Broken Connections

Creating a Partnership of Mankind, Nature and Place through Transportation

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Creating a Partnership of Mankind, Nature and Place through Transportation

A Design Thesis Submitted to the
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By
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Abstract

This Thesis will explore the transportation typology and will include a high-speed interregional passenger rail station, offices and public spaces. The city of St. Paul is quiet compared to Minneapolis and it competes with its larger neighboring city in many facets. St. Paul can garner the attention of the Midwest and revitalize itself by introducing an interregional high-speed transportation hub that will stimulate a continuous flow of traffic through the city. This typology will act as a vehicle through which the idea of repairing an urban city's connection to the natural environment will be explored. There is an issue with how large cities have sprawled out, without regard for the importance of the natural surroundings. Nature's effects on the human mental state and how these effects can help mitigate issues within the urban environment should be of utmost importance to urban designers and city officials. This thesis will look at how we can begin to reverse the effects our cities have had on nature. It will display how a lost connection between man and nature can be repaired while attempting to revive an industry that established connections throughout America's greatest cities.

Narrative of the Theoretical Aspect

At the heart of this thesis will be an investigation of the relationship between the urban environment, the natural environment and the passenger rail industry in America. The research and exploration of this topic will be a journey along which multiple concerns will be addressed regarding design, nature and transportation. Research will pertain to society's view of the relationship between the built environment and the natural world in past, present and future instances. Research will also consider effects of the natural environment on mental health and how these affects can then in turn mitigate and solve some of the issues that urban environments face today. The importance of nature in terms of establishing a sense of place within design and specifically a transportation building will be examined. This thesis will also prove the merit of reviving the locomotive industry by looking at the history of the industry, why it's no longer popular in America, and how it has been revived in countries all around the world. All of these endeavors will culminate in the overall premise of this thesis, revival of a city by restoring broken connections. This thesis will create a safe, vibrant and active city of St. Paul by repairing the connection of mankind and nature as well as diversifying the way in which we connect with other cities around the country.

This project was alluring because of my personal interest in urban projects, traveling and the natural environment. In terms of nature, I have had a close personal relationship with the natural environment since I was a small child. My parents enjoyed the outdoors and they took me along on their frequent trips to places such as the Boundary Waters Canoe Area. I enrolled in cub scouts and eventually earned the rank of Eagle. I have a lot of firsthand experience with the affects nature can have on the mental state. I believe that all humans have an inherent connection with nature whether we understand the full extents of its impact on our personal being or not. As a professional in the future I hope to become an expert in integrating the natural elements of a site and region with the architectural elements of a building. This thesis will help me begin to explore this passion of mine and inform how I proceed in my future career.

The typology for the site also stems from both personal experience and research. Last year I had the opportunity to study abroad in Brussels, Belgium. While in Europe for the semester, I traveled very often and almost always by train. It was my first time traveling by train and I fell in love with the mode of transportation. It's a great way to travel more affordably while being able to take in the countryside. There is a connection to place that is present in locomotive travel and is lost when one chooses to fly from place to place. There is also a rich and compelling

history that lies within locomotive transportation. It is a fascinating industry and I believe its revival in America is coming soon. According to the Midwest High Speed Rail Association, there are a multitude of projects occurring all over the Midwest region. The projects of specific importance to this thesis however, are the proposed high speed rail corridors from the Twin Cities region to cities such as Rochester, Duluth and Chicago (Midwest 2014). Although these projects have been met with some opposition, the overall outlook is positive that their approval is just around the corner. There is a real call for locomotive transit in the Twin Cities area and St. Paul would be the proper location for a new long distance station.

Both interests in the natural environment and in locomotive travel play well into the site and urban character of St. Paul. The city has strong historical ties with the rail industry as it was home to the railroad tycoon James J. Hill, pictured in *Figure 1*. Hill was largely influential in shaping the rail network throughout the entire country. The city also features the beautiful Union Depot building that serves the local Light Rail line and short distance busing. Placing a new train station on this site would breathe life into St. Paul's historic ties to the industry. There is an opportunity to make a strong reconnection to a lost staple of the city.

St. Paul is also a great city to study the effects of reestablishing a connection with the natural environment within a dense urban area. The city is surrounded by beautiful forests, biking and walking trails as well as the large Mississippi river. Yet, there is a distinct disconnect between the downtown area and the natural surroundings. This is all too common among large American cities. The site in St. Paul lies on incredible bluffs that create a harsh, natural edge to the downtown environment. It's a truly rich and beautiful area that is begging to be reconnected with the urban downtown. The site lies along this edge where on one side you have the downtown skyline and on the other you have the Mississippi. This site, more than any other in downtown St. Paul, is ripe for a study of how we can reconnect the natural and urban environments.

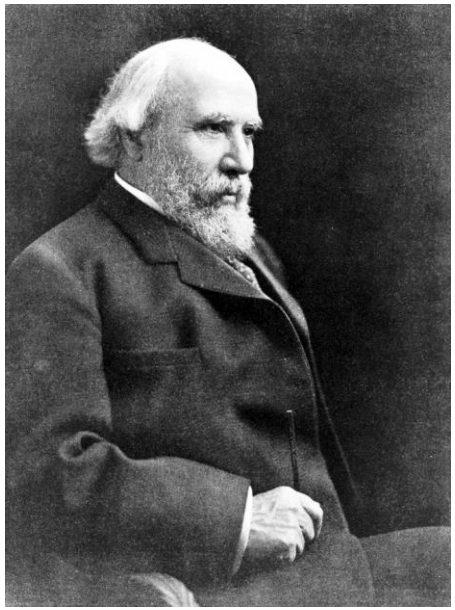

Figure 1: James J. Hill. http://www.railroads-of-montana.com

Project Typology

In America, traveling by train has become a historical novelty experienced by a small percentage of citizens. It's almost as if we have disregarded locomotives as a viable means of getting people from one place to another. In his article titled "Turning Cities Inside Out: Transportation and the Resurgence of Downtowns in North America", Martin Wachs attributes this attitude to the automobile industry. He talks about how trains laid the ground work for urban growth and connectivity. This came to an end when the Interstate Highway program was launched in the late 1900's. This paved the way for the automobile era and the passenger rail industry was left by the wayside (Wachs, 2013).

The automobile will remain a common mode of transportation for decades, but this doesn't mean that the locomotive industry won't see a revival in the near future. Europe saw a similar decline in the rail industry which has since made a tremendous recovery. Better technology and governmental focus has aided in this transformation for other countries. Wachs emphasizes the importance of connectivity between North American downtowns in order to ensure successful and healthy urban settings (Wachs, 2013). For a long time the United States has failed to acknowledge the importance of the passenger railway but we have already begun to see a shift in government spending due to President Barrack Obama's outlook towards public transportation. An article titled "Interstate High-Speed Rail Progress" cites that in 2010, President Obama directed $8 Billion Dollars towards passenger rail corridors in order to increase speed, frequency and safety. In addition to this he designated an extra $5 Billion over 5 years. Congress and various states followed suit investing an additional $5 Billion for a total of $18 Billion Dollars, by far the largest investment in Passenger Rail in United States history (Soul, 2015).

The investment made in high-speed interregional travel has already begun to pay dividends. According to Amtrak's National Facts, the nation's only high-speed intercity passenger rail provider welcomed its largest annual ridership in 2014, totaling 31 million passengers (Amtrak National Facts, 2015). The American Public Transportation Association has also taken note of the recent passenger rail success. In their article titled "Opportunity Cost of Inaction", the APTA notes that from 2001 – 2012, the U.S. population grew by 12% while Amtrak ridership over that same time period grew by 40%. Also, state corridor ridership grew by 78% over the same period (Amtrak's Economic Contribution, 2014). These statistics are incredibly promising for the future of passenger rail in the U.S.

The largest turnaround has occurred on the nation's east coast. The North East Corridor is the busiest railroad in North America with more than 2,200 trains operating per day. The high-speed trains in this corridor can run at a maximum speed of 150 mph which

allows them to be competitive with alternate modes of transportation. In fact, Amtrak carried 3x more passengers between Washington D.C. and New York City than the airline industry in 2014 (Amtrak National Facts, 2015).

Figure 2: Golden Pass Scenic Train.
http://www.europerailstar.com/plan-your-trip/

In order to visualize the long term effects that will stem from the revival of the rail industry, it is best to look at places in the world that have widely utilized passenger trains. The rail industry in Europe is very successful and is considered a model for others. While in Europe I traveled almost solely by train. Having never traveled by train in America, I was amazed and delighted by how efficient and popular the mode of transportation was. The train network across Europe is well developed and used by all kinds of people. On the trains one will meet fellow travelers, business men and women, and people visiting family members and friends. In Europe, this is a mode of transportation that is used by people from all walks of life for reasons such as familiarity, cost and efficiency. The use of high speed trains in Europe allows people to get places very quickly compared to trains here in America. The train technology is frequently upgraded and there are many people employed by the locomotive industry. This allows for a large number of trains coming and going each day from all major European cities. Locomotive travel is highly valued in Europe and as shown by the Midwest High Speed Rail Association, America is preparing to follow this example.

Passenger rail statistics in the United States look promising but there is still work to be done before we can attain a system as fluent as Europe's. The National Association of Railroad Passengers has acknowledged that increasing frequency of trains and building new tracks in proper corridors will be the key to an efficient railroad system (NARP's Vision, 2015). The NARP feels that mobility is the foundation of a healthy economy and relying heavily on two modes of transportation could be costly for the American economy and ecosystem. For example, a diesel powered train can carry 3x more passengers per gallon than the typical automobile (NARP Long Distance Trains, 2015). Trains also happen to be 17% more fuel efficient than planes and 34% more fuel efficient than cars. High-speed passenger trains put less of a burden on the ecosystem and would benefit the nation in terms of fuel costs. Also, the APTA states that if high-speed passenger rail is not pursued, the Midwest region alone would forego $11.7 Billion Dollars in benefits over 40 years (APTA, 2012). The research these organizations have conducted shows that branching out from the two

major modes of transportation will only benefit the United States.

This thesis will explore the architectural design of the high-speed transportation typology. The building will be integrated along the bluff and will go from the base of the cliff and rise above grade along Kellogg Boulevard in St. Paul, MN. It will have a multitude of programs occurring within the space which will be discussed further in the Major Project Elements and Spatial Program.

Figure 3: Departure Board Showing Typical Destinations. http://www.paris-architecture.info/PA-080.htm

Typological Case Studies

Figure 4: Antwerp Central Station.
http://www.romania-insider.com/company-behind-the-railway-cathedral-in-antwerp-to-work-on-bucharests-gara-de-nord/68690/

Antwerp Central Station

Typology: Transportation/Retail
Location: Antwerp, Belgium
Case Study Emphasis: Galleria

Distinguishing Characteristics

In a continent where rail is a popular means of travel by all sorts of people, Antwerp's Central Station is touted as being a model for all other stations. In fact, Newsweek selected Antwerp Central as the fourth most beautiful train station in the world (La Gare, 2011 p.3). Though there is plenty of beauty to be found within its 43 meter high vaulted glass roof, or its grand staircase made of 60 kinds of marble, Antwerp Central Station is more than just easy on the eyes (La Gare, 2011). This station incorporates a very unique design which makes for a very successful transportation hub.

In 1998, Antwerp was ready to embrace the resurgence of the rail industry in Europe and therefore the station underwent a massive reconstruction project. In order to increase the capacity of the station without destroying the surrounding city elements, tunnels were dug underneath the existing station in order to add additional tracks. This work was technologically difficult but it resulted in a very unique station that involves three tiers of railways. Overall, there are 14 tracks within the station, the lowest layer of which lies 20 meters underground (La Gare, 2011). Despite being far beneath the earth, all levels feature access to the central clearstory topped off by the glass vaulted roof pictured in figure 4. This allows for plenty of natural daylight within all spaces and avoids the issue of creating spaces that may feel cut off from the rest of the building. A multitude of escalators transport passengers between the levels maintaining accessibility for all individuals. The open nature of the station not only provides for brightly lit and safe spaces but it also serves to make navigating the station fairly easy and intuitive.

Antwerp Central is also unique in terms of its integration into the area around it. The station not only serves trains and travelers but also many kinds of shoppers. The station essentially acts as a mall with various forms of retail. The most unique of which is a diamond market located within the station, tying the building to the general economy of the country. Outside, the station integrates itself into the adjacent city elements. On one side of the station is the Antwerp zoo which uses the station as a beautiful backdrop for zoo-goers. The station reciprocates this relationship with the zoo through signage, art and more. Instead of shutting the zoo out, the station embraces its neighbor. Also, at the front of the station is a large pedestrian square. This landscaping works to solidify the station as a point within the city that begins to from the landscape and functions around it (La Gare, 2011).

Interpretation

When stepping off the train in Antwerp Central Station, one can sense the grandeur of this place. The visitor is immediately greeted by multiple levels which are visible through clerestory spaces that reach high up to the glass vault above. The station has a monolithic feel that almost forces the passengers into a feeling of reverence. It's as if one has entered a cathedral in which the rail system is to be worshiped and respected. It is a station whose many components come together to create a space unlike any other.

The success of the station stems from its goal of drawing people to the space. The station has been restored many times so that its beautiful dome entry can draw the attention of citizens and tourists for years to come. The station is populated with unique shops that bring the residents of Antwerp into the station whether they mean to travel or not. The station has been enlarged to increase its exposure to a multitude of travelers. By putting the user at the forefront of their design decisions, Antwerp has created a station that is teeming with life. The multi-use facets of the design will ensure that as the rail industry has its ups and downs, the station itself can remain steady in its use. The importance of the user and how that has affected Antwerp Central will be an ever present lesson through the design process of this thesis. The specific characteristics and activities that will draw the attention of people in the Midwest region will be thoroughly examined. It is a goal of this thesis that the new train station in St. Paul can become a gathering place for the masses.

