mon 1/12/15//Fri 4/3/15

Floor Plan Development//38 days//Mon 1/19/15//Wed 2/25/15

Envelope Development//26 days//Mon 1/26/15//Fri 2/20/15

Material Development//28 days//Mon 2/9/15//Sun 3/8/15

Section Analysis//12 days//Mon 2/9/15//Fri 2/20/15

Midterm Reviews//5 days//Mon 3/9/15//Fri 3/13/15

Project Revisions//14 days//Sat 3/14/15//Fri 3/27/15

Spring Break//5 days//Mon 3/16/15//Fri 3/20/15

Renderings//20 days//Fri 3/27/15//Wed 4/15/15

Presentation Work//32 days//Fri 3/27/15//Mon 4/27/15

Digital Submittal//1 day//Thu 4/23/15//Thu 4/23/15

Physical Submittal//1 day//Mon 4/27/15//Mon 4/27/15

Thesis Exhibit//19 days//Mon 4/27/15//Fri 5/15/15

Thesis Reviews//8 days//Thu 4/30/15//Thu 5/7/15

Final Digital Submittal//1 day//Mon 5/11/15//Mon 5/11/15

Submit to Repository//1 day//Fri 5/15/15//Fri 5/15/15

Commencement//1 day//Sat 5/16/15//Sat 5/16/15

Program

Growth in the Community Through Transit

Mass Transit, especially rail transit, has many positive effects on the community and the growth of that community.

Economic Growth

The first thing it does is helps economic growth. The railroad companies themselves are the first part of this. The railway companies need to employ people to run, maintain, clean, operate the stations and amenities in the stations, and many other tasks. This alone creates many jobs for the community the transit system is being implemented in. These make up a direct impact group.

A secondary group is all the companies that service the transportation industry. These include train manufacturers, parts manufacturers, construction companies that build stations, civil engineers that design the infrastructure, and other sectors. This is huge for the startup phase as well as when the transportation system grows.

Yet another group is the businesses, housing districts, shops, and services around where the stations pick up and drop off. The economy is boosted in these areas with more people traveling through them. Because of this, property values will go up.

Social Growth

"There is a clear social function of railway transport in promoting social inclusion and mobility for all. Social inclusion in the area of transport may be defined as the ability of citizens to access places of employment, education, commerce, or leisure, and to access health services and public services." (Molemaker, Pauer, 2014)

Mobility is one of the most basic of all human and social rights. It is what allows people to fulfill the most basic needs in life such as getting food, getting home, meeting people, going to work, and getting an education. Of course, a car can serve for all of these purposes as well. Public transportation fulfills the basic needs for people who cannot drive or cannot afford a car.

Being connected to the outside world from home is what transit is all about. Time is also an issue in this. Public transportation allows for quicker travel times than taking a car in congested areas. Europe has done this with public transportation particularly well with their extremely connected interail and high speed rail networks.

Environmental Growth

"Rail transport is commonly recognized as a clean mode of transport that has an important role in the creation of a sustainable transport system. With growing demand for freight and passenger transport, a shift towards the least polluting and most energy efficient modes of transport — especially in the case of long distance and urban travel — will contribute to more sustainable mobility." (Molemaker, Pauer, 2014)

CO2 emissions that come from rail transportation are very low compared to air and road travel. With more trains converting to diesel to electric, the emissions could drop even lower in Europe.

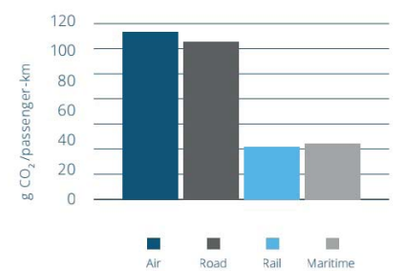


Figure 3.0 http://ec.europa.eu/

The Hotel Industry and Public Transportation

Cities with public transportation systems in place are more likely to do well in the hotel sector. When it is easy to get to and from hotels and major locations, it is less likely that people will need to rent a car or worry about getting around. This is key for business travelers and conferences. This means hotels in a community connected with a public transportation system can charge more per night and will, on average, be more full. This means more revenue for said hotels. (APTA, 2013) From this point on we will call these cities "rail cities."

It is also a general trend that more people are moving to downtown areas where things are more walkable. There are also studies showing less people in America are driving cars. This makes rail cities an ideal place for people who want this life style.

From 2006 to 2013, cities with rail access directly from airport terminals realized above average hotel performance – in both average daily room rates and revenue per available room.
- Average daily room rates are on average 10.9 percent higher.
- Revenue per available room is on average 10.9 percent higher
Even during the Great Recession, late 2008 to the start of 2010, above average hotel performance was realized in these cities, exhibiting the importance of interconnected transportation in order to remain resilient during economic downturn.
- Average daily room rates were on average 13.5 percent higher.
- Revenue per available room was on average 14.9 percent higher." (APTA, 2013)

This is great news for rail cities and a huge incentive for cities with no rail transportation to implement it. Cities such as Cincinnati, Ohio.

Rail Cities

The following section is analysis of four rail cities and how they are benefiting from rail transit.

Atlanta

Atlanta has 38 stations and had a ridership of 217,000 people per day in 2012. Because of this, the city ranks number 7 in hotel rooms. Atlanta is a popular place for conventions.

Chicago

Chicago has 114 stations and served 728,000 people a day in 2012. The city ranks number 3 in hotel rooms. Chicago has many conventions and business meetings.

Minneapolis

Minneapolis has a much smaller light rail system than the previous two cities with 19 stations serving 31,500 people a day in 2012. Minneapolis is ranked number 24 in hotel rooms.

San Francisco

San Francisco has 44 stations in its rapid transit loop carrying 418,000 people a day in 2013. The city is ranked number 13 in hotel rooms.

All of the cities above have a rail connection to the city from the airport. These connections make it much easier for businesses and even the leisure traveler get into the city. It also allows for businesses and individuals to save money on rental cars.

Benifits of Rail Transit in America

In 2004 there were 23 cities in the United States that had some sort of rail transportation. Currently there are over 40. This includes light rail, subway systems, and even street cars. The biggest systems by ridership include New York City, San Francisco, Washington D.C., and Chicago.

One of the biggest benefits to rail transportation is the ability to reduce congestion in cities.

"Rail tends to provide higher quality service than bus transit. Rail is usually more comfortable, faster (particularly if grade separated, so trains are not delayed by congestion) and better integrated into the urban landscape. As a result, rail transit usually attracts more riders within a given area, particularly discretionary riders(travelers who could drive but choose to ride transit, also called choice riders), and so is more effective than bus transit at reducing automobile trips (Pratt, 1999; FTA, 2002)." (Litman, 2004).

This shows that rapid transit and/or a light rail system cuts down on drivers on the road because they want to make a conscious decision for either the environment or just to make it easier on themselves, i.e. not having to be stuck in the traffic themselves.

Areas around these transit stations are also benefiting. Because there is easy access to the area it allows people to walk or bike to local shops after getting of the train. This encourages local shops and businesses to open in these areas and for housing revitalization. This can be seen in the Minneapolis area now with the newly opened light rail extension.

It is found that even older neighborhoods that once had a streetcar running through it still thrive because of the shops and businesses that formed on them. This could be extremely useful when planning out new line routes by using existing areas. People are also less likely to own cars in these areas.

The lines that will or did run through neighborhoods and areas also increase the property values. This makes the areas more desirable and allows for shops and businesses to charge more for goods and services. This brings cost of living up and will ultimately bring area wages up.

Another big benefit to rail transit is savings in cost of roads and parking. With more people riding rail transportation the need for parking reduces significantly at events and business offices. It is also potentially saving people money on parking. Of course, some of these costs will be relocated to the cost of riding the subway or light rail lines. It is also saving the cost of gas to get to the parking spot.

Consumer saving is a huge benefit as well.

"Personal transportation is a major consumer financial burden. About 18% of household expenditures are spent directly on vehicles and transit fares (BLS, 2003). Rail transit provides significant consumer savings." (Litman, 2004).

Cars are extremely expensive to maintain and fuel, especial in an urban center. Since people are mostly taking short trips and having to stop and start constantly, even the cars with the best fuel economies are getting below average gas mileage. The less people drive their cars, the less they will need to spend on routine maintenance and the less

likely things are to go wrong on their cars.

There is also the safety benefits of rail transportation. Traffic accidents are still one of the leading causes of death in America. With more rail transportation, deaths go down.

Another major area rail transit benefits is emissions and energy use. Rail transportation takes cars of the roads, already significantly reducing emissions. Most light rail and subway cars run off of electricity. This is a zero emission except at the power plant where the power is being produced. It also reduces the waste of natural resources like oil, gasoline, tires, air filters, and all other consumables that cars use. This results in less waste in landfills as well.

There will always be the argument of bus versus rail transit. The following graphic takes a look at the differences.

Bus Transit	Rail Transit
Flexibility. Bus routes can change and expand when needed. For example, routes can change if a roadway is closed, or if destinations or demand changes.	Greater demand. Rail tends to attract more discretionary riders than buses.
Requires no special facilities. buses can use existing roadways, and general traffic lanes can be converted into a busway.	Greater comfort, including larger seats with more legroom, more space per passenger, and smother and quieter ride.
More suitable for dispersed land use, and so can serve a greater rider catchment area.	More voter support for rail than for bus improvements.
Several routes can converge onto one busway, reducing the need for transfers. For example, buses that start at several suburban communities can all use a busway to a city center.	Greater maximum capacity. Rail requires less space and is more cost effective on high volume routes.
Lower capital costs. Is used more by people who are transit dependent, so bus service improvements provide greater equity benefits.	Greater travel speed and reliability, where rail transit is grade separated.
	More positive land use impacts. Rail tends to be a catalyst for more accessible development patterns.
	Increased property values near transit stations.
	Less air and noise pollution, particularly when electric powered.
	Rails stations tend to be more pleasant than bus stations, so rail is more appropriate where many transit vehicles congregate.

Figure 3.1 APTA

There are many benefits of rail travel and multi-modal transit to cities including economic, social, environmental, and even safety benefits. The entire economy of an area is affected by a transit system. Hotels, shops, retail, restaurants, housing and real estate, and businesses all benefit from greater connectivity to each other. Social benefits include being more connected to the community and ease of ability to get out of the house cheaply and efficiently. Public transit helps fulfill many basic social needs. The environment is being helped by lowering emissions and taking cars off the road or convincing people to drive less. This ties into safety with less cars on the road, less accidents occur.

People in the community will also be saving money in the long run. People will not have to put as much money into gas and maintenance on vehicles. There will also be savings in parking costs. The roads will also be less congested and will therefore save people time in that sense. Time will also be saved by taking the transit line instead of driving.

All of these things relate to the theoretical premise of how to turn a transportation hub into a center of activity. The

multi-modal transportation forms that go through the hub will connect people all over the city. The hub will also affect the Banks Neighborhood and bring thousand of people to stimulate the economy there. With an added high speed line connecting to the airport, the hub will bring an even bigger impact into the city and help encourage the use of CVG airport which has been on decline for quite a while.

The idea of turning the transportation hub into a center of activity also means there will be many amenities in the hub itself. This will also draw people to the hub for an experience. With the hubs location, people will already be close to the sports and convention spaces. This will, in turn, attract more business meetings and conferences to the Cincinnati area.

All in all, bringing a multi-modal transit center which also acts as a hub for people is an extremely beneficial thing for Cincinnati. It will boost the economy, get people involved as well as save people time and money.

This project is important to me and society because public transportation is a critical step for every city. For decades, Cincinnati citizens have been turning down the idea of using the already existing subway infrastructure. Rapid transit is really the next step for Cincinnati to expand. The ability for a city to expand after implementing rapid transportation is great. This project can show that a rapid transit center is a viable solution to the traffic and congestion problems Cincinnati has.'

Public transportation also creates a sense of community in a city. Cincinnati already has great things to offer in the way of amenities and event centers. This thesis project will give people an idea of how all people in the city of Cincinnati should and could be able to get to these amenities.

This project is applicable as a final project because all of the major elements of architecture are incorporated. In a transit hub, it is important to create a pleasant experience for the passengers and people passing through. Making a great experience starts with building itself.

This project ill take a look at all of the design elements necessary to make that experience. It will take a look at lighting design, including both opening placement to minimize the need for artificial light and it will look at optimum placement for artificial lighting. Next the project will look at structural systems. Transportation hubs have a lot of wide open spaces so this project will be an interesting challenge in structural design.

Acoustics is another major design element this project will look at. The project will aim to minimize echoing and reverberation in large open spaces. The project will also look into sustainable practices. A large building such as a transit center has many possibilities for integrating all different types of sustainable systems.

The project also aims to look at the connection between site and the built world to integrate the building nicely into the existing land and Cincinnati skyline. All of these things have been practiced on designs and studios across the four and a half years of school and will be applied here.

Cincinnati's Mass Transit History

Steamboats

Cincinnati has a rich history of mass transportation. Like many cities, many of the public transportation systems have been lost because of the popularity of the automobile. At one point, Cincinnati had trains, street cars, steam boats and almost a subway system. Only now has there been exploration into creating new public transportation systems.

Trains and Traction Lines

In the nineteenth century, the Ohio River and the Miami-Erie Canal were two very important veins in Cincinnati as well as the Midwest. Steamboats with goods as well as passengers traveled though Cincinnati daily. This helped Cincinnati grow quickly and by the beginning of the twentieth century, Cincinnati was one of the ten largest cities in America and was one of the leading trade centers. Cincinnati was named the Queen City. Today, mosaics in the Cincinnati Airport and the former Cincinnati Union Terminal, now the Cincinnati History Museum, depict the steam boats and the industrial age. Local architecture also pays tribute to the tall stacks on the steam boats.