Major Program Elements

The station features 14 tracks, passenger amenities, restaurants, shopping venues, a diamond market, underground parking, and a grand entry space (La Gare, 2011).

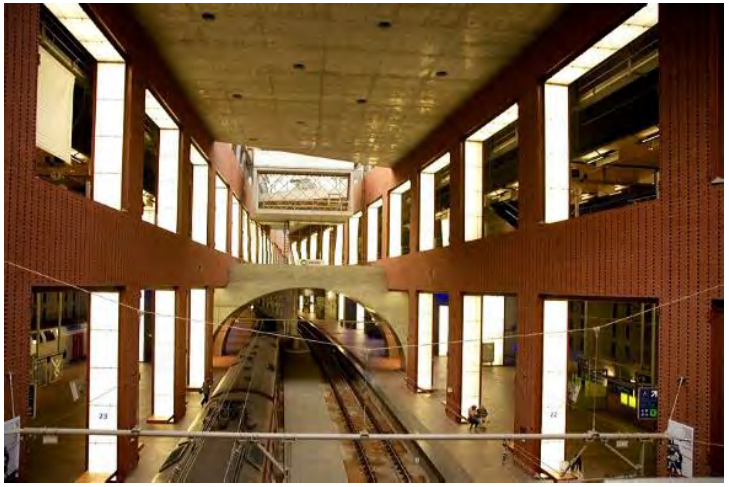

Figure 5: Antwerp Central Station Platforms. http://www.hotels-belgium.com/albums/antwerp/antwerp-104-centralstation.htm
This image depicts the lowest platforms of the station. A combination of artificial and natural daylight emanating from the clerestory ensures that the space feels welcoming and safe.

Figure 6: Decorative Entry to the dome. Antwerp, BEL

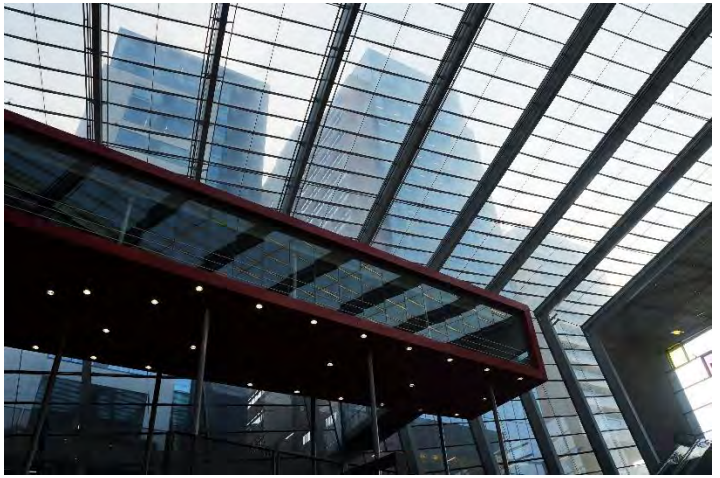

Figure 7: Downtown seen through the glass roof. Antwerp, BEL. This images displays the power of providing site lines to the outside surroundings. The visitor becomes aware of the entire city before they even step foot outside the station.

Figure 8: Clerestory Space. Antwerp, BEL.
Again, Clerestory space provides natural light and a feeling of openness to monolithic spaces such as this.

Figure 9: The Great Hall of Chicago Union Station. http://trainweb.org/henrykisor/Zephyr/

Chicago Union Station

Typology: Transportation
Location: Chicago, Illinois
Case Study Emphasis: Function

Distinguishing Characteristics

Chicago's Union Station opened in 1925 and was designed primarily by the famous Chicago architect Daniel Burnham. It was the pride of Chicago in its day and it is still one of the largest and busiest stations in the United States. On an average weekday, 118,000 passengers pass through the station carried by 320 trains a day (Chicago, 2012).

One of the unique features the station implements is a series of viaducts that were constructed to allow the roads to pass over the station below. This inventive method allowed the station to become well integrated within the city while not disturbing the surrounding area. Along with these viaduct structures, the building was originally designed to feature around 20 stories of office space above the station. Though there was a lack of funds to complete this at the time, the station's caissons were still designed to support a large expansion (Chicago, 2012).

The station features a unique rail and platform system. The station is considered to be a two stub-end station meaning that all but two of the rail lines end at the platforms and do not continue through. The two rails that do pass through the station were used primarily for freight cars which would then not have to disrupt the passenger cars coming to the station. The platforms were also designed to streamline the events taking place. The station was built with two platforms for every rail, one to be used by passengers and one solely for baggage. This separation allowed for easier boarding and less chaos on the platforms (Chicago, 2012).

Perhaps the most recognizable feature of the station is the Great Hall pictured in Figure 9. This space is elegantly decorated with a vaulted skylight running 300 feet in length and towering 115 feet above the hall below. There is 20,000 sq. ft. of space in the

Great Hall that is used for conventions, weddings and other large events. The space can accommodate up to 2,500 people for an event (Union, 2012). In this manner, the station establishes relevancy beyond the traveling passengers. It gives everyone in the city a reason to come to the station and enjoy the space.

Interpretation

It is clear that an emphasis was placed on functionality and efficiency with this nearly 100 year old design. It was built at a time when the rail industry was strong and passengers were flocking to the station. Elements of the design display an acute sense of understanding of the progression of the average passenger through the space. Every aspect of the journey through the station was thought out and detailed so that traveling through Union Station would be an enjoyable experience. For example, passengers would enter into the Great Hall, a space of grandeur evoking reverence among the travelers. Then on their way to the platforms they would pass below ground in order to avoid any congestion and traffic at street level. On the platforms the people would be consolidated on one platform while their baggage was taken care of on another.

Though times have indeed changed, the process of traveling by rail is similar to the past. Today, there is still a great sense of organization and efficiency when experiencing the station. Odd and even platforms are separated to either side of the station. Above each platform, the buildings sound system announces the number of each platform so that visually impaired individuals can still navigate the station. All of the passenger rail functions happen on one level while the food court and retail spaces lie above. This separation, along with ample amounts of signage, make the station fairly easy to navigate.

There are many lessons to take from Chicago Union Station in terms of passenger progression and functionality of the station itself. When designing for the city of St. Paul, I will reflect back on these lessons and consider how the station can create a more efficient experience for travelers. If traveling by rail can become fluid and more relaxing, the revival of rail transportation in the United States will be hastened.

Major Program Elements

Great Hall, restaurants, 24 two stub-end tracks, separate baggage platform for each track, eight stories of office space above the Great Hall (Chicago, 2012).

Figure 10: Chicago Union Station.
https://www.planning.org/greatplaces/spaces/2012/
The grandeur of the entry to the station creates feelings of respect and reverence for the activities inside. The design helps to reinforce the civic and important nature of passenger trains.

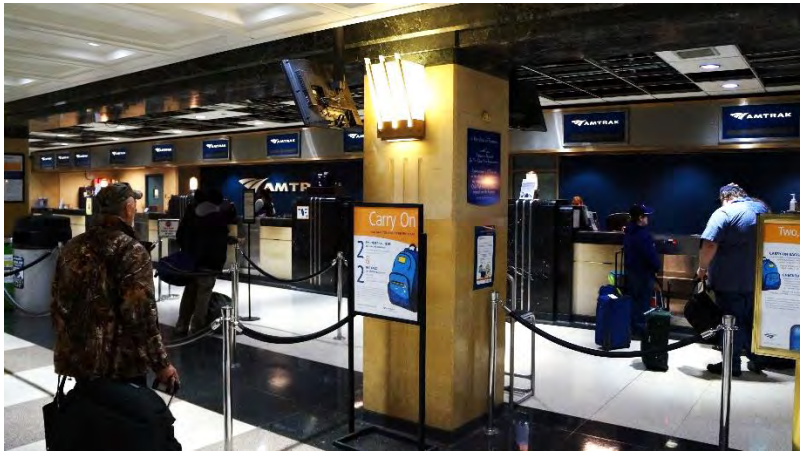

Figure 11: Chicago Union Baggage Check
The Station features efficient baggage check identical to what one would expect to find in a major airport. This is quite different from European stations but it allows passenger rail stations to meet the standards of safety in the United States.

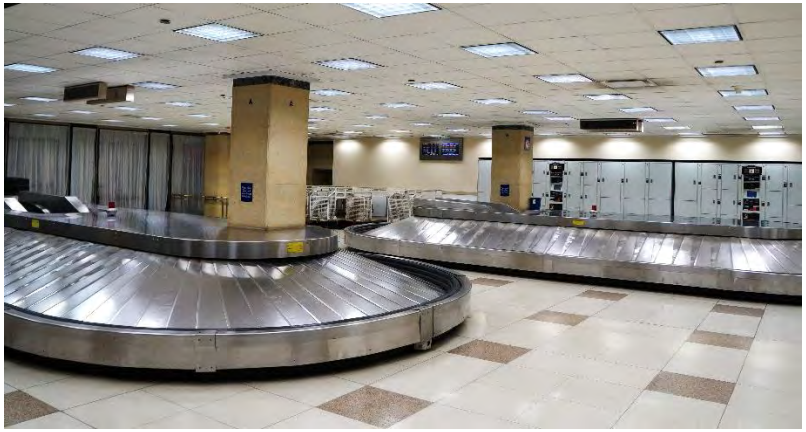

Figure 12: Baggage Carousel at Chicago Union Station
Again, this image shows the similarities of baggage handling for passenger rail stations and airports. However, Chicago Union Station only features two baggage carousels.

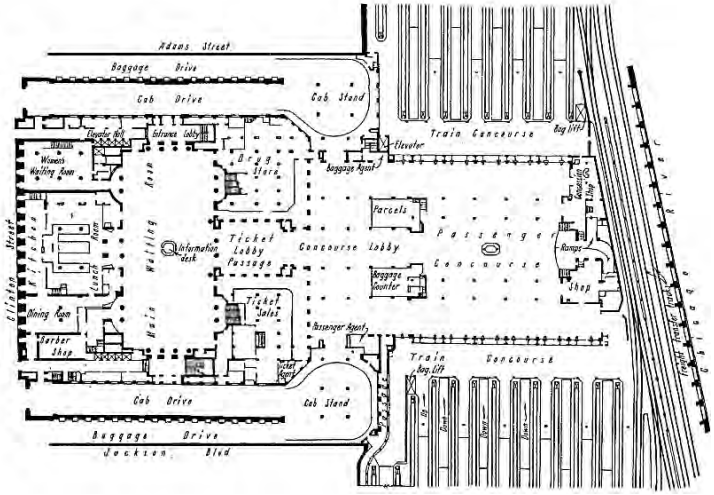

Figure 13: Station Level Plan of the Headhouse and Concourse. https://chicagology.com/1920buildings/unionstation/

The plan tells us a lot about the station. In this drawing we can see the progression of spaces and can envision the route of the passenger. They would enter from the grand entry on the far left side and into the open Great Hall space. They would then pass through the ticketing spaces before separating into the platform lobbies. Also apparent in the drawing is the structure of the building. One can see how the Great Hall and office portion draws its strength from heavy, load bearing walls and columns. These heavier materials aid in creating the sense of grandeur in the station. On the other portion of the building where the platforms can be found, the structure is more slender in nature and relies on a grid of steel columns. The two stub-end platform system is shown in this image as well as the symmetrical nature of the design.

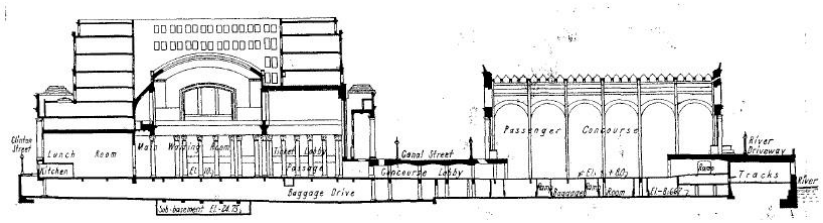

Figure 14: Section of the Headhouse and Concourse. https://chicagology.com/1920buildings/unionstation/

The section speaks to the volumetric qualities of the spaces. The organization of the station as almost two separate buildings functioning as one is apparent here. Canal Street separates and passes over the area where passengers will pass from ticketing spaces to platforms. Apparent in this image is that sense of grandeur and reverence that would be evoked through the use of tall, open spaces in the Great Hall. The large spaces depicted here over the platforms is no longer there. Office towers have since been built so that the platform spaces are now solely underground. In this image, one can see how the offices sit above the Great Hall but still allow light to pass through the vaulted roof. The organization of these offices also allows for more natural daylighting in the office spaces themselves. Also present in this section is the symmetrical nature that was also shown in plan. With some variance, the spaces are well organized and feature a clear pattern and symmetry.

Figure 15: Liege-Guillemins TGV Railway Station Exterior (1). http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

Liege-Guillemins Station

Typology: Transportation
Location: Liege, Belgium
Size: 527,000 sq. ft. (including tracks)
Case Study Emphasis: Structure

Defining Characteristics

Santiago Calatrava's train station in Liege is a building that captures the imagination of the traveler. The city of Liege was split by the existing tracks of the old station and Calatrava sought to reconnect the two districts. He sought to accomplish this through transparency which is an overwhelming element of the project. The station is made up of steel and glass which provides an incredible sense of openness. The traveler's first experience with the space occurs when exiting onto the platforms. The glass roof arches 115 feet above the tracks which creates an immediate sense of awe and wonder (Minutillo, 2010). Besides the materiality of the building, the station is open to the outdoors. One can stand on the elevated platforms and look directly out over downtown Liege. It allows the passenger to immediately feel the presence of the city as if they have already left the station. The transition from the indoor space to the outdoor city is seamless. The form of the station and the sense of openness created is truly breathtaking.