Figure 4.0 http://thelope.com/2006/08/cincinnati-union-terminal.html

Soon after the golden age of steamboats came the age of trains. Traction lines took over as the new transportation of choice for goods and passengers. There were nine of these electric powered train lines operating out of Cincinnati between 1864 and 1926. Steam powered railways also started developing in the 1850s for high-speed freight and passenger transportation.

Passenger train stations in this time were spread out around the Cincinnati area. There were five different train stations. A centralized station called Union Terminal was not opened until 1933. It is one of the most grand train stations ever built and is still the second biggest half dome building in existence. By this point, train travel was already on the decline and by 1972 the station closed its doors.

By 1856 the canal was no longer a profitable means of transportation and in 1977 it was abandoned. For years the canal became stagnant and smelly. It soon became a health hazard.

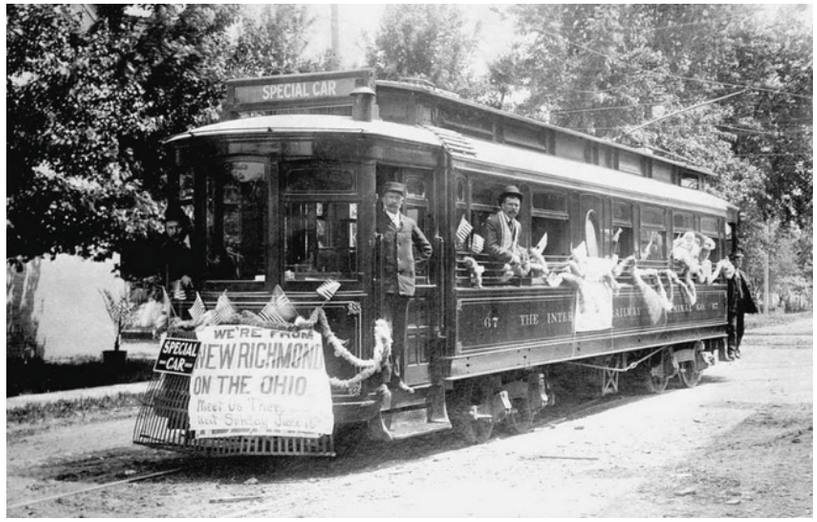


Figure 4.1 The Cincinnati Subway: A History of Rapid Transit, Allen, J Singer

Streetcars

At this point in time, Cincinnati already had a successful streetcar system in place, but they were slow and added to traffic issues in the city. Most of these street cars were powered by horses. By 1888, Thomas Edison's DC power started coming into Cincinnati and streetcars were converted to electric streetcars. In 1910 there were 222 miles of streetcar tracks in Cincinnati. With the growing popularity of Ford's automobile, traffic started to become an issue.

The Cincinnati Subway: A Failed Vision

The Vision

In 1884, a September 27th issue of The Graphic, Cincinnati's weekly magazine had a bold new idea to re-purpose the canal and turn it into a rapid transit system. This is an idea that sparked a project that could have changed the city entirely. It was not until 1907 that this idea was even pursed.

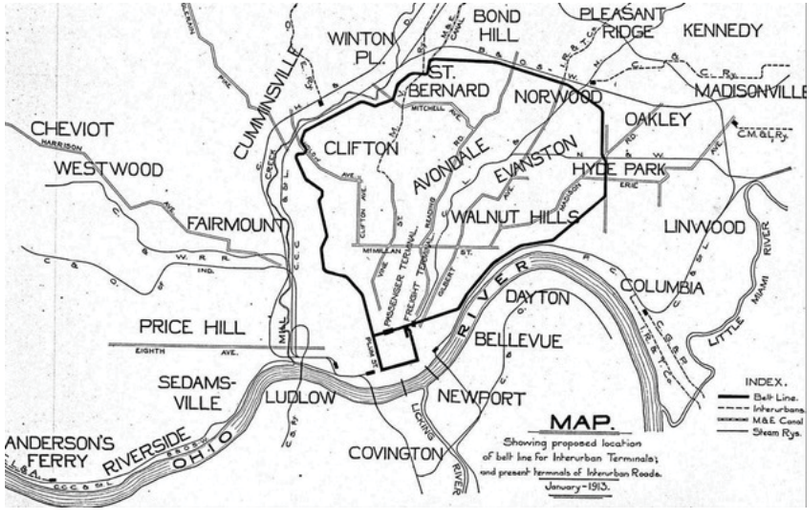


Figure 4.2 The Cincinnati Subway: A History of Rapid Transit, Allen, J Singer

In 1907, a report to City Hall called the "Kessler Plan" was presented. This plan proposed for the abandoned canal to be covered with a wide road called Central Parkway. Underneath the road would become an underground rapid transit system. The plan for the Cincinnati rapid transit subway was planned to be a loop around and into the city to serve the suburbs. Most of the loop would be above ground and the canal would be used as the subway stretch of the loop bringing subway cars into the heart of downtown. By 1917, the plan was finally approved.

Figure 4.3 The Cincinnati Subway: A History of Rapid Transit, Allen, J Singer

Setbacks

Later in 1917, the US entered World War I. Since no money from bonds could be issued during war time, the $6 million bond was canceled and construction could not continue. After the war was over, the loop could no longer be built for the original amount and the plan needed to be rethought. This cut the size of the loop in half so the budget could remain at the original $6 million.

Construction finally began in 1920. By 1924 the loop was only about 28% complete. By 1927 It was decided to halt any more work on the rapid transit system until a better study of the needs of Cincinnati could be done. Soon after in 1929, the stock market crashed and it seemed the subway dream was dead.

It was not until 1936 that rapid transit was looked at again. Studies were done for the next 5 years on what to do with the existing infrastructure. Ideas from a parking garage to storage and even tunnels for automobiles were discussed. On December 7th, 1941 the project was halted again, this time because of World War II.

Finding a Use for the Tunnels

In 1956 the tunnels finally had a use. The city approved a proposal for a 48 inch water main to run through the tunnels saving $300,000 in excavation costs. With this a clause was put in place saying in the case the tubes were needed for a rapid transit system, the water main would need to be relocated.

Other ideas have included wine cellars, freight tunnels, bus tunnels, shopping malls, parking garages, nuclear fallout shelters, and wind tunnels. The most recent proposal in 2001 was to use the tunnels for a light rail system. The idea was voted down by a two thirds vote. The tunnels still sit under Central Parkway just waiting for a use.

Recent talks and surveys have discussed putting light rail service through the subway tunnels but it was voted down because it was cost prohibitive

Site Analysis

The city of Cincinnati, Ohio is the city I grew up in. I grew up in the Northern suburbs of the city, far enough removed from the hustle and bustle of commerce. Whenever we did make it down to the city, it was always an exciting place to be. The City is in a period of urban renewal in multiple neighborhoods. One of these neighborhoods is called The Banks. The Banks is master-planned as a community oriented neighborhood. The neighborhood includes the Great American Ball Park and Paul Brown Stadium, an underground railroad museum and two parks. There are also open spaces used for farmers markets and other activities. This keeps the neighborhood lively.

The other neighborhood is Over the Rhine. This neighborhood celebrates the German heritage of Cincinnati. The neighborhood is on the National Register of Historic Places and has been undergoing restoration since 2011.

Also in Cincinnati, is the famous Fountain Square. One of the best designed urban plazas, it is used for concerts, markets, and becomes an ice skating rink in the winter. This adds to the excitement of the downtown area and will be a short walk or subway ride away from the Union Transit Center. Around Fountain Square there are bars and restaurants which celebrate the German Heritage of Cincinnati.

Located along the Ohio River in Cincinnati, the site sits in between the Roebling Suspension Bridge and the Paul Brown Stadium. To the north of the site is the city center and to the South are views of the river.

The Cincinnati Union Transit Center will need to tie into multiple existing infrastructure systems. This being said, the site is placed where it is so that it can tie into the community as well. The site ties into the rail system via a new tunnel corridor which would tie into the existing rail corridor on the west side of the city center.

The site is mostly flat on the North side and slopes down towards the river on the South side. There are wooded areas on the South side next to the river, otherwise the site is bare or as remnants of a parking lot. The North side of the site has a four lane road and a bicycle route. The West side of the site has a parking lot and the East side faces a riverfront park. The site has about 925 feet of riverfront.

The site is an area of 7.21 acres. The most comparable transit center, Transbay Terminal in San Francisco, has a site area of 5.4 acres. While the vegetation on the site is minimal right now, it will be important that more is added to fit in with the park next door.

The road that makes up the North border of the site has a nice curve to it which will likely influence the design of the building. The site will also likely become part of the skyline of Cincinnati from the Kentucky side of the Ohio River.

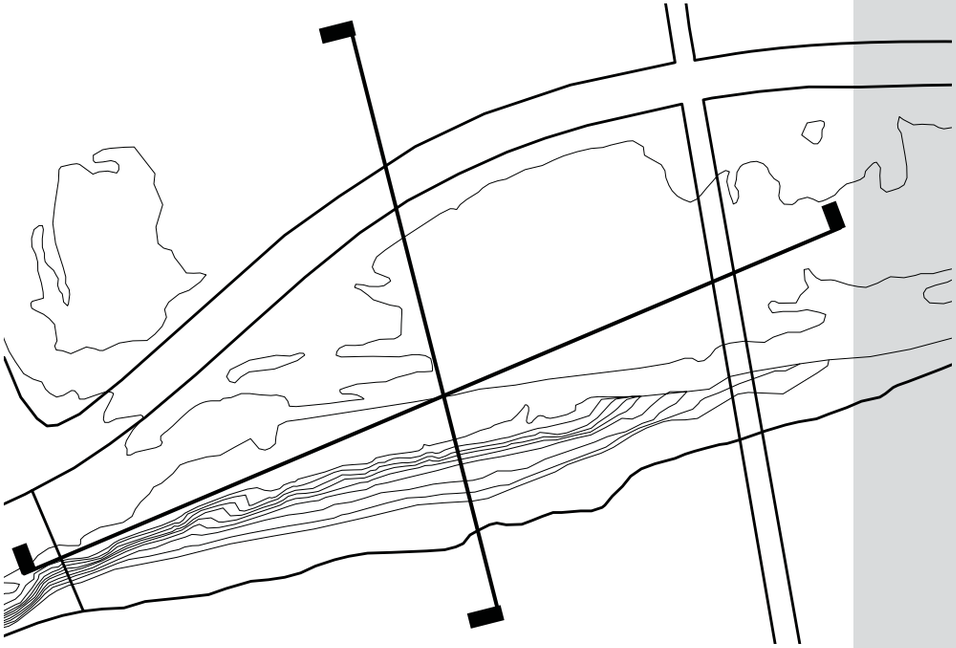


Figure 5.0

Figure 5.1

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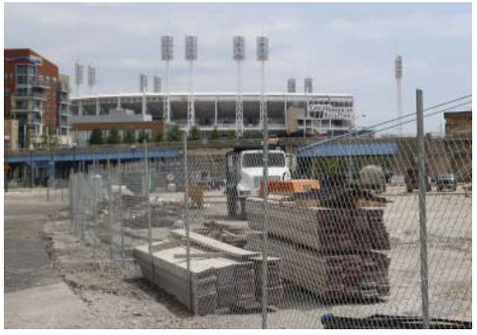

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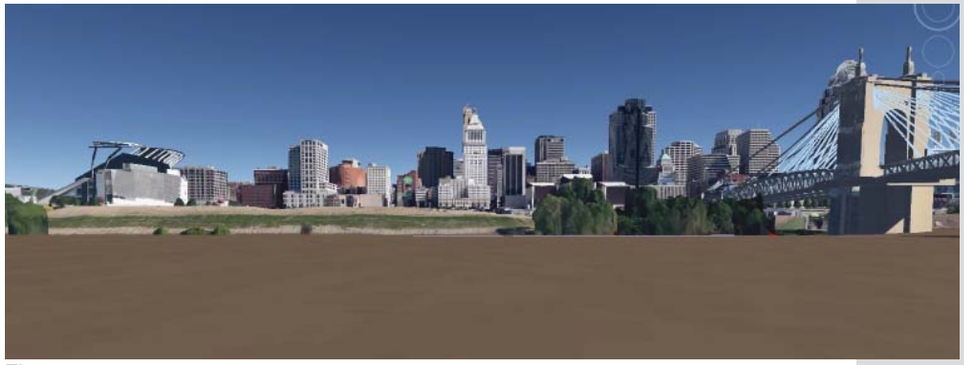


Figure 5.9

Figure 5.10

The site for this thesis is across a freeway from the downtown Cincinnati area. Directly near the site, the density of buildings and structures is fairly low since the area is currently under development. The area currently has two sports stadiums, a riverfront park, an arena/convention center, a museum and multiple parking lots. Across the freeway in the downtown area of Cincinnati, the density is fairly high. There are high rises, office buildings, parking structures, and other building types.

Light Quality
Light on the site is very readily available due to the surroundings of the site. There is very little vegetation on the south side of the site blocking minimal light. On the West side of the site there is a bridge which blocks some light in the morning. All other sides of the site are far enough away from built and natural obstructions to not be affected by shadows.

Wind Patterns
Winds are out of the South 14% of the time, South-West 14% of the time, West 11% of the time, and the North-East 11% of the time.

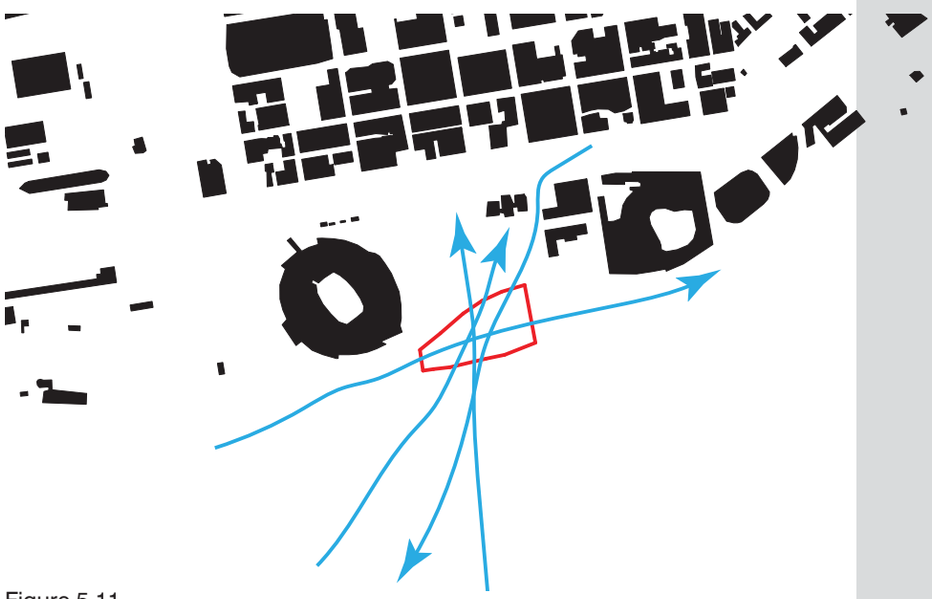


Figure 5.11

The Ohio River runs along the Southern border of the site. The river had been a huge source of income in the 1800s. Now it is used for shipping goods, tourism, recreational boaters, and fishing. The average depth of the river is about 24 feet. The average velocity according to NOAA is around 2 miles per hour. The pollution level depends on the time of year and the amount of rain seen at a given time because of sewage overflow. Most of the time it is safe to swim in.

100 Year Floodplain

Figure 5.12

Human Characteristics

The site is currently being used as a parking lot for Paul Brown Stadium as well as overflow parking. It is in the process of being turned into a riverfront park. The site sits between a park and more riverside parking with a large parking lot to the North and the river to the South. There are sometimes people fishing on the bank of the river. The lot to the North is planned to be developed as a multiuse building project.

Distress

There is not much distress on the site since it is being torn up to rebuild the site into a park. There is some erosion of soil on the bank of the river. All of the vegetation on the site appears to be healthy and thriving

Soils

The soil classification on the site is mollisoils. Mollisoils are commonly found in grassland areas.

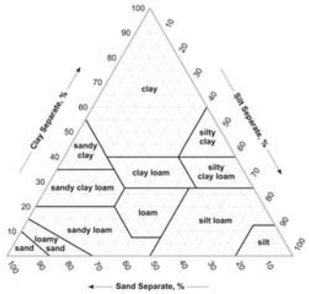


Figure 5.13 http://hydro_bm.esri.com/Soils/soilOrderMap2Beta.htm

Figure 5.14

Vehicular traffic is very high in the downtown Cincinnati Area. This is due to the fact that many people who work in the city live in the suburbs. It is also due to the fact that Cincinnati does not have a functional public transit system in place.

Figure 5.15

Power: Duke Energy.

Natural Gas: Duke Energy.

Sewage: Municipal

Water: Municipal

Telephone: Cincinnati Bell

Cable Provider: Time Warner Cable

Internet Service Providers:

Time Warner Cable &
Cincinnati Bell

Hybrid Map

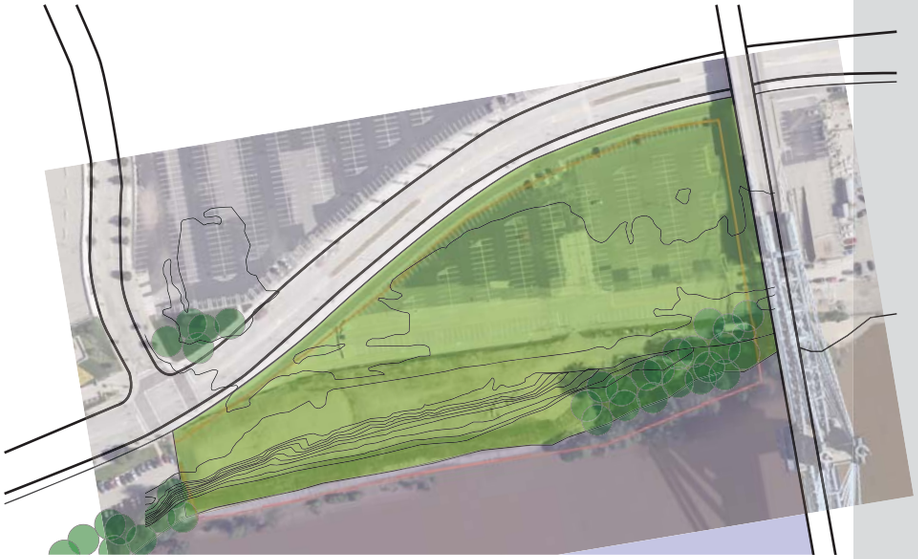


Figure 5.16

Figure 5.17

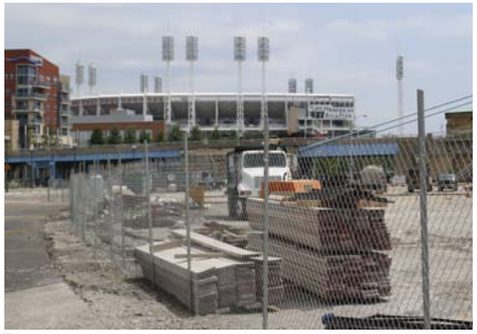
South

Figure 5.18

North

Figure 5.19

West



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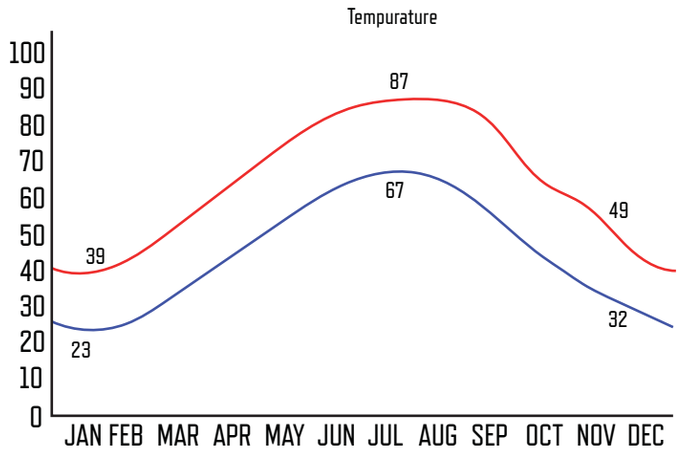
East



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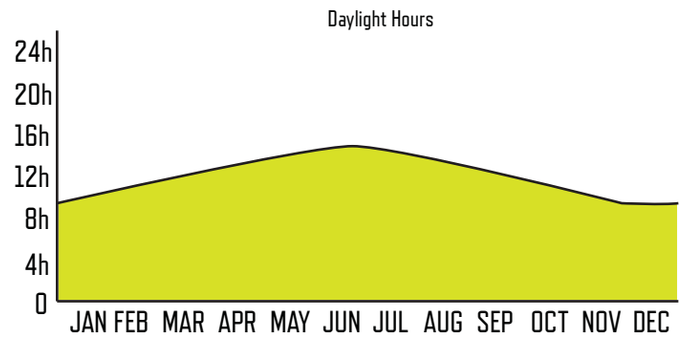

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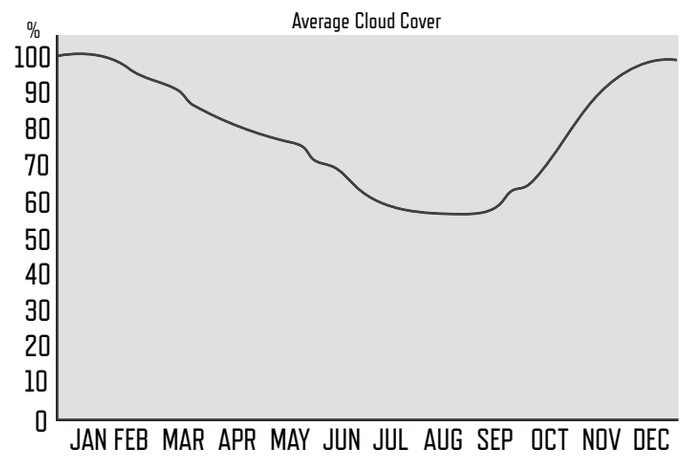

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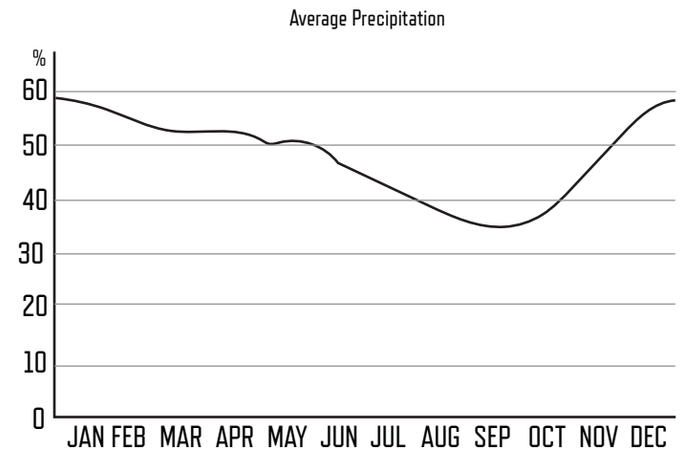

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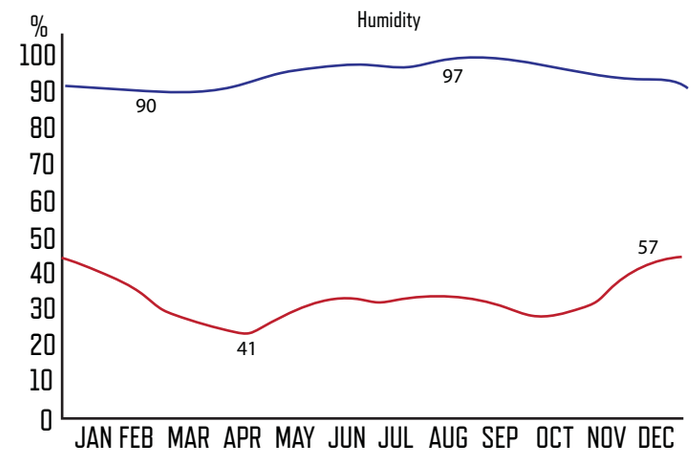

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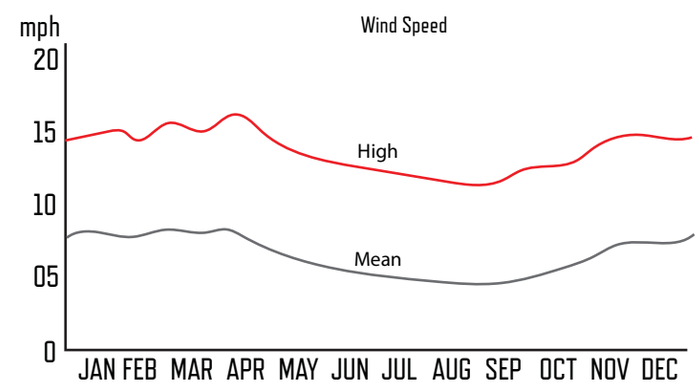

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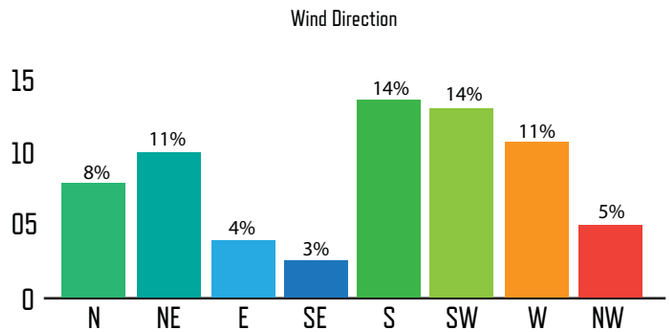


Figure 5.27

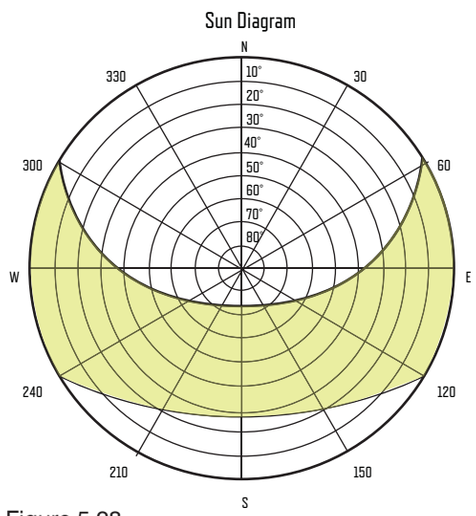


Figure 5.28

The site is very rough in nature currently. The ground is torn up so there is not much green on the site. There is some tree coverage on the south side of the site on the bank of the river. Much could be added to the site since it is basically a blank canvas right now.

The sight can be seen from the city as well as from the river and the freeway. There is really not much blocking views on or off of the site.

Building Program

Program Spaces (Pre-Midterm)

Transit Hub Spaces	102,700 sq. ft.
Grand Hall:	40,000 sq. ft.
Concourse:	30,000 sq. ft.
Ticket Sales/Admin:	3,500 sq. ft.
Waiting Areas:	8,000 sq. ft.
Platforms:	20,000 sq. ft.
Luggage Storage:	1,200 sq. ft.
Retail and Restaurants	75,000 sq. ft.
Supermarket:	30,000 sq. ft.
Food Court:	10,000 sq. ft.
Retail & Restaurant Spaces:	35,000 sq. ft.
Community Spaces	19,700 sq. ft.
Designated Performance Spaces:	2,000 sq. ft.
Conference/Convention Spaces:	16,500 sq. ft.
River Access:	1,200 sq. ft.
Support Spaces	135,800 sq. ft
Circulation:	20,000 sq. ft
Restrooms:	5,000 sq. ft.
Bike Storage:	800 sq. ft.
Mechanical Rooms:	10,000 sq. ft.
Parking Garage:	100,000 sq. ft.
Total	233,200 sq. ft.
Total with Parking	333,200 sq. ft.