The most intriguing aspect of the station is undoubtedly the structure. 39 Ribs actively curve and arch their way over the platforms. These dynamic forms blur the line between roof and façade as they arch their way into the likeness of a dome that does not fully enclose the space along the sides. The ribs span an impressive distance of 518 feet in order to create platforms free of any structural elements. The structural elements also peel away at points to create separate spaces for passenger bridges, shops, and circulation (Minutillo, 2010). In this way the structure takes on many roles within the building that might typically be performed by other building elements. This allows the building to be free of clutter which adds to the open feeling sought by Calatrava.

Interpretation

Liege Guillemins was one of the most impressive stations I encountered on my travels through Europe. The experience of the space is unparalleled due to the unique structure of the building. The ribs cause for the eye to wander around the building as they shift and undulate across the enormous space. They also work to create a beautiful frame in which the city of Liege is pictured. The structure of Liege Guillemins creates a sense of activity and motion that play to the activities occurring within the building.

The design of Liege Guillemins provides many lessons to be applied in the design of train stations around the globe. Stations run the risk of becoming a great divider of city districts, but Calatrava created a station that mitigated that disconnect. The station provides clear sight lines to the city and many pathways that cross the station. It is an active space both in design and function which allows it to become a catalyst that mends the separation of the city districts.

Although the winters in Belgium are much different than St. Paul, there are many lessons that can be applied to a station on the West Publishing site. Repetitive structure creates a sense of motion that can be powerful within a train station. Also, the large spaces created by a vaulted structure creates a feeling of grandeur and provides for excellent sight lines. There is a clear connection with the city of Liege upon arrival, something that should be present in the design of every transit hub. The open nature of the station may not be directly applicable in a climate that features harsh winters, however through innovation there may be a way to achieve the same success that comes from an open design such as Liege Guillemins.

Major Program Elements

The station features a well-integrated structural system, 5 elevated platforms, 9 tracks, 40 elevators, multi-level spaces that conform to the contours of the site, shopping and restaurant options, pedestrian walkways and integrated parking (Minutillo, 2010).

Figure 16: Liege-Guillemins TGV Railway Station Platforms. http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

Figure 17: Liege-Guillemins TGV Railway Station Retail. http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR
Interior shops feature similar structure and lighting methods as the platforms above. This works to create a more cohesive design and evoke the essence of motion throughout the entire building.

Figure 18: Liege-Guillemins TGV Railway Station Exterior (2). http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR
The design of the station plays with the language of the hills beyond. One can see in this image how open and inviting the station would feel as passengers made their way into the building. The buildings around the station are very different architecturally which allows the station to stand out as a landmark for the city.

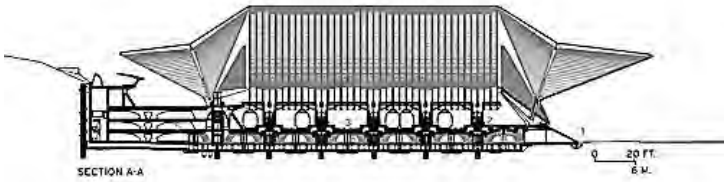

Figure 19: Liege-Guillemins TGV Railway Station Section. http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR
This section displays a couple of key aspects to the design. For one, the image shows the variation of levels as one moves from one side of the station to the other. On the left there are multiple levels of parking and on the right there is only two levels of public spaces. The trains come through the center of the station and above the public walkways and shops below. The most distinct element of the drawing is the roof structure. This dwarfs the other spaces in the building. One can see here how the building's structure responds to the Belgian climate of cool and rainy winters. The building opens up to the element along the sides and yet the large overhangs provide shelter from the heavy rainfall.

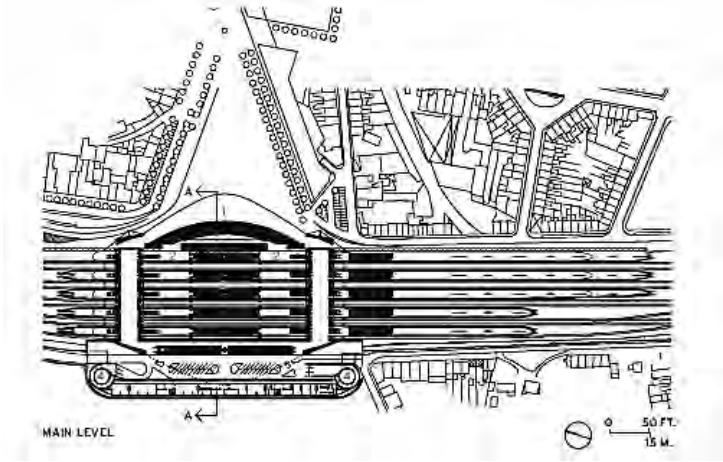

Figure 20: Liege-Guillemins TGV Railway Station Plan. http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR
This plan is a combined floor and site plan. One can get a good feel of the scale of the station compared to the streets and site elements around the building. In the floor plan the public walkways are shown crossing over either end of the platforms. These lead from the green space at the front of the station to the parking at the back. Also shown is how the structure of the roof extends like fingers along the platforms for various lengths. These covering would protect passengers from rain as they walk into the main station.

Major Project Elements

This project will provide a variety of spaces to accommodate the transportation typology of the building. Because this is a long distance train depot, it will be large in scale to accommodate the expected future growth of the Twin Cities and growth of the locomotive industry in America. Having a large site to work with allows for plenty of creativity with what will be included in terms of programmatic spaces.

Branching off of the existing tracks that run along the site will be the passenger platforms. There are currently two tracks running past the site which will have to be altered. The tracks will have a diversion that will lead into the base of the building. At this diversion is where these two tracks will branch into at least six tracks to accommodate six platforms. The platforms will only be long enough to accommodate one train at a time which still allows for exponential growth to the current long distance train departures and arrivals in St. Paul. This space will feature a unique roof structure that allows for plenty of natural daylight. This was a feature carried through in the case studies and it is appropriate for this project as well. In *Figure 21* depicting the arrival of a train in Frankfurt Germany, one can see the how the glass roof and walls give a feeling of openness and allows the natural daylight to play off of the trains. The platforms should be brightly lit and feature views of the river and forests surrounding St. Paul as this will be the first space the visitors experience within the city. Views out will allow for an immediate connection to the essence of the place.

Figure 21: Morning on the Platform. Frankfurt, Germany

The portion of the building above the platforms will include a great variety of spaces. Community spaces will play a role in drawing crowds to the station. They will also act as a space where travelers will be able to gather and wait for their trains to arrive. These spaces will feature large video boards displaying the train schedules and various transportation information. The community spaces will be very active in quality as one of their primary purposes is to bring people to the space. Convenient stores and shops geared towards travelers will be located around these spaces as well. Views of the surrounding area will also be key features of the community spaces.

Offices accommodating the business side of the transportation hub are of importance and may feature entryways on multiple grades. Some of the offices will be more private in nature, while others will be oriented towards the aiding of the public using the transportation hub. There may be multiple levels of offices depending on layout.

Dining options will play a role in creating an active building. A general food court will be convenient for people working within the building, travelers using the building and the public living and working in downtown St. Paul. There will also be a place for more unique dining options at street level. This area will be used heavily by the general public. The dining spaces will feature plenty of views towards the Mississippi river.

Throughout the program will be an outdoor public walkway that allows the general public to get from the downtown area to the riverside of the Mississippi. Unique and creative designs will be required to integrate this public way into the fabric of the design. This will be an essential step towards connecting the urban downtown to the natural elements of the city. It will also ensure that people from all over the city will pass through the site.

Beyond the guidelines listed above, Amtrak provides designers and architects with an in-depth document for designing a train station. In their *Programming and Planning Guidelines*, Amtrak states that a station is a community asset whose architecture should reflect the civic and technological nature of modern rail travel. Stations should be flexible, mixed use facilities that place sustainability and accessibility at the forefront of their designs. This project will be large in character and therefore falls into the category 1 type of station in the programming guidelines. These stations typically are on par with major airports serving anywhere from 400,000 – 1,000,000 passengers annually. Category 1 stations serve either the center or edges of large urban areas and are highly integrated into the existing public transit system (Amtrak Station Program, 2013). Therefore this project should be a regional multi-modal transportation hub that becomes a centerpiece for the downtown St. Paul area. Many of Amtrak's suggestions and guidelines will be taken into account through the design process of this thesis project.

User Description

The thesis will facilitate the movement of people to the edge of the city and connect two divided entities of the city. Therefore a building that is dedicated to private functions is not appropriate for the project. It is important to design a building which places the public at the forefront of its design intent. This very public/civic building will be enjoyed and experienced by the general public of St. Paul and the Twin Cities area. As a result, it is expected that a wide variety of people would find themselves coming to the site and using the space.

One group of users who would occupy the space would be business men and women working within the station. These people would find themselves with an abundance of new jobs in the high-speed rail industry. Those specifically working with the transportation element of the building would work on the platforms to direct travelers, occupy the office spaces within the building, and run the various customer service tasks throughout the depot. It is expected that around 200 people would be present at the station 24/7/365 in order to ensure the efficient and safe operation of the station. There would also be about 100 more transportation professionals that will work various hours at the station. Within the station will be various dining and retail options so it is expected that around 150 people would be employed to perform these functions at various hours. In addition to the people whose jobs would be located specifically in the building, conductors and attendants on the trains traveling back and forth would also occupy the space for some time as they travel across the country.

The second major portion of the users will be local, regional and international travelers with 700-900 travelers using the terminal facility each day at peak capacity.

Figure 22: Conductor Helps Passengers Board. http://articles.dailypress.com/2011-06-26/news/dp-nws-amtrak-ridership-20110626_1_amtrak-ridership-amtrak-figures-passenger-rail

This group of travelers would be mostly made up of two kinds of people. Business men and women working within the larger Midwestern cities would make up one group of travelers. These people may

travel back and forth on a regular basis to conduct business. For example, with Amtrak's current high-speed trains running at 150 mph, it may be possible for a person to live in Rochester, MN and commute to St. Paul in under an hour (Amtrak National Facts, 2015). Having a long distance depot will really open up the variety of business people coming and going within the city. The other large group of travelers using the space would be the middle and lower class individuals and families. These people may not be able to afford a plane ticket but still want to travel across the country. This could be for family vacations to cities such as Chicago or simply to visit loved ones who are now more conveniently reached via the revived train network. A constant flow of travelers will be a welcome change for St. Paul. The city has been seeking buildings that can create a flow of traffic through the city and a high-speed interregional train station could fulfill this need.

The last major group of users will be the workers and residents of downtown St. Paul. The building will feature many outdoor spaces and a pedestrian walkway that brings the public from downtown to the river's edge. It will also include well defined connections to other local transportation features. Along the river are parks and bike trails that would be used by residents of St. Paul and business people during their lunch breaks or after work. There are also going to be restaurants and large public spaces within the building. These will make great additions to the locations within downtown that business people can enjoy on their breaks.

Spatial Analysis - Building

Grand Entrance:

Square Footage: 2,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

Figure 23: Grand Central Terminal
https://en.wikipedia.org/wiki/Grand_Central_Terminal

Case studies and experience have displayed the importance of an entry sequence that is both efficient in function and breathtaking in design. The Grand Entryway is the first space that will be experienced by visitors coming from downtown St. Paul. This space will be large both in terms of square footage and volume. It will not only act as an entry but also a large lobby space where people can gather as they wait for arriving travelers. It will feature a large arrival/departure board with clear sight lines to the entry doors. *Figure 23* displays one example of how traveler services, vertical circulation and grand entrance spaces can be effectively integrated. As stated in *Welcome to Antwerp Central*, the Grand Entry should act as a cathedral in which the train is looked at with reverence. It should pay tribute to the power and history of the locomotive industry.

Traveler Services:

Square Footage: 6,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers and Station Employees

The visitor information spaces are a key component of the entry condition. When travelers arrive at the station, it is important that they have easy access to all resources that will help them navigate the station and the intercontinental rail system. For this reason, these spaces will be located in close proximity to the Grand Entrance space. The traveler services will be open to and a part of the Grand Entry Space. This space will also feature clear site lines to the entry doors for easy way finding. The visitor information will require signage, kiosks and ample space for lines to form. Signage will include maps of the station, route maps across the country, and arrivals and departure board among other helpful items. The space will accommodate six staff who can assist passengers on a 24/7 basis. In order to enhance passenger experience

and comfortability, seating will be required within the space. In the case of large numbers of people using the information desks, numbers can be assigned to travelers so that people don't have to stand in line for prolonged periods of time.

Ticketing/Planning Services:

Square Footage: 1,500 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers and Station Employees

Figure: 24: Customer Services at Liege-Guillemins
http://www.fr.regus.be/locations/business-lounge/liege-guillemins-railway-station-regus-express

The Ticketing and Planning Services space would feature a prominent connection to the Grand Entry space. This space is important to the travelers as it will be their source for ticketing and specific route information. Eight professionals would be available during peak hours to assist in planning and mapping out routes to get passengers to their final destinations. This setting will allow for in depth communication between the passenger and ticketing officers. This space would be separated from the Grand Entry to create a quiet setting in which more efficient conversation can take place. In this space, passengers meet with an individual who asks general information about their trip. The passenger is then given a ticket and is seated in a lounge. The ticket numbers are announced as officials become available. The passenger and official partake in a back and forth dialogue that allows the official to plan an efficient and cost effective trip for the passenger. The passenger can then purchase tickets right away for trips both in the near and distant future. This system is effective in stations such as Brussels Midi and should be utilized in the new St. Paul interregional station. To accommodate this function, the space will feature an open lounge space as well as smaller intimate spaces where travelers meet with professionals. It will feature a see through barrier to the Grand Entry to allow for separation of spaces and yet prohibit ambiguity as to what is occurring in the space from the Grand Entry.