Program Spaces (Final)

Grand Hall:	37,000 sq. ft.
Ticket Sales/Admin:	2,600 sq. ft.
Platforms:	45,000 sq. ft.
Restaurant	7,500 sq. ft.
Designated Performance Spaces:	2,000 sq. ft.
River Access:	6,000 sq. ft.
Plaza	31,000 sq. ft
Support Spaces	
Restrooms:	2,000 sq. ft.
Bike Storage:	1,000 sq. ft.
Bike Shop:	2,000 sq. ft.
Mechanical Rooms:	5,000 sq. ft.
Total:	141,700 sq. ft.

Interaction Matrix

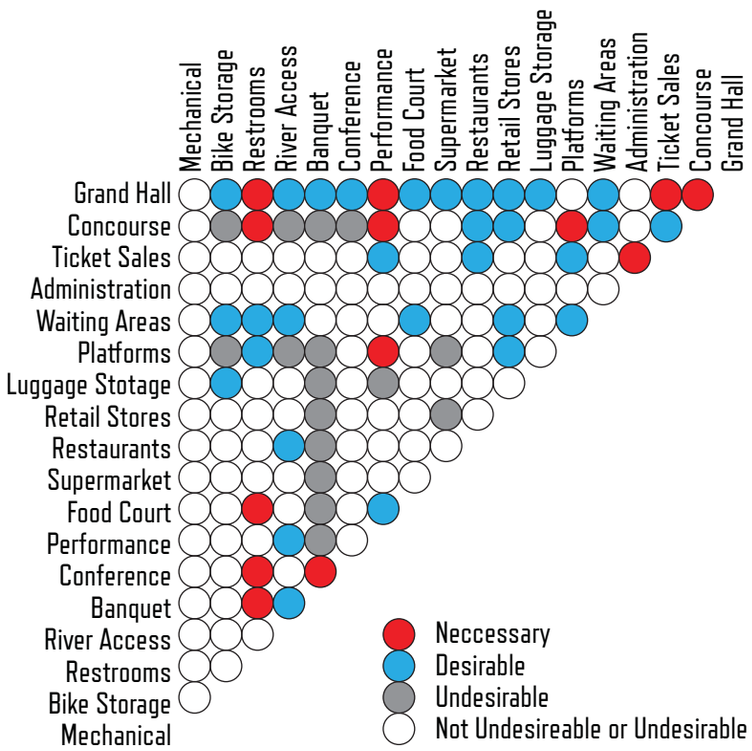


Figure 6.0

Interaction Web

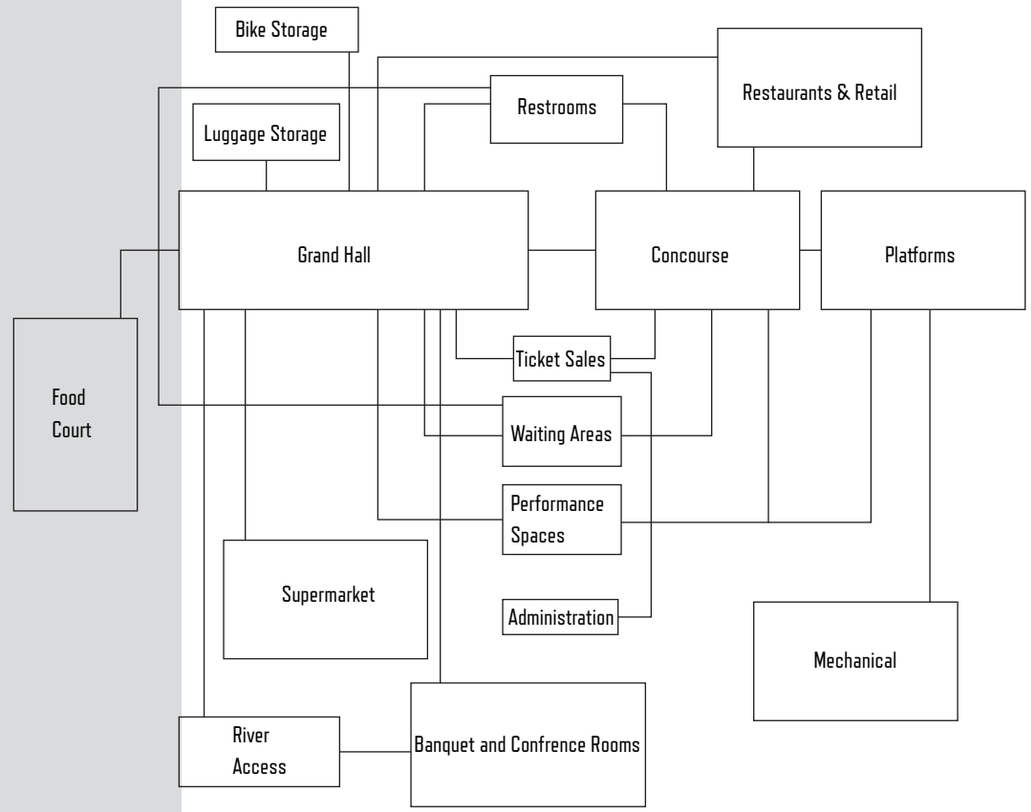
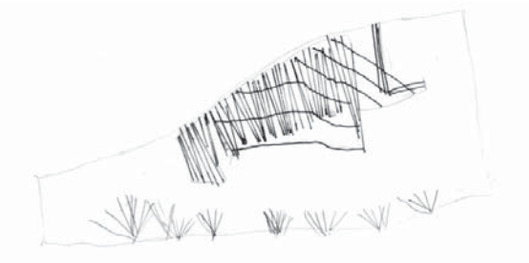
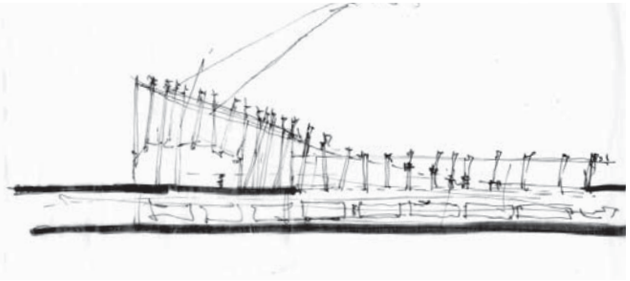
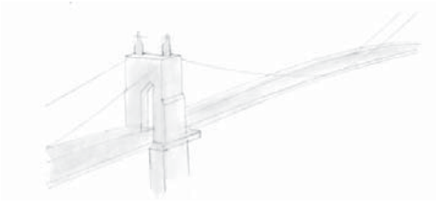


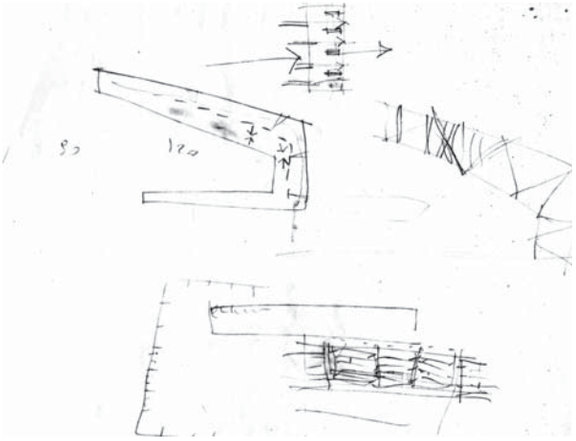
Figure 6.1

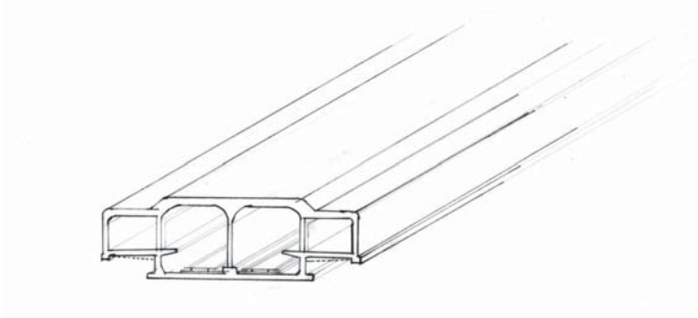
Design Solution

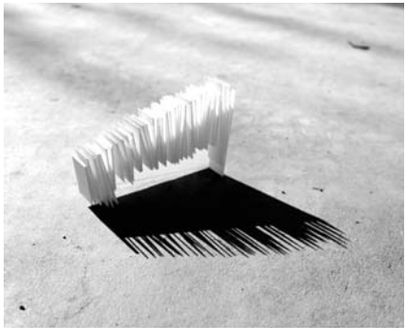


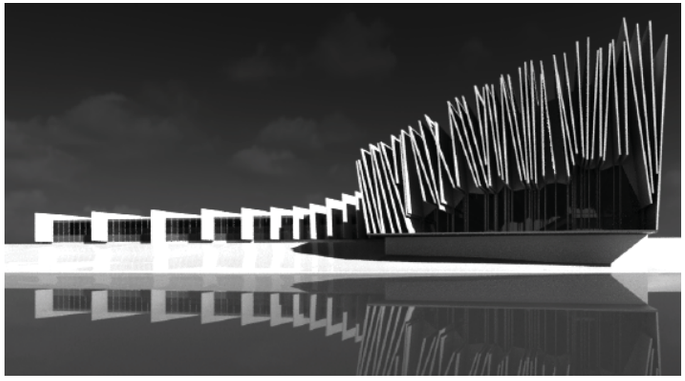


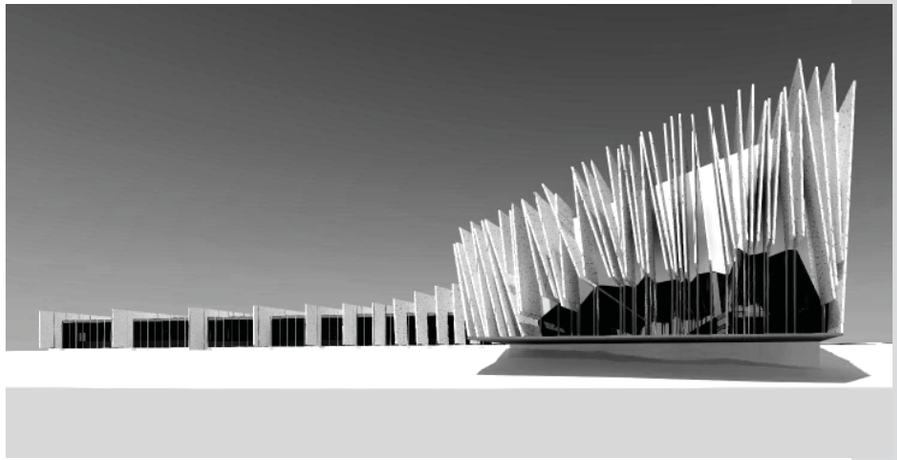


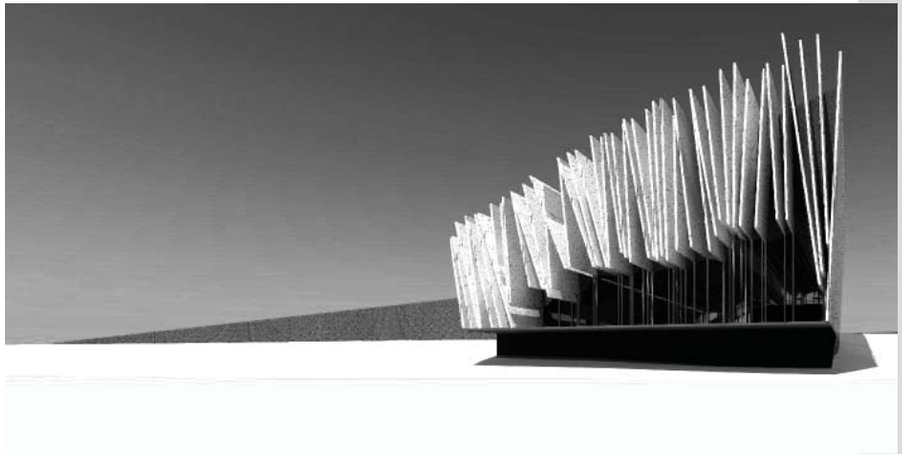


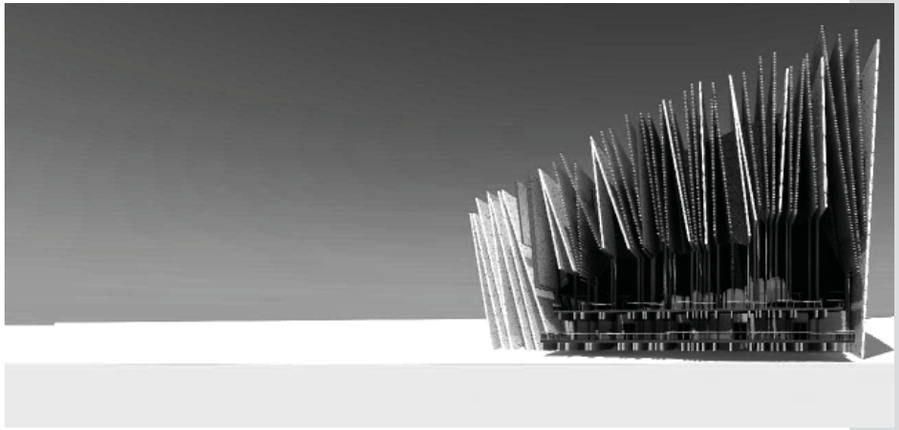




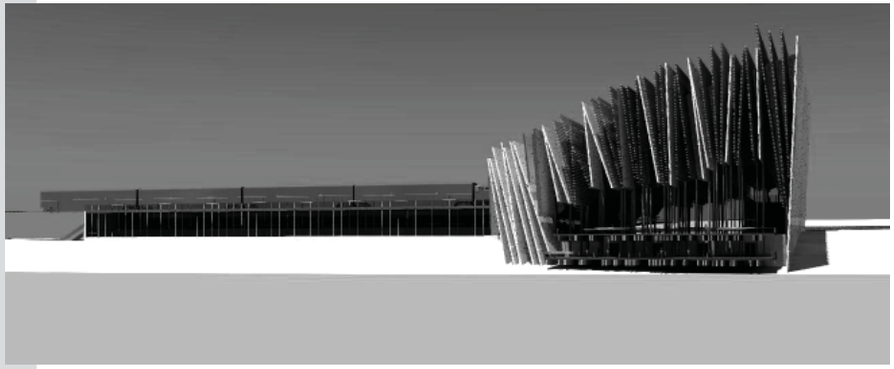


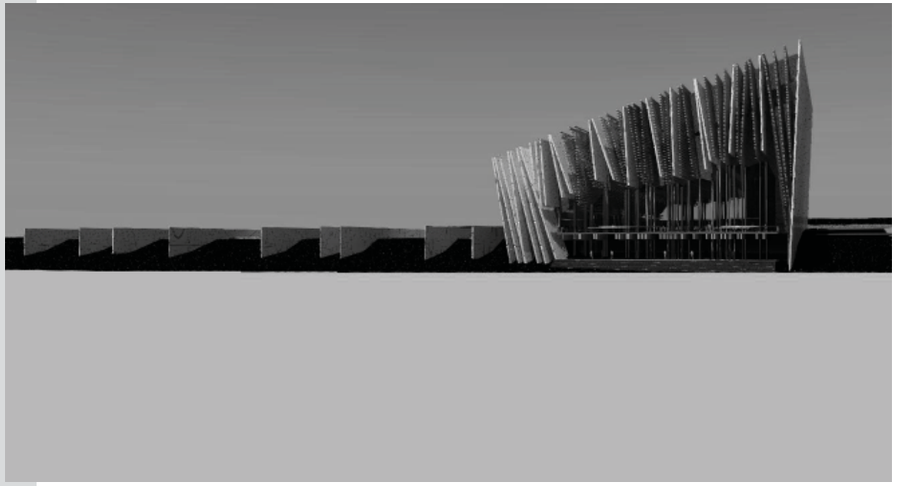




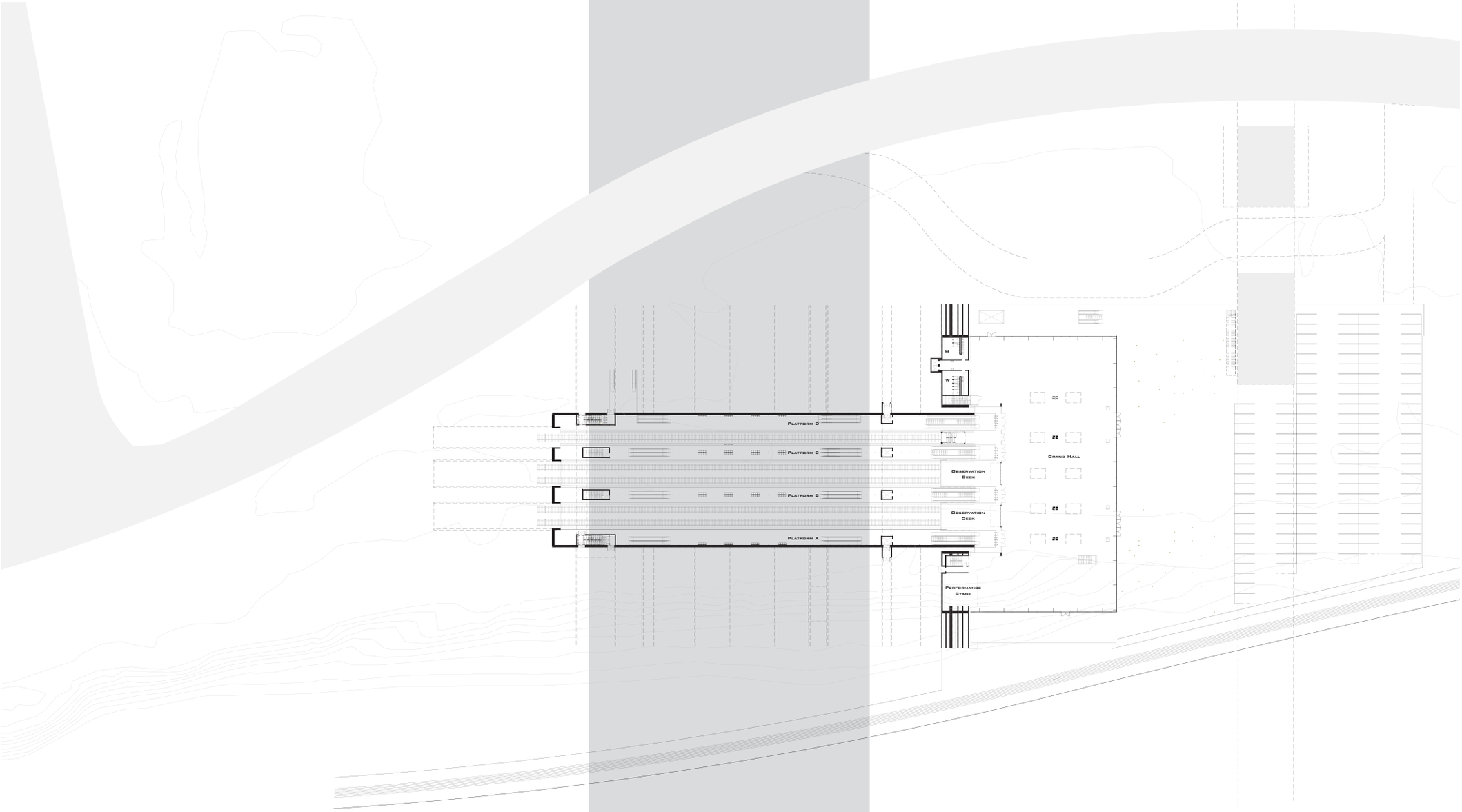


Process Documentation

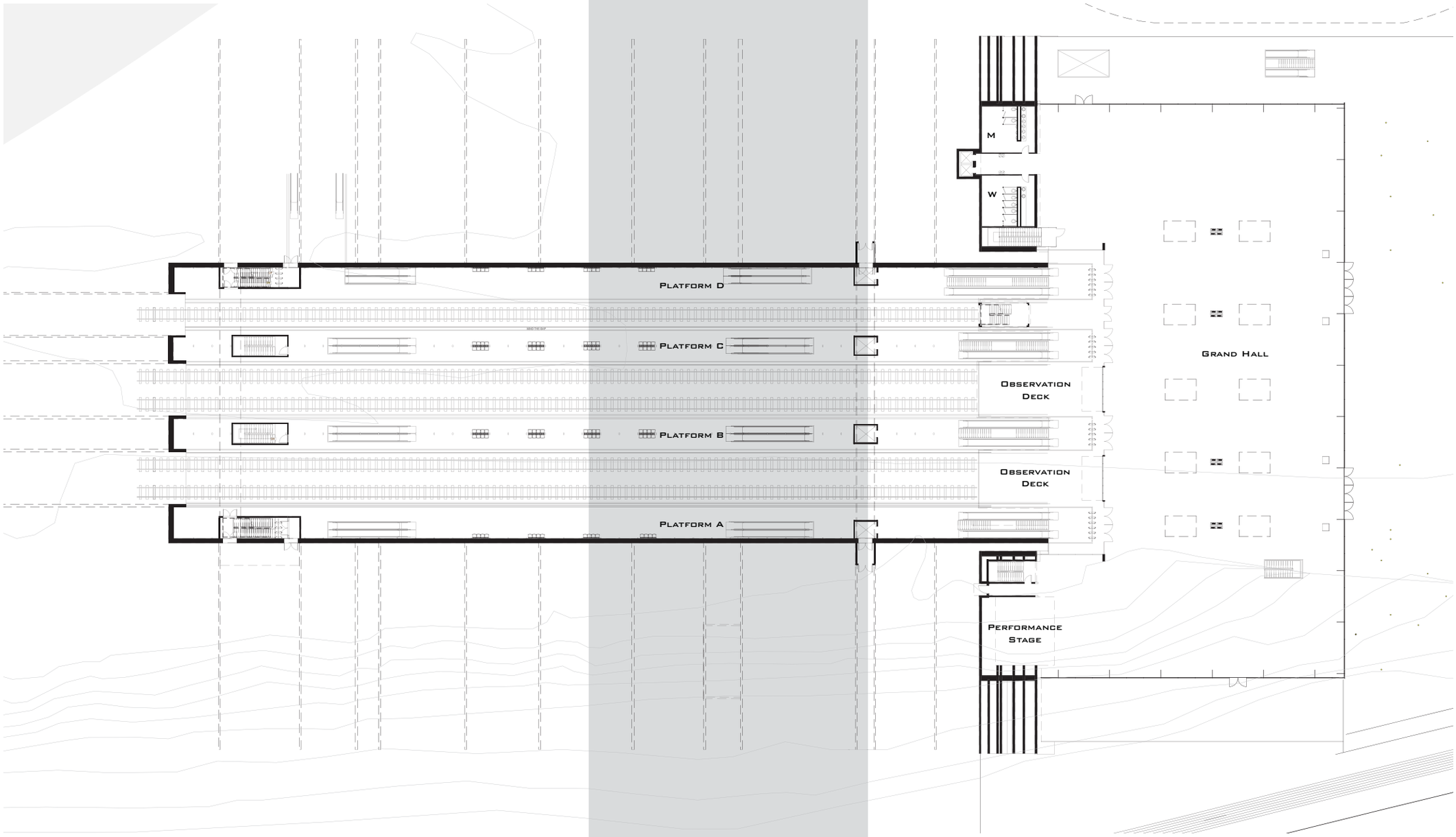




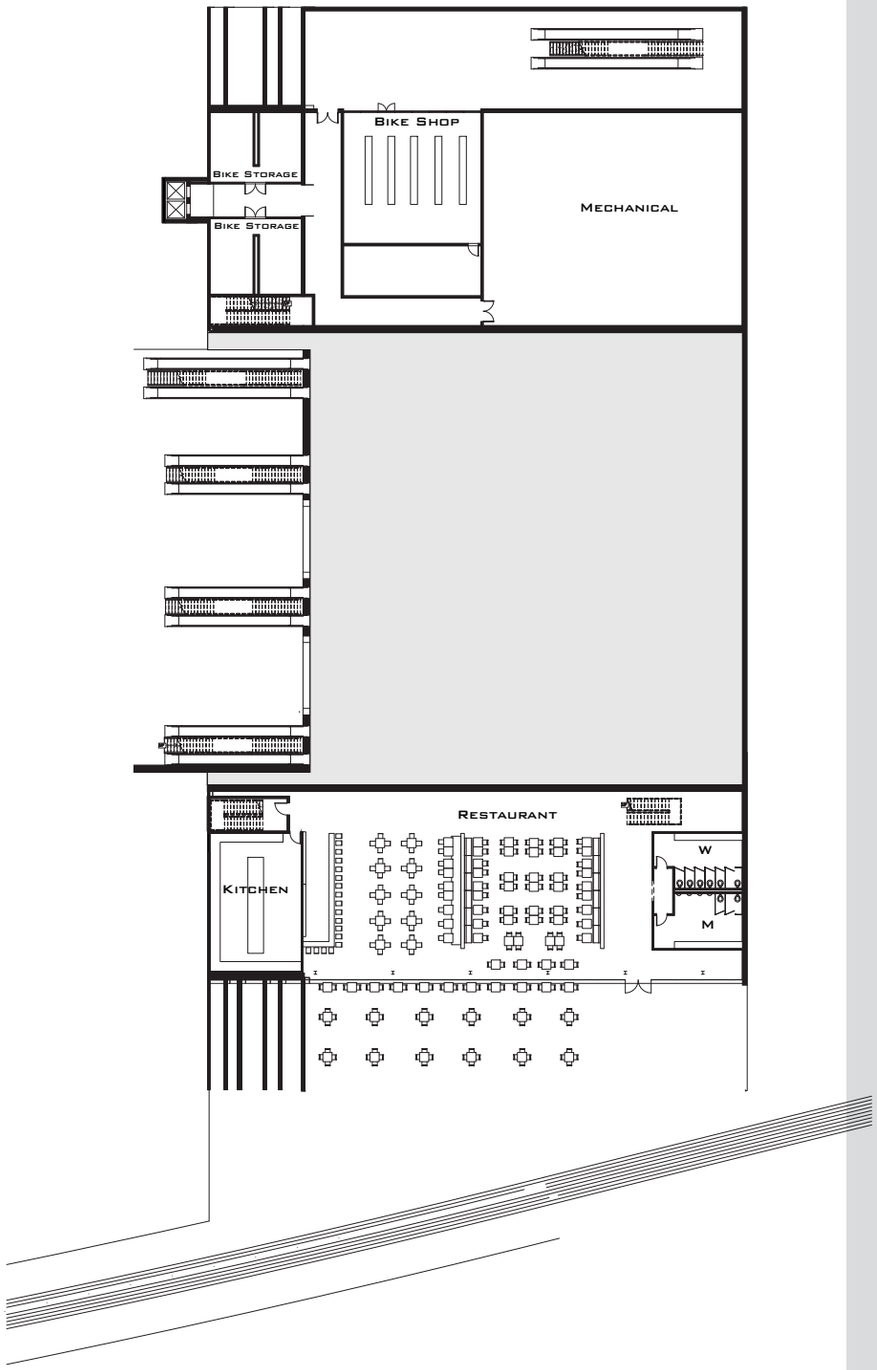
Site Plan


Platform D
Platform C
Platform B
Platform A
Observation Deck
Observation Deck
Grand Hall
Performance Stage
M
W