Circulation and Restrooms:

Square Footage: 48,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

The vertical quality of the building site will place an increased emphasis on vertical circulation. It is important that the station remain accessible to all parties using the building. Therefore, the station will feature large public elevators, and at least six escalators between each level. This circulation will be located in close proximity to the entry spaces. A majority of the vertical circulation will also be located towards the center of the station. These circulation elements will mimic the design and effectiveness of Antwerp Central's circulation in terms of location and ease of way finding.

With the large capacity of the spaces within this station, the restrooms must be large in size and there must be plenty of them on each floor. There should be restrooms for both public and private spaces where a separation of the two occurs. These spaces must be visible from the public spaces and yet should be placed along the cliff so as to not take natural daylight away from spaces that need it.

Security:

Square Footage: 6,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Station Employees

In order for the station to be a safe public space, security must be on site at all times. There will be one major security office located in close proximity to the entrance of the station. This is so that travelers entering the station are immediately aware that their safety is a priority of the station. Being located at the entrance will also increase awareness among passengers of where security is located if it is needed in emergency situations. The main security space will feature customer service spaces as well as more private offices for security professionals. This space will also accommodate the command center that oversees the entire station's security systems. In addition to this main space, security stations will be located near each entrance to the station to ensure a secure and safe environment throughout the station. These stations will not be individual spaces but rather space will be accounted for them in the other programmatic spaces that will require extra security.

Passenger Security/Baggage Check:

Square Footage: 4,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers and Station Employees

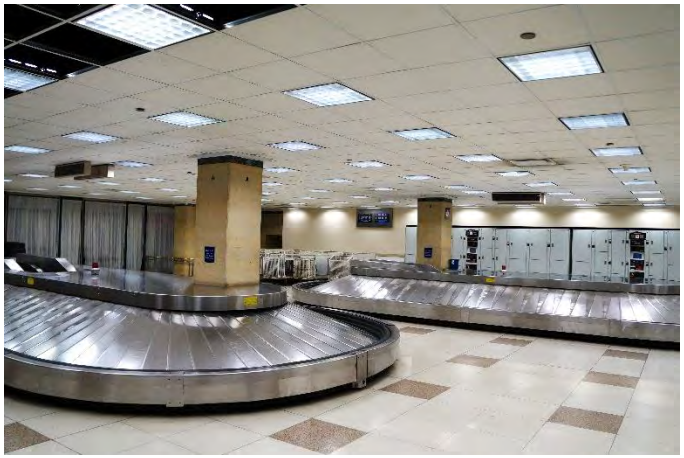

Figure 25: Baggage Carousel at Chicago Union Station.

In European train stations, there is no baggage check or security lines like one would find in an airport. Though this is convenient for the passengers, it is not likely that this will be allowed in the U.S. Therefore the station needs a space where passengers can go through security protocol and check their baggage with security officials. This space will be located near the platforms. Because the station is to be used as a public community space, security and baggage checks will only occur beyond the community spaces but before the traveler reaches the platforms. This way the building remains accessible while enhancing the safety of the passengers. Large luggage would be checked in at this space and taken by officials to be loaded onto the trains. This will mitigate chaos on the platforms by removing oversized luggage and create a more streamlined procession through the station.

Passenger Lounge:

Square Footage: 10,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers

In regards to public transportation, there tends to be a lot of waiting involved. Travelers wait for security checks, baggage checks, and for the specific vehicles to arrive. Ample lounge space is important for an interregional station as passenger comfortability and accommodation will go a long way towards increasing the use of high speed trains in America. The station will include two spaces for lounge seating that go beyond the general seating in the station. These spaces will have clear sight lines to the circulation and surrounding spaces yet the lounges will be closed off. They are meant to be a quiet space where passengers can escape the hustle of the station if they need to wait for prolonged periods of time. The lounges would include arrival and departure boards, television screens, comfortable seating arrangements and vending amenities. Travelers would come to this space to read, relax and escape the hectic nature of travel.

Community Spaces:

Square Footage: 10,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

A large component of this project is the inclusion of community spaces. Stations such as Chicago Union Station as well as Antwerp Central Station utilize community space to imbed the importance of the station into the surrounding community. In both of these stations, the community space is integrated into the grand entry conditions. This St. Paul station will have a large entry space, but it will also include an additional designated community space. This space will be located in close proximity to the retail/commercial space in order to create a galleria of sorts. This space will be large in both volume and square footage and will feature strong views to the surrounding city. This will be the primary space for crossing paths as people move about the station. The retail/commercial space will create a constant flow adjacent to the community space. The vertical circulation elements will move travelers through this space on their way to and from the platforms. The community space will feature green space and native plants that contribute to the sense of place. The community space will utilize design technology to create an outdoor like atmosphere within the heart of the building. The community space will act as an indoor park with various elements that will be used for seating and recreation. On a regular basis the community space will be utilized by travelers as well as people working and living in downtown St. Paul. Business men and women will come to the station's community space to eat their lunch while travelers enjoy the space while they await their train. This community space will also be available for large community gatherings and events like the Great Hall in Chicago Union Station. *Figure 26* depicts a flash mob dance that broke out in the Antwerp Central Station entrance and community space. One can get a glimpse from this picture the kinds of engaging and rewarding opportunities this space can provide the public. This space will contribute greatly to the integration of the building into the city and natural surroundings.

Figure 26: Flash Mob in Antwerp Central Station. http://www.stikkymedia.com/blog/while-lipdubs-reach-new-heights-awesomeness-flash-mobs-wreak-havoc

Casual Dining:

Square Footage: 10,000 Sq. Ft.
Hours of Operation: 12 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

The station will act as an active element to create activity in the city of St. Paul. Therefore it is important that the station accommodate spaces that will draw citizens of St. Paul to the building. Dining will be one major element that draws people to the station. Besides the fast food options that will be available to travelers, the station will also feature casual dining options. These will be large scale restaurants that will accommodate travelers who have more time to wait between trains, as well as the St. Paul community living and working downtown. These spaces will be located with good pedestrian access to the downtown infrastructure. It will also be located near the entry spaces to the station. The station will house four main restaurants for the casual dining experience.

Retail/Commercial Spaces:

Square Footage: 16,000 Sq. Ft.
Hours of Operation: Mixture of 12 and 24 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

Figure 27: Commercial Space at Chicago Union Station.

Another important aspect of the station will be the retail/commercial spaces. This will accommodate the needs of travelers as they prepare to embark on their journeys. These spaces will also be used by the general public as a new food court and retail hub in downtown St. Paul. People working in downtown can come to the station's community space and retail space in order to get lunch with co-workers and relax. The stations in Europe almost all have retail/commercial functions that are hugely successful at bringing people to the stations. These spaces will feature sight lines to the surrounding city as well as a strong connection to the community space. The St. Paul station will accommodate eighty interchangeable retail/commercial spaces which will be

made up of dining, clothing, convenience, and more. The abundance of space set aside for this function will make it one of the largest indoor community gathering spaces in the downtown area. The retail/commercial spaces will ensure that the station experiences a constant flow of pedestrian traffic outside of the travelers and station employees.

Office Spaces:

Square Footage: 40,000 Sq. Ft.
Hours of Operation: 12 hours
Users of the Space: Station Employees

The station must accommodate plenty of office space for the employees working within the station. This ranges from customer service professionals overlooking the station to interregional professionals overlooking the entire network of high speed rail lines. It will also cover the public relations and business side of operating a station of this size. Therefore the station will require twenty office suites for management of the station and interregional routes. These office spaces do not need the same public accessibility as the other customer services so these offices can be located in a more private area of the building. The offices should even have their own floor in order to separate the business side of the station from the public.

Service Spaces:

Square Footage: 32,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Station Employees

The station will accommodate a large program of spaces and therefore will require large HVAC systems and equipment. Mechanical rooms must be given ample space and will be located in more private areas. They will be placed alongside the cliff so as to not take away natural lighting from the spaces that need it. The HVAC equipment doesn't need to be hidden away but rather should become a component that enhances the design through its display.

Interregional Platforms:

Square Footage: 82,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers and Station Employees

The interregional platforms will be the foreign traveler's first experience with St. Paul, MN. This space must establish a sense of place and like the grand entry space evoke a sense of wonder. The platforms should be a source of pride for the passenger rail industry as they are the heart of the station's purpose. Santiago Calatrava realized the importance of the platforms in his design of Liege-Guillemins and the St. Paul station's platforms will require that same level of

detail and design. The platforms should be brightly lit spaces and feature views to the surrounding city. It should be clear as to where the passenger is as soon as they step onto the platform. The platforms themselves will be 550 feet long to accommodate the length of high speed passenger trains. Each platform will be thirty-five feet wide in order to accommodate clearance from the rails, passenger traffic and passengers waiting for arrivals. The station will accommodate six rail lines coming into the station and will feature at least one platform per rail. The platforms should also feature a smaller community space at the ends of all of the platforms. This space will feature arrival/departure boards so that passengers can easily look up their connecting trains if needed. Some of the retail/commercial spaces will be located near the platforms in the form of convenience shops. These will accommodate the passengers who need to quickly purchase items in between trains. This community space will also feature security, information and various customer service elements also featured in the grand entrance space. This duplication of spaces is due to the fact that the platforms themselves are an entry to the station and should function as such. The platform area will also include vertical circulation elements for accessing the rest of the station.

Local Platform:

Square Footage: 18,000 Sq. Ft.
Hours of Operation: 24 hours
Users of the Space: Travelers, Station Employees and St. Paul workers and residents

The local platform is a necessary element of the project in order to connect the new high speed rail station to the old Union Depot. Union Depot will remain in operation as the local transit hub for the city of St. Paul serving the bus, and light rail needs of the city. These are also important amenities to the travelers coming to and leaving the station. Therefore there must be a means of connection between the two stations. This will come in the form of a light rail line specifically used to transport travelers back and forth between the stations. The stations are six city blocks apart but they both rest along the river and alongside the existing tracks. This distance is too far to ask passengers to walk with luggage so a light rail shuttle is necessary. This technology is much different than what is required for high speed, therefore a separate rail and platform will be required for the station to accommodate this. The local platform will allow incoming travelers to access the major public transport within the Twin Cities area if they don't wish to use taxis or buses. This platform will be located alongside the interregional platforms and will connect to the same community space allocated for the platforms.

Green Spaces:

Users of the Space: Travelers, Station Employees and St. Paul workers and residents

This station will feature the natural elements of the site and surrounding ecosystem of the Twin Cities area. It will facilitate a partnership between the built environment and the natural environment. Therefore, spaces will be allocated for interior green space. The station will feature natural elements of the area such as native trees and exposed limestone interiors. These natural elements would be located throughout the station where possible. For example, the community space will be large and feature a lot of glazing which provides the opportunity for plants to grow in this space. *Figure 28* depicts just one of the ways green space can be included into transportation hubs such as Amsterdam's Schiphol Airport. Meanwhile *Figure 29* depicts Atocha Station in Madrid, Spain which provides a great example of how an interior community space can include an integration with natural site elements that provide a sense of place. The inclusion of natural plantings and site features in the St. Paul station will also contribute to the overall sense of place and connection to the site.

Figure 28: Green Space in Amsterdam Schiphol Airport
http://www.psfk.com/2011/06/amsterdams-new-airport-park-pics.html

Figure 29: Atocha Station in Madrid, Spain
http://swimimingsuit.blogspot.com/2014/10/the-most-scenic-train-stations-of-world.html

Spatial Analysis – Site

Public Transportation Space

The success of the station will be greatly affected by its accessibility to the public. The Twin Cities area has established a good public transportation network and the station must accommodate these means of transportation. At the entrance of the station, space will be provided for taxi and vehicle pickup in the form of a pull off lane alongside Kellogg Boulevard. Along with this lane there will be a pull off lane that will accommodate two city buses at a time. These accommodations will ensure that the station remain easily accessed by public transportation. Also in this entrance area, there will be a need for bicycle racks and a bike share installment. At the base of the bluff along the river lies a large bike share rack and pedestrians should be able to bike back and forth between the urban downtown and riverside. Beyond the entry transportation spaces, it is also essential that the site accommodate the light rail line that will run to Union Depot six blocks away. This rail will run along the base of the cliff and will require different overhead technology and clearances than the high-speed platforms and rails. *Figure 30* depicts the current light rail system in the Twin Cities. With all of these conditions met, the station will be well integrated into the urban fabric of the downtown.

Figure 30: Light Rail line in Minneapolis http://www.burandoburando.net/light-rail-minneapolis-park-and-ride-extraordinary-proposed-light-rail-transit/

Pedestrian Bridge/Crosswalk

Another aspect of connectivity in the site will be ensuring that pedestrians have safe and easy access to the building. Kellogg Boulevard is a major vehicular route around the edge of downtown so traffic will be an issue to overcome. The station sits at the intersection of Wabasha and Kellogg so there are opportunities for safe crosswalks at these points. One design option to overcome the traffic would be a pedestrian bridge that carries people over the busy roads and safely to the surrounding city blocks.

Entry Spaces

The case studies examined for this thesis all involved strong site integration in terms of landscaped space and plazas. The grand entrance of this station will be situated along the edge of downtown St. Paul and adjacent to a current park space. This existing parks runs along the top of the cliff on the opposite side of Wabasha Bridge and can inform the entry landscaping on the station's site. The entry condition should be a source of pride for the entire city of St. Paul. It should also be inviting and draw the public into the space. The site design outside of the entrance should combine natural and urban elements to create a space that can be used by the public year round.