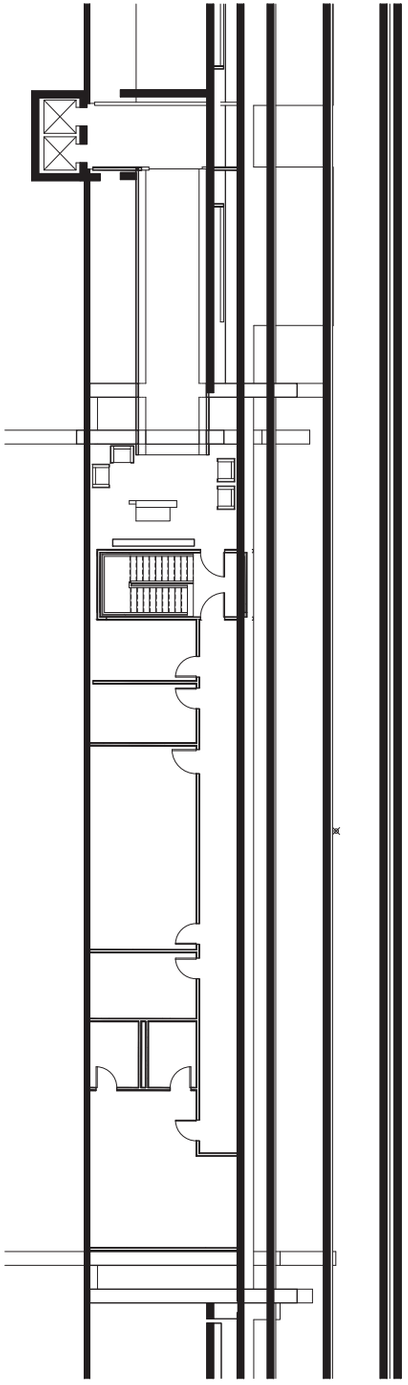
Level 0-1 Hybrid



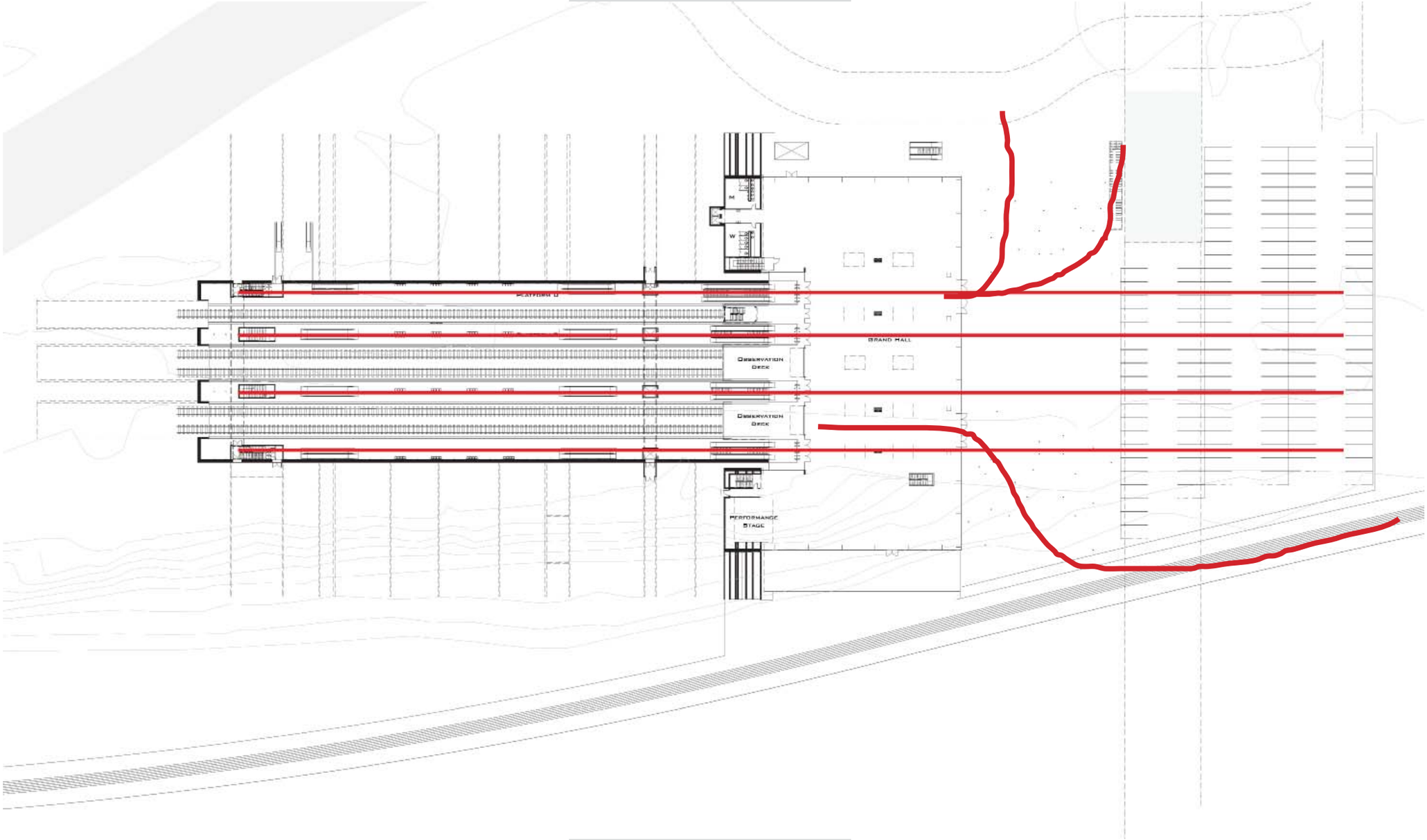
Level 0



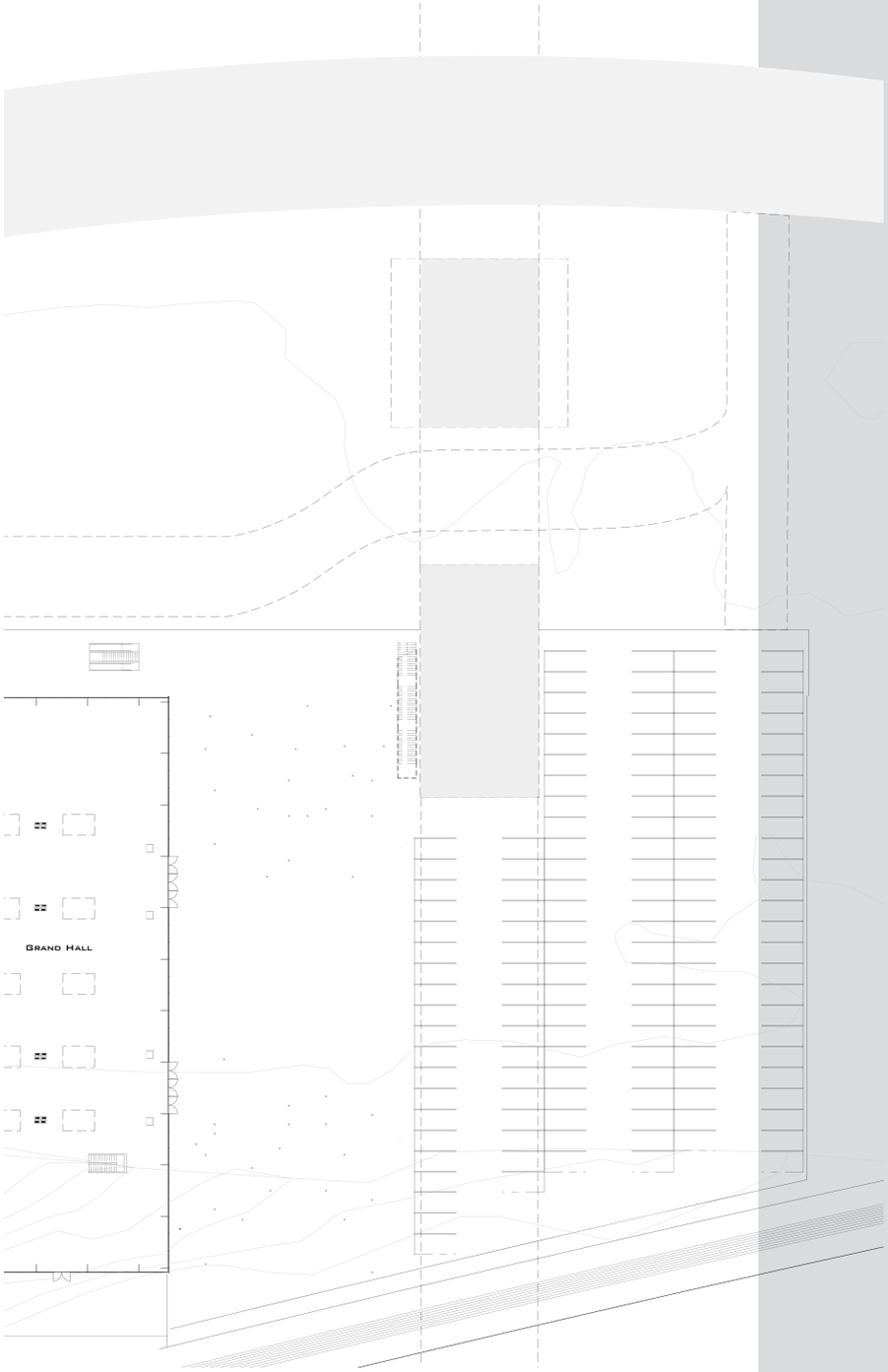
Level 2



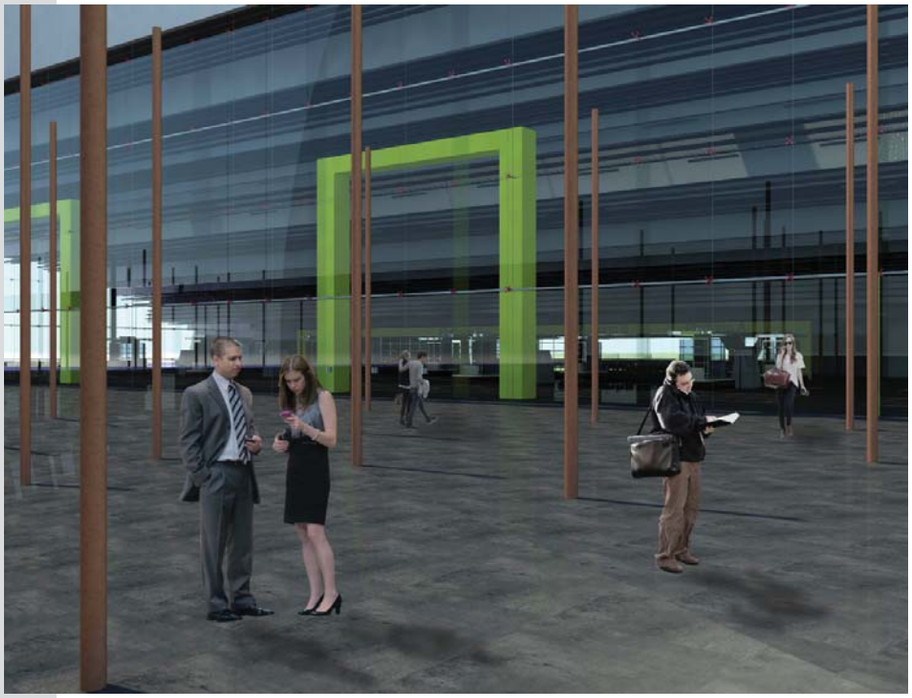
Circulation



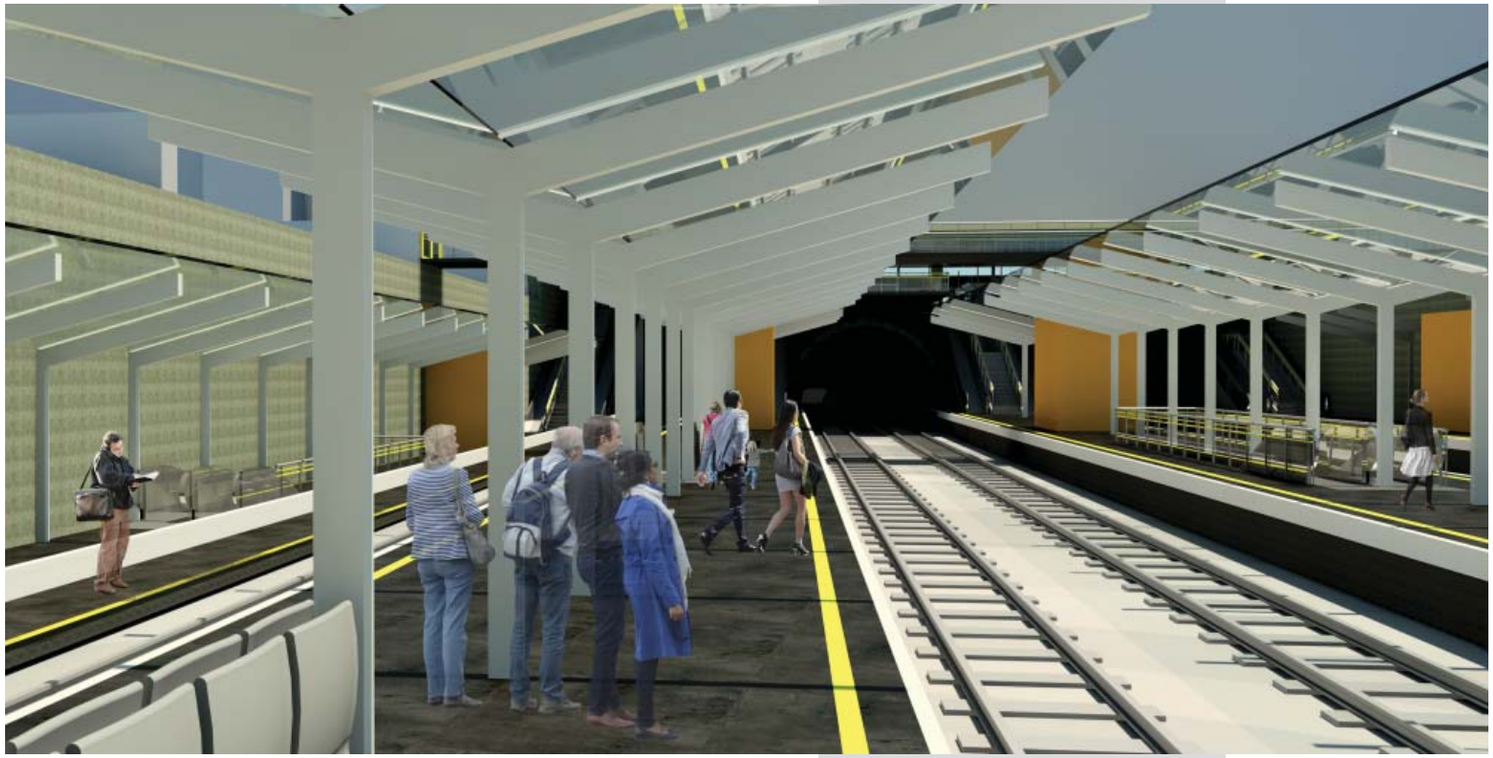
Parking



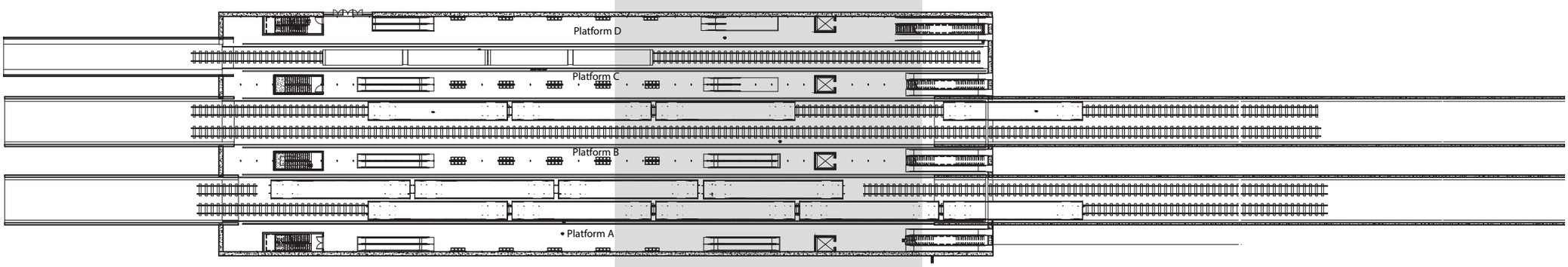
Plaza



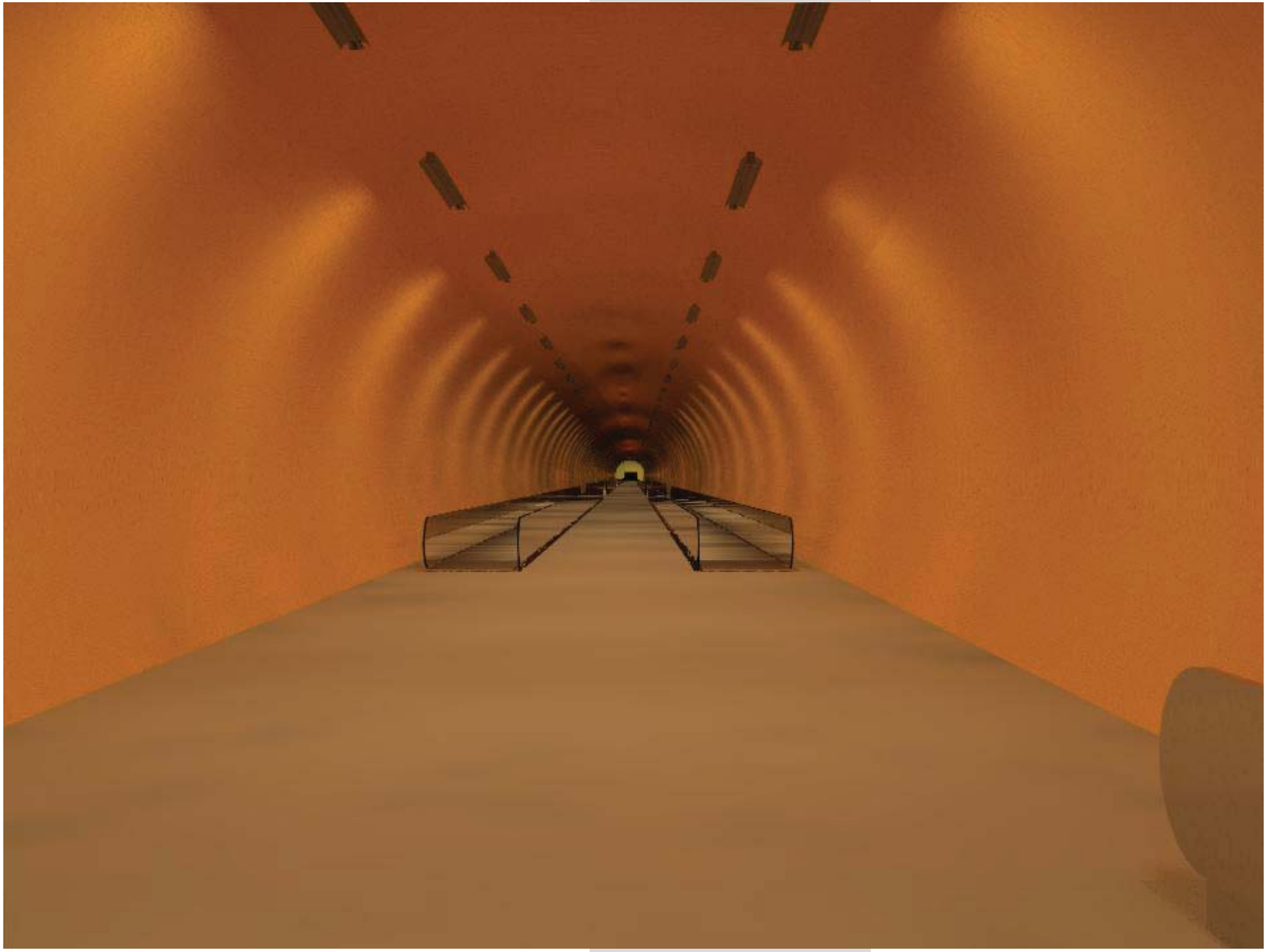
Grand Hall (Natural Lighting)

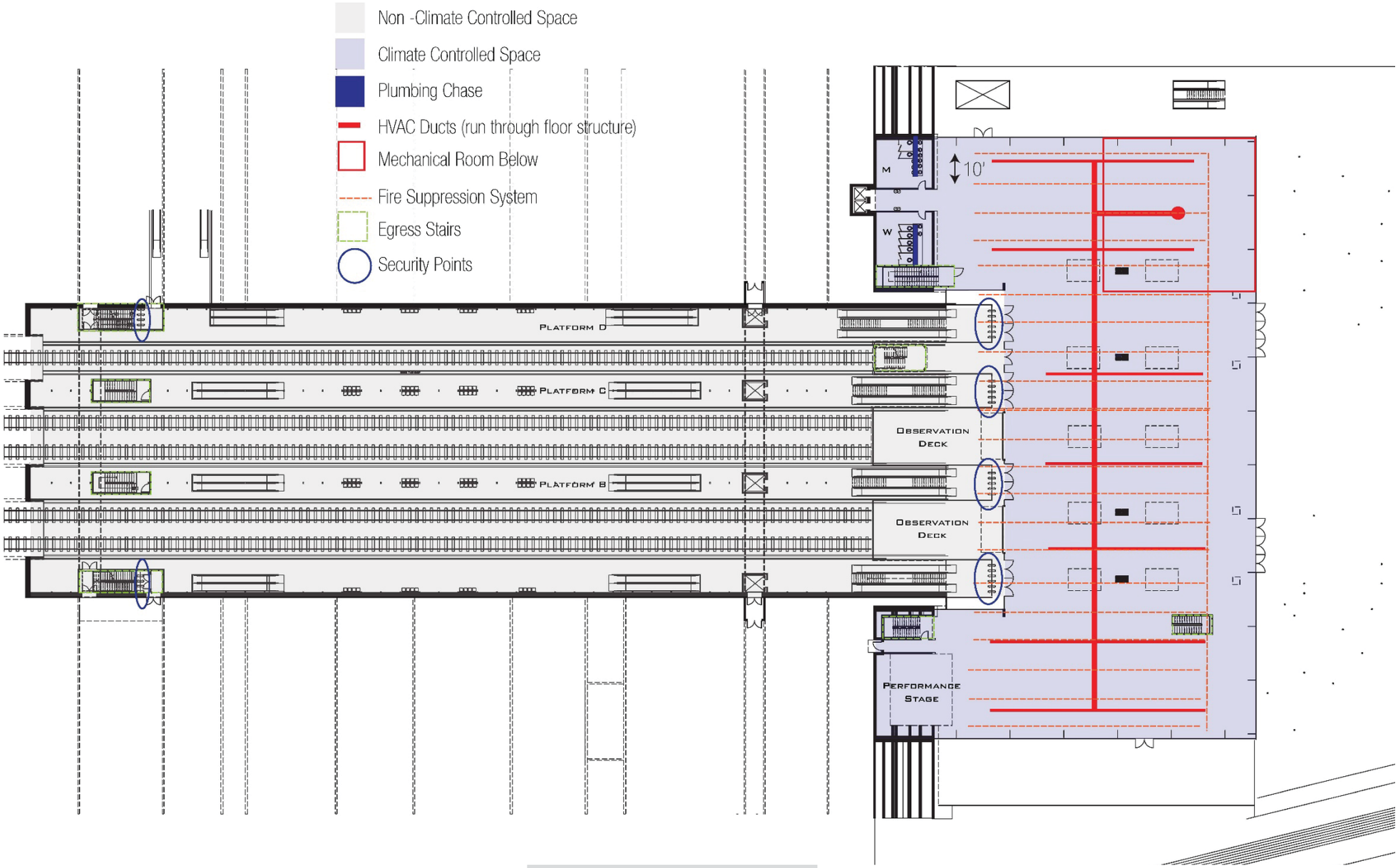


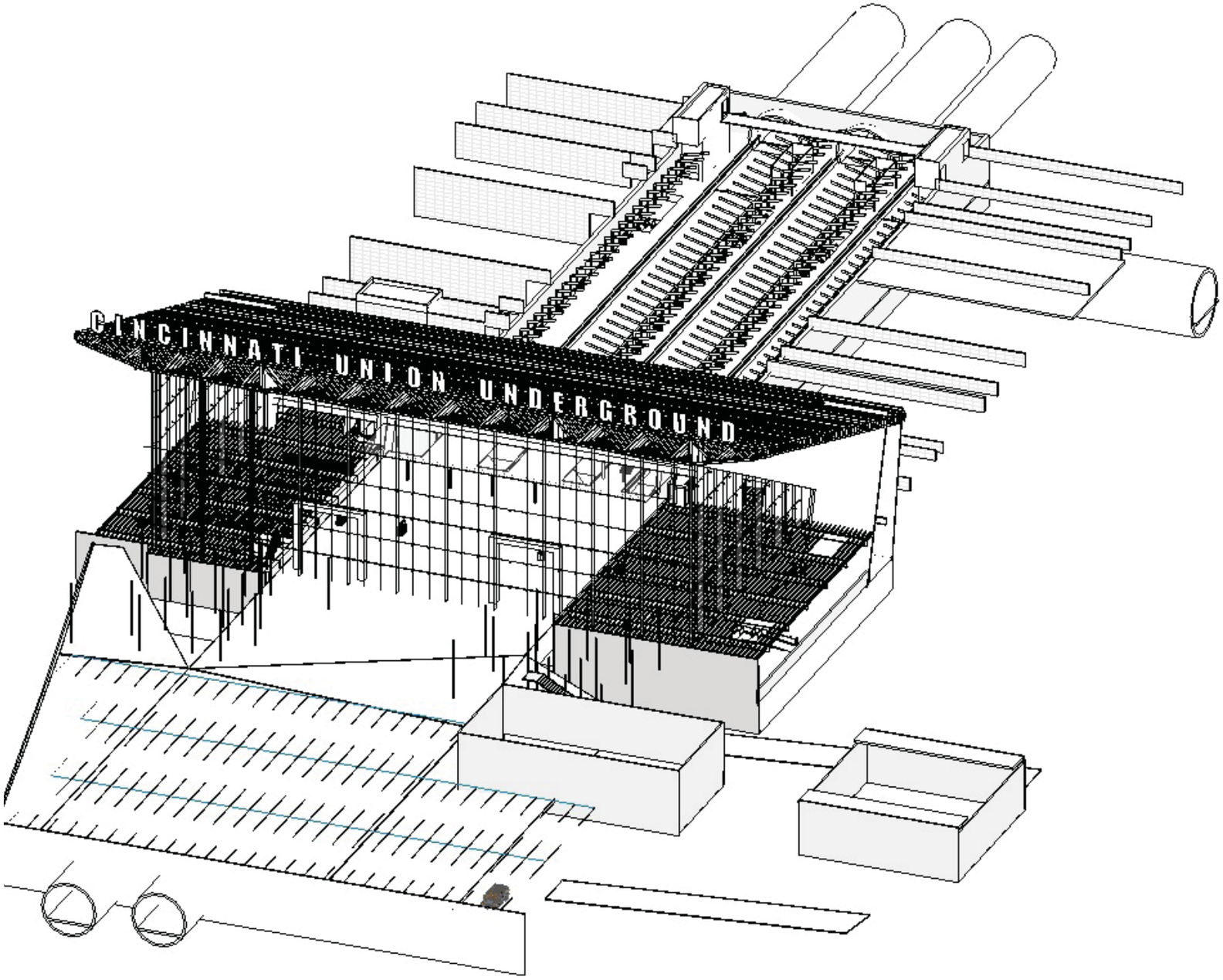
- Platform A: Blue Line East
- Platform B: Blue Line West, Orange Line East
- Platform C: Orange Line West
- Platform D: Street Car to Amtrak/ History Museum/Ohio State University