Outlook Spaces

The site features arguably the best views of the Mississippi out of all of the downtown lots. Though this station will be built between downtown and the river, the building cannot create a barrier between the two. Santiago Calatrava achieved this transparency in Liege-Guillemins in order to avoid dividing the city of Liege and the same precautions must be taken here. One way to ensure that the public is aware of the surrounding natural elements is the provision of scenic outlook spaces. There will be a need for public space on the site and some of these spaces should have direct access to the cliffs edge and the views of the surrounding city. These spaces will be used primarily by the St. Paul general public as a space to unwind from work and stroll through the downtown area. This space could be continuous or be broken into separate spaces as long as it achieves direct sight lines between downtown and the river. *Figure 31* shows the power of a scenic outlook located in an urban setting. One could stand in this spot in Luxembourg City and forget that they are in the hustle and bustle of an urban downtown.

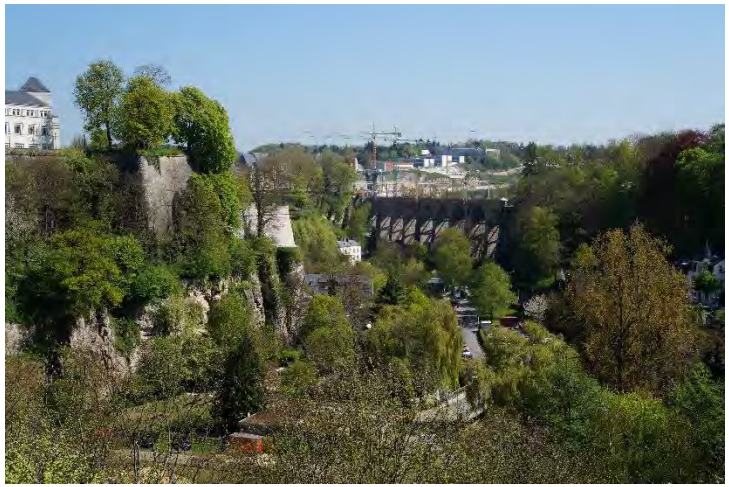

Figure 31: Downtown Luxembourg outlook

Outdoor Dining

A component of the station's program is the inclusion of leisure dining spaces for the benefit of both travelers and the general public. These spaces will have direct access to the downtown area and therefore will require site treatment as well. Some of the most frequented restaurants in the downtown Twin

Cities area offer outdoor accommodations. This station will offer this option as well for use in the warmer months of the year. These spaces should feature views over the Mississippi river and act as a major draw for the public. These restaurants will offer some of the finest views of any in the entire downtown area and these outdoor spaces will be sought out by citizens all over the metro area. They should have plenty of space to accommodate large groups of people and also be visible from the downtown side of the station. Not every restaurant needs to include these spaces but there should be at least two dining options that feature these outdoor spaces.

Pedestrian Walkway

The downtown St. Paul area suffers from a physical disconnect to the Mississippi river due to the bluffs. The current condition of the pedestrian river access is such that a pedestrian coming from the center of downtown must walk to either end of the bluffs in order to get to the river. The site for this station rests near the center of the bluffs and should be utilized as a bridge between the natural and urban environments. It is important that the site offer a means for pedestrians to walk and bike from downtown to the riverside trails. Therefore a pedestrian walkway must be integrated into the design of the building. This walkway will feature natural greenery and be wide enough to accommodate multiple forms of pedestrian travel. This walkway must safely carry people down the bluffs and across the tracks and street that run along the river. The pedestrian walkway is essential to the repairing of the urban and natural disconnect.

Green Spaces

The importance of urban green space is well documented among scientist and urban designers. These spaces have mental and physical healing affects that help to create safe and friendly environments in urban communities. The entire site must accommodate the natural environment and work to restore a sense of place through site design. Plantings on the site must be native and work to restore the loss of natural elements in the urban core of St. Paul. These green spaces should be placed near entrances, within plazas and along pedestrian walkways so that their presence is always felt on the site. Green spaces will tell a story of what would have been present on the site and reinforce a sense of place for travelers and the general public.

Site Introduction

Figure 32: Twin Cities Aerial. https://www.mapbox.com

The site for the project lies in the downtown portion of St. Paul, MN. Between the two Twin Cities depicted in *Figure 32*, St. Paul is the smaller and more reserved city. Some may feel that St. Paul would be less interesting to work with, however I would argue otherwise. Ramsey County commissioner Rafael Ortega sums it up well when he states that, "we feel that St. Paul is on the verge of a renaissance" (Walsh 2015). Having spent a lot of time in St. Paul this summer, I share Ortega's sentiments. There is construction all over the city and there is an air of excitement to St. Paul. The city is finally beginning to grow again and there is much curiosity as to what the city could become in the near future. The time to begin St. Paul's revival is now.

The city has recently made the decision to demolish the West Publishing and jail buildings along the bluffs on the edge of downtown. The city is very determined to reenergize this site as, according to the *Star Tribune*, Ramsey County has budgeted $13 million dollars to prepare the site for future construction (Walsh 2015). The site is clearly important to the city as it is listed as one of the top key elements of the *St. Paul 2015* city plan published by Mayor Coleman. According to the plan, the city is now looking to fill the site with various mixed use buildings including housing, hotel, business and more (Coleman 2015). After researching the site, the open possibilities facing the old West Publishing and jail site are exciting. The city will undoubtedly develop this area and it's the perfect time for a young designer to propose something exciting for this downtown site.

Figure 33: West Publishing. St. Paul, MN

I feel lucky to be working with this site as it is a place that I happened to stumble upon while working in St. Paul this summer. Every day on my way to work I would walk across Wabasha Bridge into downtown and admire the beauty of the city. St. Paul is rich with natural beauty surrounding the city and it features old, historic buildings that make up its skyline. I was taken aback by the beauty of the cliffs which can be seen in *Figure 34*, that rise up from the river and create the edge of the downtown area. Nestled along the cliffs to the West of the bridge lies the old West Publishing and Jail. I worked right across the street from these buildings and was very intrigued by all of the construction work occurring around the buildings. With each new day my intrigue and love of the area grew and I began looking at the site as an incredible opportunity for a thesis project. Here, at the edge of this beautiful, historic downtown, lay these beautiful 40 foot high bluffs with foliage growing along the top and out of the cracks along the faces. An amazing opportunity would be at hand to create a building on a site with very dynamic characteristics. By mid-July, I decided that this would be the perfect site for me to conduct my thesis project.

The site works well for this thesis for many reasons. One of which is that the city of St. Paul has been outspoken about a desire to become a more eco-friendly city. This mindset, combined with the natural beauty surrounding the city, makes the perfect

Figure 34: View from Wabasha Bridge looking east. St. Paul, MN

Figure 35: View from Wabasha Bridge looking west. St. Paul, MN

combination for a study of how we have designed cities in relationship to nature in the past and how we can do it better in the future. Most Urban cities have pushed the natural elements of the region away as they have grown, whereas St. Paul still has a rich natural beauty that surrounds the city. It remains feasible to design buildings that integrate with the natural elements of the city in order to reconnect the natural and urban environments within downtown St. Paul. In a recent article in the *Star Tribune*, the president of the St. Paul

Port Authority, Louis Jambois mirrored my sentiments about the site. He stated that "This project is a great opportunity to continue to reconnect the St. Paul central business district with the river" (Walsh 2015). Studying the effects of intertwining the benefits of the natural environment with the urban landscape will be very interesting on a site that includes bluffs, the Mississippi river and a large urban downtown area.

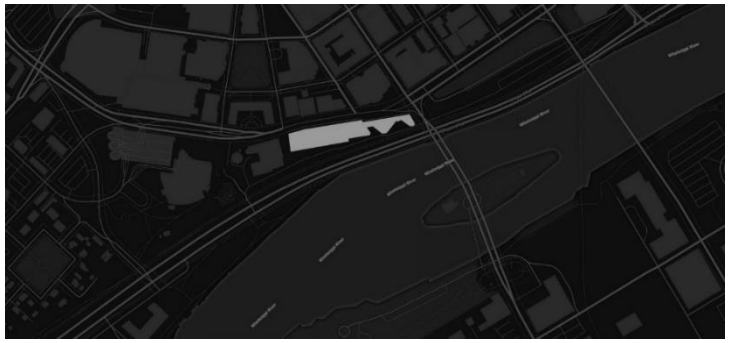

Figure 36: Aerial Map of West and jail buildings. https://www.mapbox.com

The site is also well suited for the project because there is a current plan to connect the Twin Cities area to cities like Rochester, Duluth and Chicago by high speed trains. This form of travel will be good for the Twin Cities area because it provides another reliable option for public traveling around the Midwest that is more affordable than flights. Locomotive travel has worked so well in Europe and it is only a matter of time until the United States also revives its train industry. Of the two Twin Cities, St. Paul is the one more suited to spearhead the revival of this industry. The city has strong historical roots to the locomotive industry such as being the hometown of railroad tycoon James J. Hill. There are still plenty of railroad tracks running through the downtown area that could be renovated and used. It also features a historic railroad building in the Union Depot. While this building has been restored, it currently serves the local light rail and busing systems. In order for St. Paul to accommodate a revived locomotive industry that is sure to grow in the near future, a new building is necessary. The site chosen has enough land area to make room for this typology and it will serve the city of St. Paul well as it brings people to the edge of the bluffs and reconnects the urban city to the river's edge.

Site Context

A History of the City

Figure 37: Wabasha Street in 1908
http://www.shorpy.com/node/10124?size=_original

St. Paul is a city rich with history and culture. Its origin dates back to 1819 when Fort Snelling was being established at the branch of the Mississippi and Minnesota rivers. This settlement brought attention to the area and began the development of what would become St. Paul, MN. As more people flocked to the Minnesota Territory, St. Paul became a township. In 1858 St. Paul was made the capital of Minnesota as the state was admitted to the union. The city grew from a population of 900 in 1849 to 10,000 citizens by 1860 (Wikipedia, 2015). According to the United States Census Bureau, the city is now home to 297,640 people. This, combined with the over 2 million residents in the Twin Cities metropolitan area, makes St, Paul a very large urban setting.

St. Paul was able to thrive due to its geographic location, resting along the Mississippi river. This made it a port for fur trading which further expanded into a variety of trade and commerce for the city. The steam boat was a popular mode of transportation and soon after the city was granted the title of capital, trains became a centerpiece of St. Paul's identity. The first train left St. Paul in 1862 and in 1883 the Northern Pacific Railway was completed running from St. Paul to the West Coast. James J. Hill led this endeavor which made St. Paul the gateway to the Pacific Northwest. St. Paul was a thriving railway center for many years, however the current state of affairs is much different. According to Amtrak's statistics, St. Paul is still the major Minnesota hub for passenger rail with 7 of the 8 busiest routes in the state either arriving or departing from St. Paul. The current St. Paul station is the 16th busiest in the nation in terms of long distance routes as it still capitalizes on its connection to the Pacific Northwest. 89,675 passengers utilize the St.

Paul station for long distance travel each year. Although St. Paul still features a formidable long distance rail market, the commuter services and shorter routes across the state are non-existent. This has aided in the sharp decline in ridership from 138,100 passengers in 2008 to 89,700 passengers in 2014 (Amtrak Fact Sheet, 2014). This is an issue that must be addressed if the passenger rail is to be renewed in St. Paul. The NARP has recognized this same issue and has proposed high-speed routes beginning in St. Paul and running to cities such as St. Cloud, Fargo, Duluth and Rochester. *Figure 38* depicts the NARP's map of the future passenger rail network in the U.S. with new routes depicted in blue. The NARP notes that these routes would connect the major cities in the Midwest area and would allow commuters to live and work in separate cities as they please (NARP's Vision, 2015). This proposal sets the stage for this thesis project. The time has come for the expanding of the passenger rail industry in Minnesota to include high-speed interregional trains that would connect the state and improve the Minnesota economy. It is only fitting that this endeavor begins in St. Paul, the historic center of the railroad industry in the state of Minnesota.

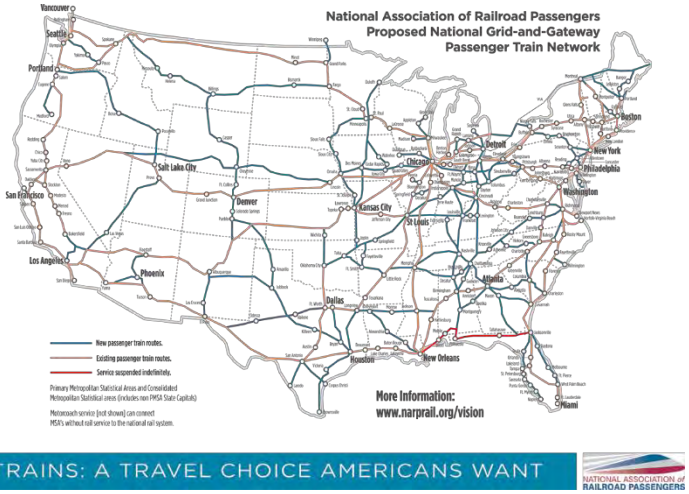

Figure 38: NARP's Vision of a Passenger Train Network https://www.narprail.org/our-issues/narps-vision-for-trains-in-america/

A History of the Site

Figure 39: St. Paul's West Publishing site in 1964
https://www.minnpost.com/politics-policy/2015/05/downtown-st-paul-if-you-unbuild-it-will-they-come

The beauty of St. Paul's riverside bluffs was noted by early settlers. Today, these features help to make St. Paul a unique and beautiful city. Because the river was the lifeblood of the city in its early years, development along the water's edge happened quickly. The first building built on the West site dates back to 1886. Over 100 years the site would continue to be developed which resulted in the six separate structures that make up the buildings on the site today.

These structures were eventually consolidated down to two entities, West Publishing and the Ramsey County jail. These two buildings faced issues in their time such as flooding of the Mississippi river. This along with the suburban movement led West Publishing to eventually move out of its office and into the suburbs in the early 1990's. In 1991 Ramsey County bought the six West Publishing buildings for $1. Ramsey County filled the West Publishing building with offices up to 2008 when they too began to move out of the building. By 2013, the buildings on the site were completely empty (Melo, 2015).