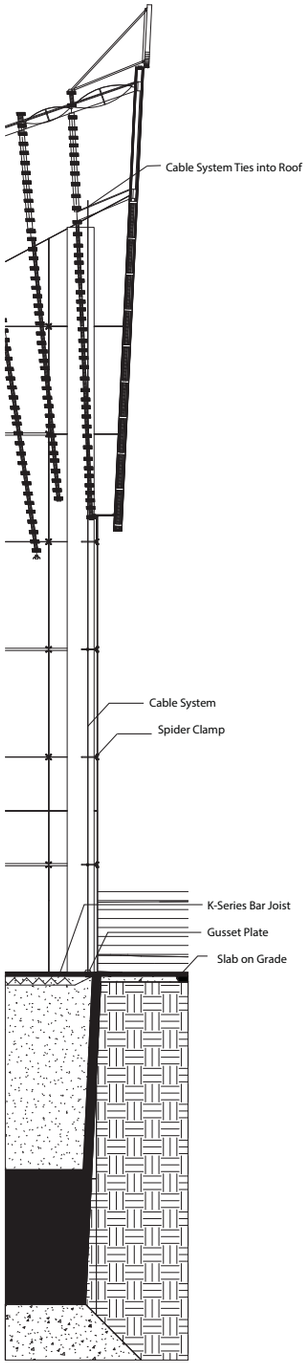


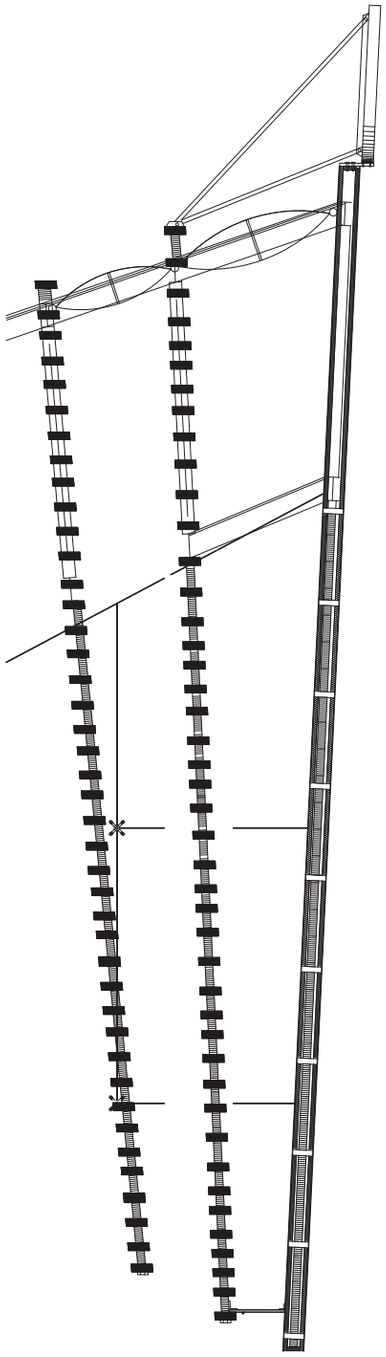

Plat



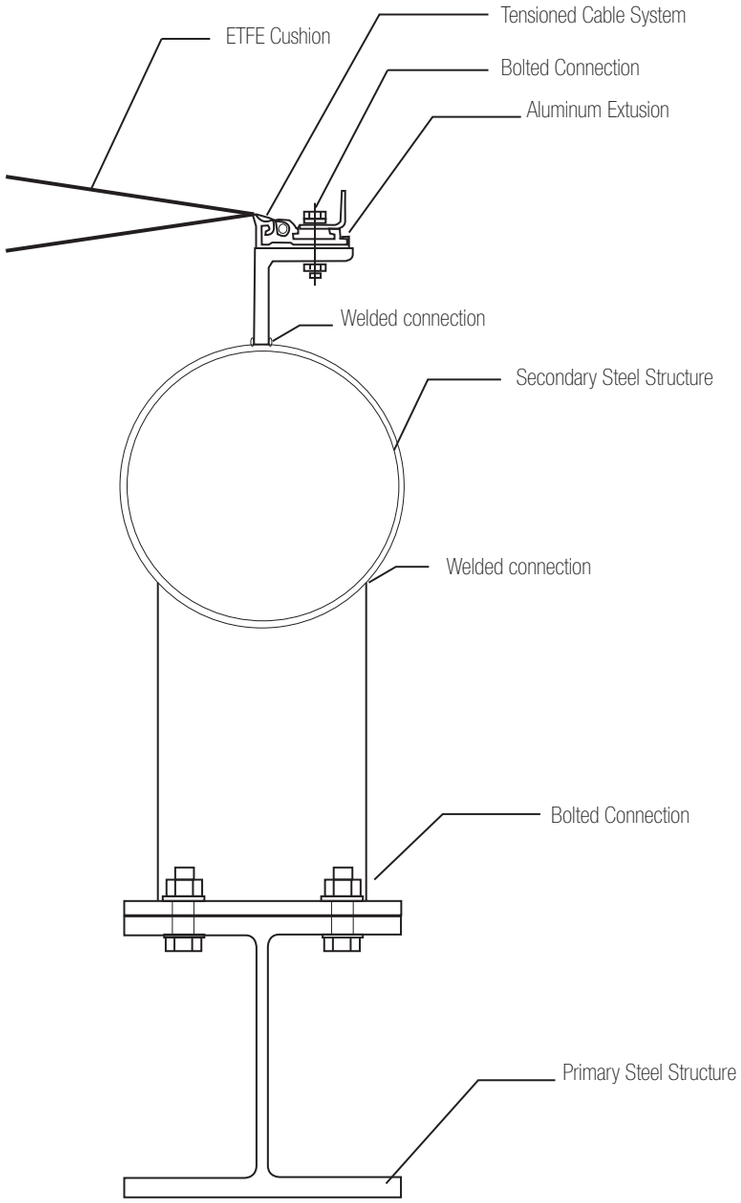

Non -Climate Controlled Space
Climate Controlled Space
Plumbing Chase
HVAC Ducts (run through floor structure)
Mechanical Room Below
Fire Suppression System
Egress Stairs
Security Points
M
W
10'
Platform D
Platform C
Platform B
Observation Deck
Observation Deck
Performance Stage


CINCINNATI UNION UNDERGROUND

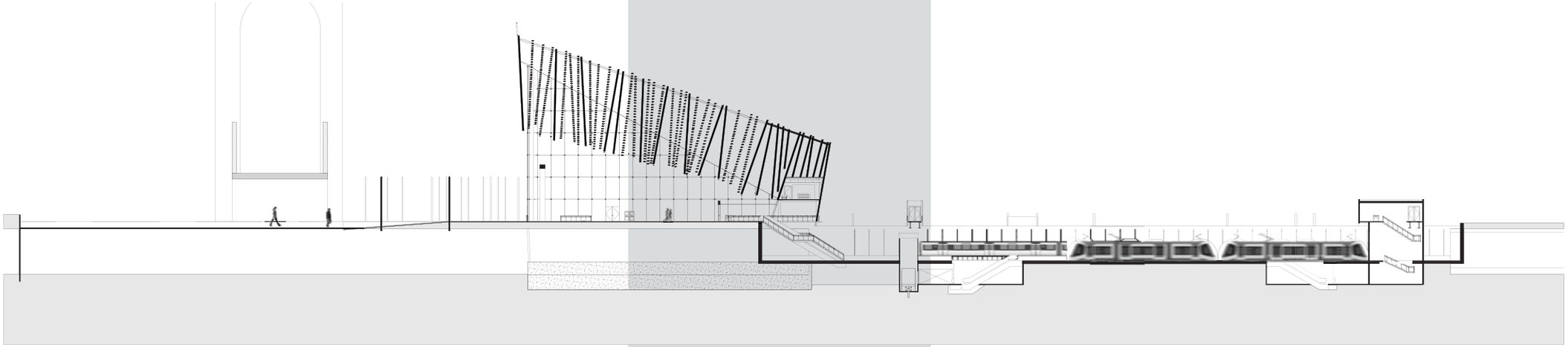




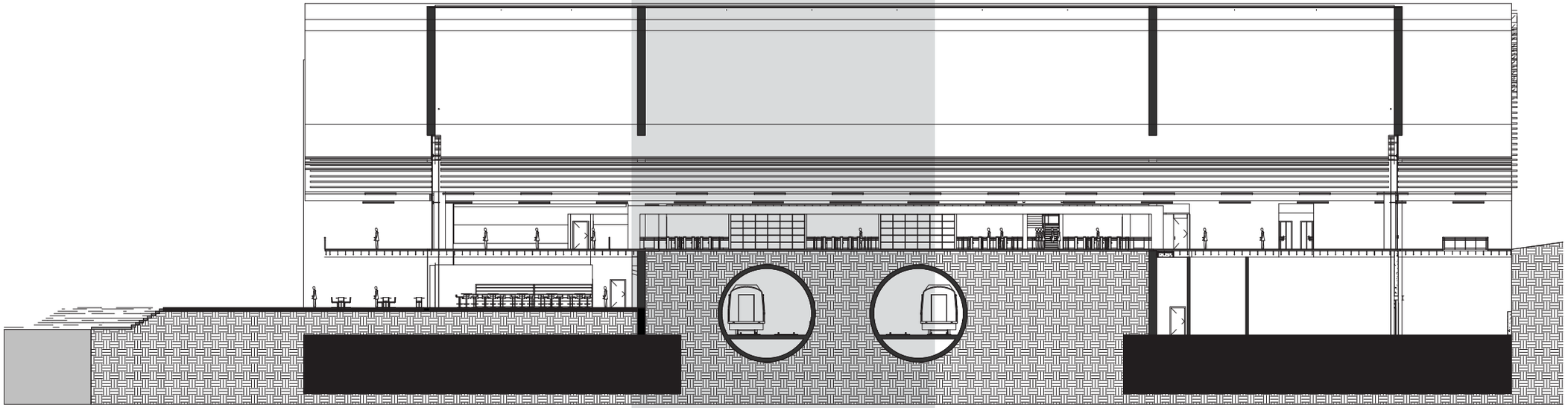
ETFE Clear Roof System Detail




Grand Hall Floor Structure Detail
3" Concrete Slab on 2" Metal Deck
K-Series Bar Joist 12"
W-Wide Flange Beam W-36



Longitudinal Section



Transverse Section

Response to Site

The thesis project responds to the site by using a four fronted approach to the building. The first front faces the city and draws people in from the businesses and restaurants. The second front draws people in from the Roebling Suspension Bridge which crosses the Ohio River. The third side addresses the Ohio River front by drawing people in from boats. The final side draws people in from the subway and street car systems.

The site plan includes a large plaza as on of the main design element. This plaza acts as the main outdoor public space to be used from three of the four directions. The persons using the building always cross the plaza.

Response to Typological Research and Program

The thesis responds to the typological research by incorporating ideas from Grand Central Station in New York, Rotterdam Centraal Station in The Netherlands and Transbay terminal in San Francisco. It draws out the simple axial design of Rotterdam Centraal Station with the simple progression of three spaces. A plaza, a grand hall, and the platforms. It echoes ideas of being a multi-modal transportation center from the Transbay Terminal, and captures the lighting and grandness of Grand Central Station.

The program was originally intended to have a mall, a food court and convention center spaces. To simplify the idea of the project, these spaces were taken out and the program square footage effectively was cut in half.

Response to Goals and Project Emphasis

The thesis responded to the goals in three ways: Academic, Professional, and Personal. The academic goals of the project being comprehensive was met by developing clearly the structures and systems within the building in plan, section, and in 3 dimensional ways. The professional goals were met by combining my skills in technologies of softwares as well as knowledge gained in Europe about mass transportation and the train system. My personal goals were met by really digging deep into how the proposed building would be put together and executed in the real world.

The thesis responded to the project emphasis by addressing how the existing subway infrastructure might be used in the final design of this transportation center by connecting to the existing transportation hub for buses, and reusing the existing subway tunnels. The project also attempts to create a activity oriented transportation hub by drawing users in from four fronts.

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2nd Year: **Fall 2011:** Darryl Booker
Tea House
Boat House

Spring 2012: Joan Vorderbruggen
School of Dance
Birdhouse
Dwelling

3rd Year: **Fall 2012:** Mike Chistensen
Ideal Theatre

Spring 2013: Steve Martins
Curling Club/Wintergarden
Dinosaur Museum

4th Year: **Fall 2013:** Bakr Aly Ahmed
Highrise
Vision

Spring 2014: Paul Gleye
Urban Renewal

5th Year: **Fall 2014:** Mike Chistensen
Oilpatch

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Email: ryan.linne77@gmail.com
Hometown: Lakeville, MN

"Transportation is the center of the world! It is the glue of our daily lives. When it goes well, we don't see it. When it goes wrong, it negatively colors our day, makes us feel angry and impotent, curtails our possibilities." –Robin Chase