Ramsey County has been looking to develop the site since the early 1990's but developers were reluctant. Since then, flood mitigation has been implemented to make the site more suitable for development. Demolition began on the West buildings in 2015 in order to prepare the land for developers. The site and the city are ready to begin work on a project that will breathe new life into downtown St. Paul.

Cultural and Social State of St. Paul, MN

The city of St. Paul was first settled by various people of European descent in the early frontier days. This led to a predominately white city, however, this has changed in recent decades. Due to increased immigration over the last century the city has seen an increase in diversity. St. Paul is now made up of many

major ethnicities comprised of 60% Caucasian, 15% African American, 15% Asian and 9.6% Hispanic (United States Census, 2014). This diversity grows each year and is part of what makes the city a large, thriving urban center.

The site itself sits in an area of downtown that lacks in housing. The riverfront has drawn new development such as a brand new apartment complex that integrates with the bike paths along the water. Otherwise, the development around the site is primarily public in nature such as the Science Museum and River Centre Parking ramp. Therefore, it is good to note the areas around the site that feature plenty of housing in order to gauge who may be interacting with the site. The downtown area surrounding the site and just across the river features many neighborhoods where the majority of residents have an ethnic background other than European. The ethnic make-up of the city can be seen in *Figures 40, 41,* and *42*. It can be expected that the site will see a wide variety of people experiencing the station.

Another unique piece of the social make-up of the city is the age range of its citizens. The median age of citizens living in St. Paul is well below the national average at just over 30 years of age. The youth of the city corresponds with the median income as it is almost $15,000 below the state's average at $47,010 (United States Census, 2014). This combination of youth and income fits well with the call for a downtown high-speed interregional train station. Young people with a lower income are more likely to take advantage of an affordable mode of public transportation.

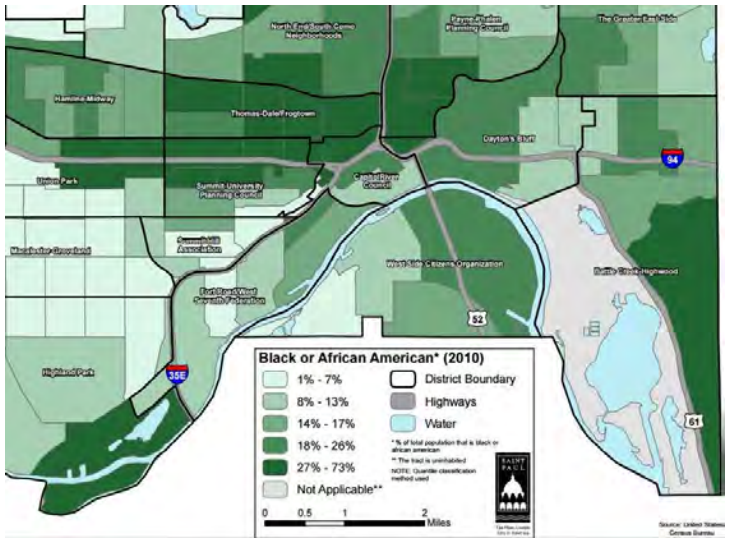

Figure 40: Percentage of African American citizens in St. Paul, MN. http://www.census.gov/

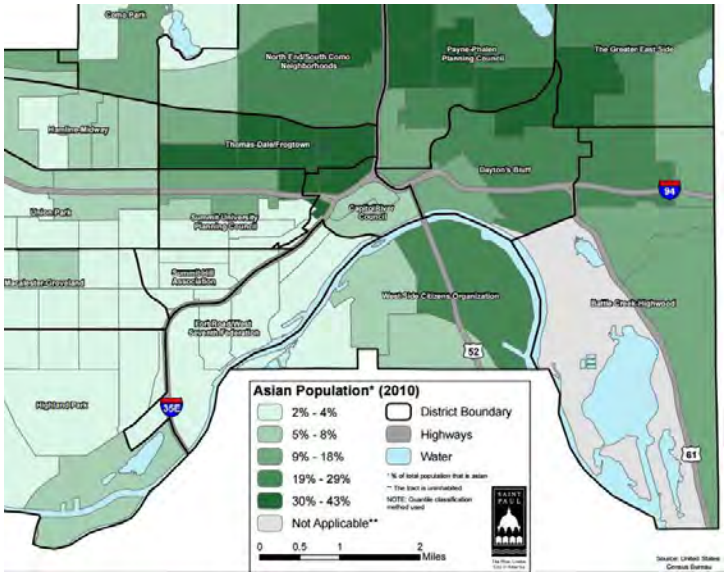

Figure 41: Percentage of Asian citizens in St. Paul, MN. http://www.census.gov/

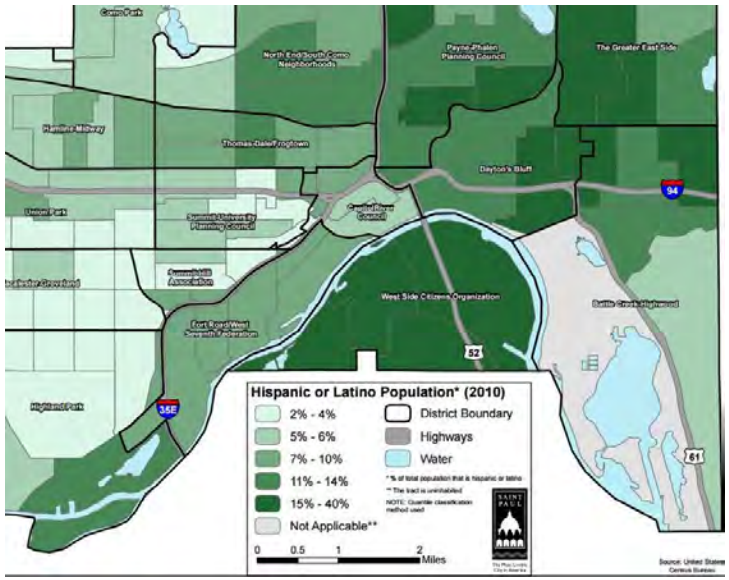

Figure 42: Percentage of Hispanic citizens in St. Paul, MN. http://www.census.gov/

Site Analysis

The West site along the banks of the Mississippi river in downtown St. Paul is full of potential. I recognized this the first day I walked across Wabasha Bridge into downtown. The site has continued to amaze as research and evaluation has been conducted. Architecture should always respond to its natural surrounding and the investigation of how the built and natural environments can coexist is an integral portion of this thesis. Therefore, the following site analysis will go a long way to influencing the design response of the high-speed interregional train station.

Climate

Temperature and Humidity Analysis

The Minnesota climate is full of extremes with its hot and humid summers mixed with harsh and frigid winters. It is safe to say that this climate will be one of the most influential forces on the design of this thesis project. The book *Heating, Cooling, Lighting: Sustainable Design Methods for Architects*, analyzes various aspects of the Midwestern climate that will directly impact the design response of the station. The following figures begin to paint a picture of the rather dynamic Minnesota climate.

Figure 43: Midwestern Basic Climate Condition. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

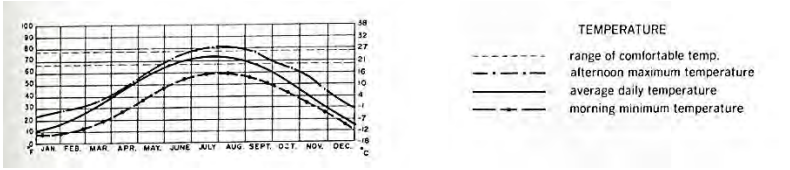

Figure 44: Midwestern Annual Average Temperatures. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

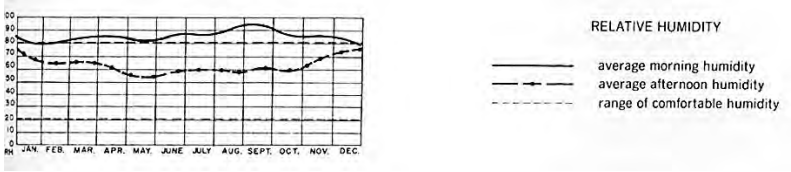

Figure 45: Midwestern Average Relative Humidity. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

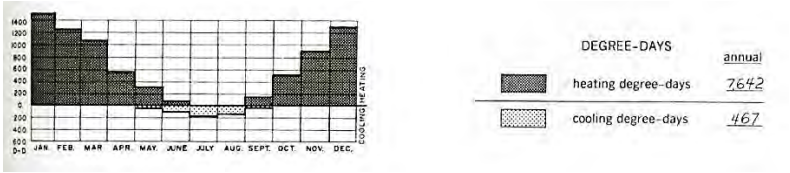

Figure 46: Midwestern Average Heating and Cooling Periods. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

The first image to analyze is *Figure 43*, depicting the overall climate condition of the Midwestern region. This simple chart displays that the natural climate is comfortable for only 12% of the year.

Meanwhile, the climate is too cold for 76% of the year. One can conclude from this graph alone that a high priority must be placed on heating the station for a majority of the year. *Figures 44* and *46* reinforce this as they state that it is typical for buildings to require heating from the month of September to as late as early June. The graphs show that temperatures reside below a comfortable range for a large portion of the year. Active systems will no doubt come into play here, but passive systems will also be utilized to naturally heat the building in the winter. The buildings orientation in terms of solar exposure is of great importance and will be discussed further in Solar Analysis.

Although this data overwhelmingly shows that heating the building is important, one cannot ignore the three months out of the year that require cooling of the building. *Figure 45* shows that although the afternoon humidity often remains within a comfortable range, the morning humidity is frequently above a comfortable range. Minnesota experiences intense heat in the summers and also features periods of beautiful weather in the spring and fall seasons. Therefore, this thesis will also allow for passive cooling systems to play a part in the building design. A goal of the thesis project is to blur the distinction between the natural and built environments. This becomes difficult in a climate that features harsh winters, however these more comfortable periods encourage design strategies that will open the station up to the elements. One strategy to overcoming the extreme temperature swings may be to implement moveable or retractable building components. Various design technologies will be investigated that allow the building to actively respond to the current climate.

Solar Analysis

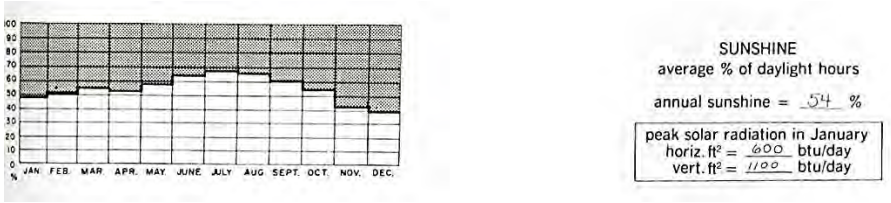

Figure 47: Midwestern Average Hours of Daylight. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

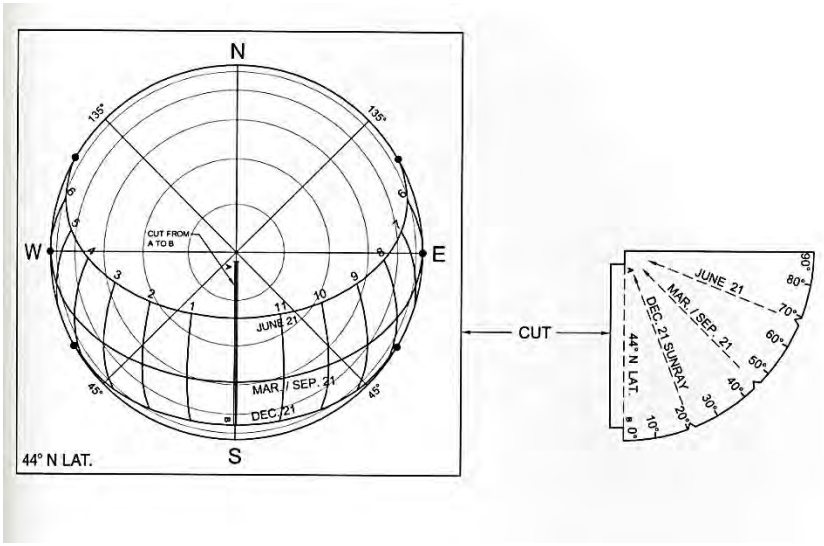

Figure 48: Solar Diagram for 44 Degrees North Latitude. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

Figures 47 and *48* depict the solar conditions that will need to be taken advantage of on the site. The first graph shows that in the winter the site will spend less than 50% of the day exposed to sunlight. This means that the little amount of sunlight provided must be harnessed in order to make its effects last longer. Thermal massing may be a strategy to pursue that could take advantage of the brief moments of sunlight. With this strategy, the heat from the sun could be captured and emitted into the building even after the sun itself is no longer present. Glazing on the southern side is another method that would allow for plenty of low lying winter sunlight to penetrate the building and heat the spaces.

The site rests in perhaps the most advantageous spot in downtown St. Paul for taking advantage of solar energy. The site itself rests along the southern most edge of the downtown area and along the Mississippi river. Because of this, there are no buildings on the southern side to block solar gain, even in the winter when the sun is at its lowest position. Likewise, because the building will mostly rest along the edge of the bluffs, the station will not be hindering the surrounding buildings north of the site in downtown St. Paul from receiving good amounts of solar heat. *Figure 49* shows the solar diagram for the 44 degree north latitude overlaid on the thesis site. This image depicts the advantageous position of the site in terms of the built environment around it. The winter sun will reach the building at any time during the day, while the summer sun will be blocked in the mornings and evenings by Wabasha Bridge to the east and the energy plant to the west. Passive solar design will be integral to the success of this thesis design.

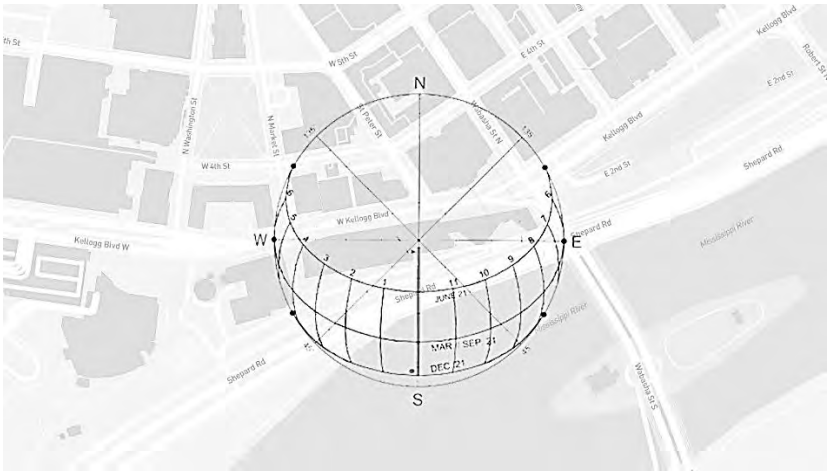

Figure 49: Solar Diagram Site Overlay

Wind Analysis

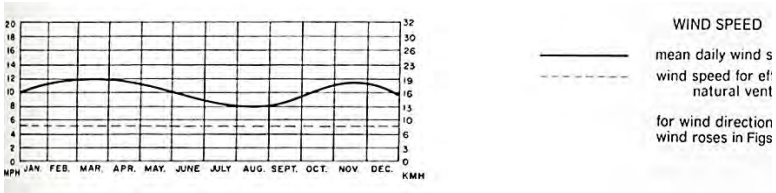

Figure 50: Midwestern Average Wind Speeds. Heating, Cooling, Lighting: Sustainable Design Methods for Architects

Another important component of the Minnesota climate is the wind. *Figure 50* depicts the average annual wind speeds that affect the site. Throughout the entire year the wind tends to flow at a speed above what is effective for ventilating a building, however the highest speeds occur during the cold periods of the year when natural ventilation is not sought after. Generally, the state receives cold winds that flow over Canada and come from the northwest in the winter. Meanwhile, in the summer warm winds come from the southeastern portion of the country. Again, the site's natural features and orientation will be advantageous for these conditions. A majority of the building will rest alongside and below the bluffs that run the entire length of the north side of the site. The built environment of the downtown will also help to mitigate could northern winds as the urban downtown rests to the north of the site. Warm winds coming from the south will pass over the Mississippi river and reach the site mostly un-hindered. The river will likely act as a cooling agent in the summer so that the warm winds reach the building at a more comfortable temperature. *Figure 50* shows that wind the average wind speed is closest to an effective ventilation speed during the warm summer months. This will create opportunities to allow the cooled wind to penetrate the building in the summer and aid in the cooling of the building.

Water Analysis

The site's proximity to the Mississippi River makes water an important ecological factor for the site. This large body of water will always be present, so it is best to take advantage of it in the design of this project. As stated in earlier climate analysis, the river positively effects the site in terms of passive design. The river is a flat plane that will allow solar exposure to always be a factor regardless of future development. Also, the city addressed the flooding issues of the river years ago so that this is no longer an overriding concern for the site.

Rainfall will also influence design decisions throughout the thesis. *Figure 51* depicts the annual precipitation numbers for the entire state of Minnesota. Ramsey County lies almost entirely in a region that receives anywhere from 31-33 inches of rainfall per year. This is rather high for the state and is of special importance when taking into account the natural formation of the site. The site is almost entirely on sloped terrain which becomes very steep at the bluffs. Because of the slope, rainfall will flow towards the

tracks so this must be addressed in the design of the station. Storm water treatment and runoff from the building will have to be directed in order to be utilized effectively in the design. Rain gardens and collection ponds are just a few of the design responses that will be investigated in the design of the station.

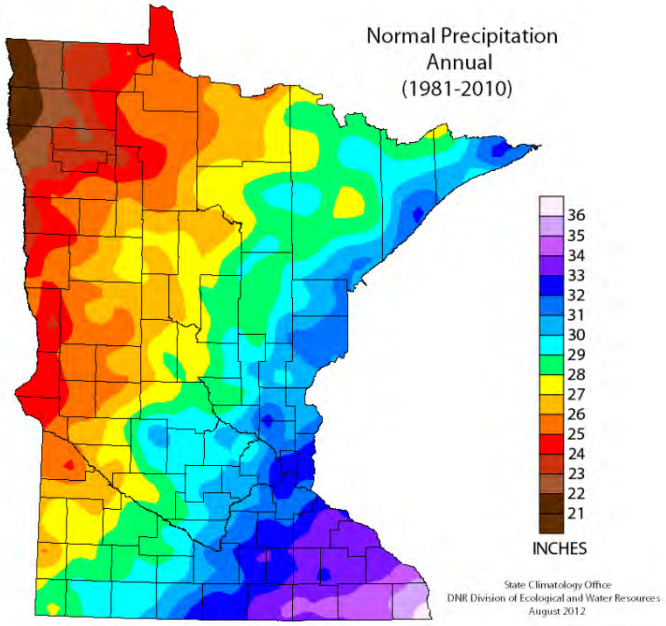

Figure 51: Minnesota Annual Precipitation Averages. http://climate.umn.edu/img/normals/81-10_precip/81-10_precip_norm_annual.htm

Topography

Contours and Slops Analysis

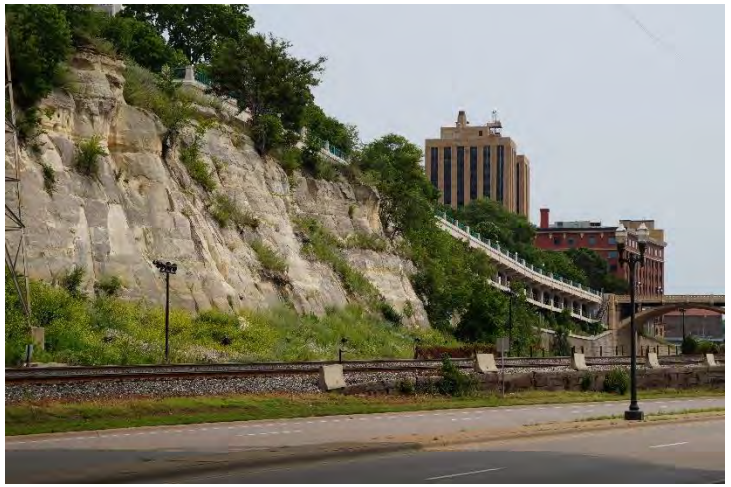

Figure 52: Exposed bluffs to the east of the site

As discussed previously, the natural character of the site is incredibly dynamic. As one approaches downtown St. Paul, they are met by an incredible view of the urban downtown resting on top of 50 foot high bluffs that rise above the Mississippi River. These bluffs not only influence the site but rather they establish the natural character of the larger downtown area. *Figure 52* shows the exposed bluffs to the east of the site under Wabasha Bridge. Though they are quite beautiful, they will make building and construction rather tricky. Therefore, creative design choices will be applied in order to utilize the bluffs to add character to the design of the station. *Figure 53* shows the extreme

elevation change that is present on the site. Each contour line represents 2 feet and overall the site experiences an elevation change of over 60 feet. Their effect on runoff has been discussed previously and will be of great importance. The task of building on this site would seem more daunting if it hadn't already been done. The bluffs present a very dynamic site that can be used to enhance what will be a very dynamic building.

Figure 53: Elevation Map of southern downtown St. Paul, MN

Soils Analysis

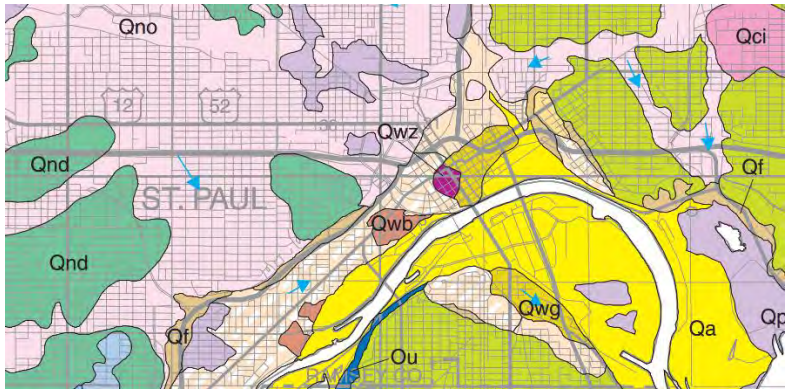

Figure 54: Soils Map of downtown St. Paul, MN. http://www.mngeo.state.mn.us/chouse/geology/county_regional.html

The soil make-up of the site will determine the foundation design and influence material choices for structure. *Figure 54* provided by Minnesota GIS depicts the soils status of the downtown St. Paul area. According to the map, the site lies on the border of Langdon and Grey Cloud Terraces which is composed mostly of sandy soils. This soil make-up is not the best for building, but luckily the site features a low depth to bedrock. *Figure 55* is provided by the Minnesota DNR and displays the areas depth to bedrock. The image shows that the topsoil of the site rests at a maximum of 10 feet above bedrock. Bedrock is firm and can support heavy building loads so the shallow nature of the soils will allow for less intensive foundation designs.

Figure 55: Depth to Bedrock in downtown St. Paul. http://www.mngeo.state.mn.us/chouse/geology/county_regional.html

Adjacencies

Built Environment Analysis

Although the built environment of downtown St. Paul doesn't directly rest upon the site, its impact on the project will be great. St. Paul is a large urban center that features an older downtown sprinkled with some new buildings. Its high rises contain a mixture of offices and homes. *Figure 56* is a picture taken of the site from the riverside walkway. Here the materiality and character of the downtown skyline can be seen. St. Paul's buildings are made up primarily of stone and brick facades. Limestone cladding is common among the downtown towers. The prevailing use of stone and brick materials gives the city its historic character.

Figure 57 further shows the character of downtown along the northern edge of the site. This picture was taken from the site and looking down St. Peter Street. The variance in stone cladding and building heights can be seen here. It is important that the station feel as though it is a part of the greater urban language of the city. At the same time, this station is a new building and therefore its design should exude technology and modernity. Therefore, it can be reasoned that the use of stone cladding such as limestone could be used as an exterior material, especially along the northern façade where the building has direct contact to the downtown. The platform spaces and south façade however may be more liberal in material choice and perhaps could see the use of long span steel and glass materials to respond to site conditions and typology.

Figure 56: West Publishing buildings and downtown St. Paul, MN

Figure 57: View Corridor of downtown looking north on the site

Beyond the buildings of downtown, the roadways are another important built characteristic that will affect the station design. *Figure 58* shows the area of downtown St. Paul near the site, depicting the buildings in a dark shade of gray and the roadways in white. This image shows the unique layout of the city's infrastructure as the grid meets the bluffs and river. The site is bordered by three roadways, those being West Kellogg Boulevard to the north, Wabasha Bridge to the east and Shepard Road to the south. Because Wabasha is a bridge, the site can only be directly accessed by the other two roadways. Train tracks currently exist along the bottom of the bluffs on the south side and this is the best place for them to remain. In this way, trains can come and go into downtown without interrupting vehicle and pedestrian traffic in downtown St. Paul. Therefore, West Kellogg Boulevard to the north of the site will be the main vehicle access for drop-offs, taxis and city buses. Due to space constraints, parking may be best along the cliffs but will likely require an entrance along Kellogg that allows the flow of traffic to move down the bluffs, much like the River Centre Ramp to the west of the site.

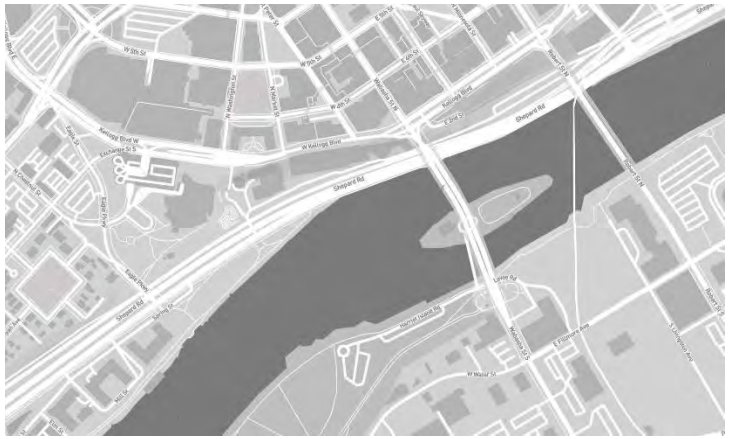

Figure 58: Downtown St. Paul Built Elements. https://www.mapbox.com/

Pedestrian and Vehicular Traffic Analysis

Both forms of traffic will have the greatest impact on the northern and southern edges of the site. As stated above, only two roadways offer direct access to the site but traffic coming over Wabasha Bridge will have an impact on the site as it is a major artery for traffic crossing the river. *Figures 59, 60* and *61* depict the average traffic congestion in downtown St. Paul. These images show the traffic on a typical weekday in

the morning, afternoon and evening. Weekend traffic is less on average throughout the city so it is not shown here. These images are recent and therefore show West Kellogg Boulevard in its current state of being blocked off along the site due to the demolition of the West Publishing and Jail buildings. It can be expected that once reopened, traffic on West Kellogg Boulevard will be less in the morning and afternoon yet likely heavier in the evening. Businesses begin operation at various times in the morning but often close up around 4:30 in the evening which accounts for the heaviest amounts of traffic coming at the 4:00 – 5:00 hour.

These maps help to envision the sources of noise pollution surrounding the site as well. The noise pollution from vehicles will only be a problem along the northern side of the site on West Kellogg Boulevard. The traffic maps show that Shepard Road remains fairly calm and quiet throughout the entire day. Besides, the biggest source of noise pollution on the south side will come from the trains themselves as they move in and out of the station. The traffic on Wabasha Bridge will be occurring above most of the building so it is likely that it will not be as impactful as the noise coming from the top and bottom of the bluffs. Because of these sources of noise, it makes sense that the public spaces of the building be located at the top and bottom of the building, while the private office spaces may be located at the center of the building, halfway up the bluffs.

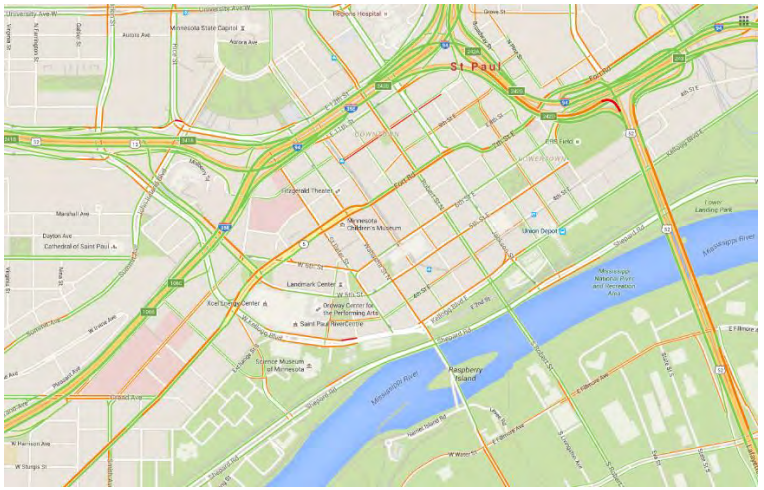

Figure 59: Downtown St. Paul Traffic at 9:00 AM on a Weekday. https://www.google.com/maps

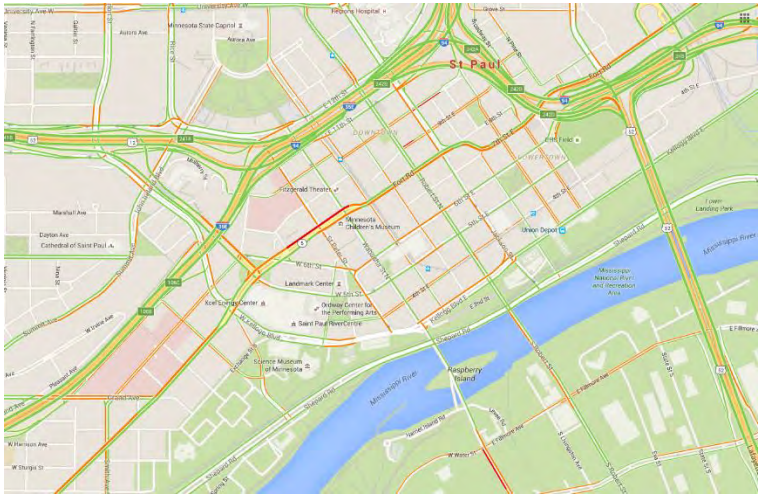

Figure 60: Downtown St. Paul Traffic at 12:00 PM on a Weekday. https://www.google.com/maps

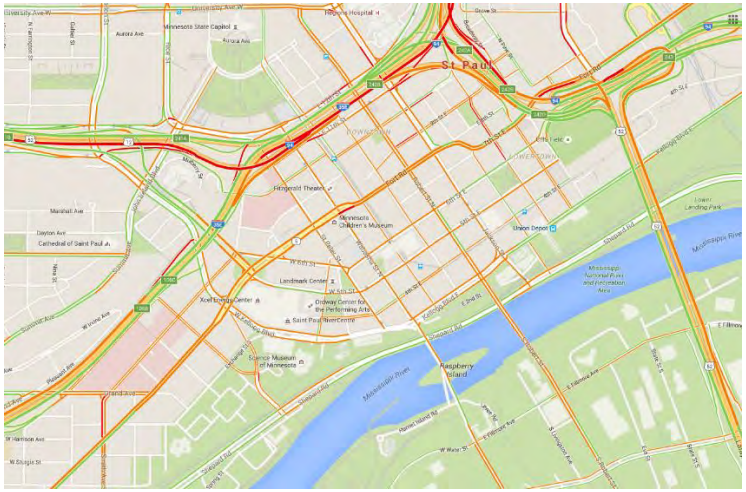

Figure 61: Downtown St. Paul Traffic at 4:30 AM on a Weekday. https://www.google.com/maps

Pedestrian Traffic will be heaviest along the roadways passing the site. Wabasha Bridge will feature a medium amount of pedestrian traffic as people working in St. Paul cross into downtown. But most of the pedestrians will be coming to the site either from within downtown to the north or from the pedestrian walkway along the river. There are issues with the current state of the pedestrian infrastructure around the site that will need to be addressed in the design.

For one, the pedestrian walkway between Shepard Road and the Mississippi suffers from a severe disconnect from the downtown area. The bluffs create a divide which hinders the use of the beautiful trails and walkways on the river's edge. The design of this station will work to connect the riverside and downtown through some form of pedestrian walkway. Because of the steep nature of the site, this walkway may need to wind its way back and forth along the site in order to meet code and remain accessible to all.

Another issue is that West Kellogg Boulevard is a busy street that separates the entire site from downtown. Pedestrians coming from the center of downtown must cross a long crosswalk that can be hazardous and scary for people with impaired mobility. This thesis should seek to create a safe pedestrian connection across West Kellogg Boulevard. This may be in the form of an elevated walkway that also connects to the park across Wabasha Bridge. Despite these issues, the site will experience plenty of pedestrian traffic which will improve the experience and effectiveness of the station.

Natural Environment Analysis

Despite being located in a large urban environment, the site is close to natural environments. The mighty Mississippi River runs along the southern edge of the site and creates beautiful views to the south. There are many parks spread across the downtown area including the large Harriet Island Park across the river. The closest parks are one that runs along the river across Shepard Road and one that lies across Wabasha Bridge on the top of the bluffs. These two parks are positioned in such a way that the site fits right in

between them. A pedestrian walkway connecting the riverside walkways to the downtown could also connect these two parks and create a large greenway along the southern edge of downtown St. Paul. *Figure 62* shows the natural green spaces and Mississippi River surrounding the site.

Currently, the site is almost desolate of any natural character. The West Publishing and Jail buildings cover most of the site and the rest is almost all paved over. Some foliage has been planted along Shepard Road along the southern edge of the site and this makes up all of the site's vegetation cover. A greenway that runs through the site would be a massive improvement to the current condition.

Figure 62: Natural Areas surrounding the site

Site Views Analysis

The site features some of the most sought after views in the entire city. The bluffs open up to beautiful views overlooking the woods surrounding the city along with the beautiful bridges spanning across the Mississippi River. Because of the bend in the river and the curving of the site, the views to the east and west also look out over the river. The north side of the site looks directly down the streets of downtown St. Paul and the urban landscape of the city. *Figures 63, 64, 65* and *66* show the main view corridors in each direction. Because the site is an active construction zone, the view pictures were taken just off of the site.

Figure 63: Looking east of the site underneath Wabasha Bridge

Figure 64: Looking west of the site at the Smith Ave. S. Bridge

Figure 65: Looking south across the Mississippi River at Harriet Island

Figure 66: Looking north of the site down St. Peter St.

These images present the impact that the Mississippi River will have on the site as it is the main focal point in every direction except north. Also present in the views to the east and west are the series of bridges. This creates a constant presence of transportation and works well with the typology of the thesis. The mixture of natural views and urban views will also be helpful in designing a building that works to meld these two realms.

Project Emphasis

The project will cover a variety of topics; however, three will be of special importance. The thesis will focus on how we should look at new urban projects as embodying a partnership of man and nature, not just one or the other. The thesis will look extensively at how we can reenergize downtown St. Paul by creating spaces that promote activity and movement through the city. Finally, the thesis will explore how reviving the passenger rail industry will put St. Paul at the forefront of cities leading the way for the renewal of convenient, high-speed interregional travel as an emergent option.

Partnership of Man and Nature

In the past we built massive cities and cleared away the natural environment to make way for our creations. This is a major problem as nature has a profound effect on how we act and feel within a place. A qualitative study was conducted in the UK in 2012 to better understand what draws people to various green spaces. The study looked at what motivated people to interact with green space as well as how people felt after interacting with the space. The study showed that a majority of people went out of their way to visit green spaces for physical pursuits such as walking or relaxation. After inhabiting the green spaces for a time, participants reported feeling relaxed and revitalized. They also reported feelings of attachment to the specific green space. The study showed the restorative powers of green space on participants' perception of their well-being. (Gaston, 2013). This qualitative study is also backed up by more quantitative research. A study which looked at the relationship between proximity of green space and health was documented in the article "Green Space, Urbanity and Health: How Strong is the Relation?" In this study it was found that proximity to green space had a profound impact on mental health. The impact was strongest among lower social classes, citizens with less education, and youth (Maas, 2006). These are the same groups of people that live and struggle in urban areas across the country. If we create designs that increase the well-being of these people, we will create safer and more vibrant communities for everyone.

By removing nature from the realm in which we spend the most time, we are depriving ourselves of a fundamental need for green space. In the article "Nature in the City or the City in Nature", Drago Kos explores very interesting views of urban design and the natural environment. He emphasizes the importance of nature in the city as he states that these spaces are what maintains a healthy city above all else. Too often people move to the suburbs in order to have increased access to nature and Kos feels we must stop this. We can design our cities to have a symbiotic relationship with nature where the two entities can co-exist and support one another (Kos, 2008). Architects and

designers have followed Kos's sentiments and have begun to explore this symbiosis between the built and natural realms. A great example of this is BIG and Heatherwick's recently approved design for the new Google Headquarters in California. As depicted in *Figures 67* and *68*, this design brings the natural beauty of California into the office space. The design features a light-weight canopy structure that covers the entire campus, allowing the offices to be arranged as separate buildings in and of themselves (Rosenfield, 2015). This design shows how one may begin to think about melding the natural and man-made.

Figure 67: Exterior of Google Headquarters. http://www.archdaily.com/603947/see-big-and-heatherwick-s-design-for-google-s-california-headquarters

Figure 68: Future Google Headquarters in California. http://www.archdaily.com/603947/see-big-and-heatherwick-s-design-for-google-s-california-headquarters

This thesis will look further at how we can overcome the challenge of integrating two unlike entities such as nature and the built environment in a much harsher environment than California. Within this emphasis the thesis will:

- Explore how we can repair the disconnect of urban and natural settings.
- Display the importance of creating a clear sense of place within transportation hubs through the integration of architectural and natural elements.
- Examine the design approach cities have taken towards integration of nature all throughout history and how it should change.
- Examine how the desire to walk through green spaces as shown in the UK study can be utilized in the design to increase traffic around and through the building (Gaston, 2013).

Activity and Movement

Many downtowns in American cities become desolate once the business day ends and people head home to the suburbs. This is a huge issue in downtown St. Paul and the city is actively searching for a way to create a lively downtown scene. Judith Martin's article titled "If Baseball Can't Save Cities" addresses the issue of downtown activity. She states that baseball was once the cure all for breathing life into a city. St. Paul recently built a new stadium for the minor league St. Paul Saints baseball team pictured in *Figure 69***.** However more work needs to be done to bring people to the city. Martin expresses her feelings that public places such as markets may contribute to a downtown revival. The idea is that these spaces are full of people and life which will emanate to neighboring sites and eventually effect the whole of downtown (Martin, 1984). Author William White backs up Martin's notions in his book *The Social Life of Small Urban Spaces*. In this work, White examines studies of urban spaces and the users of these spaces. Their tendencies show that people are drawn to a place by the abundance of other people. Even if we are not intending to socialize, we enjoy being amongst others (White, 1980). Therefore, by creating a building whose typology promotes movement and activity, one can suspect that the city of St. Paul would begin to see a revitalization of its downtown. This is the main reason why this typology is well suited for this particular site.

The emphasis of movement and activity within this thesis will:

- Explore the affect train stations have had in cities around the world.
- Examine what qualities of public space draw the attention of the public
- Demonstrate how outdoor, natural public space can be seamlessly integrated into the urban environment.

Figure 69: St. Paul Saints Stadium. http://www.startribune.com/st-paul-saints-new-ballpark-gets-high-marks-for-sustainability/304062301/#8

Revival of the Passenger Train

The successful growth of a city has always depended on its connectivity to the important places around it. For example, entire cities have been located based upon proximity to water in order to accommodate boat traffic. The rail network was once the innovation that resulted in an explosion of growth across America. But, as new technology developed such as the automobile and passenger plane, the rail industry has a seen a decline. Only in recent decades has the passenger rail seen a revival in parts of the world. This has stemmed from governments investing in the industry and the competitive cost of train tickets compared to other means of transportation. In America, organizations such as the Midwest High Speed Rail Association and the National Association of Railroad Passengers have begun leading the charge to revive the passenger rail. It may be a slow process but it is only a matter of time until this industry becomes relevant once again in the United States. St. Paul would become a leader in the transportation industry and could initiate a new wave of growth within the Twin Cities area. Within this emphasis the thesis will:

- Examine trends among the most successful American train stations and stations around the world.
- Study how increasing variation in transportation methods can stimulate success for an urban city.

Goals of the Thesis Project

The Academic

This thesis project is the largest task I have taken up in my time at North Dakota State University. This process will be strenuous and difficult as well as fun and rewarding. This thesis is an opportunity to display the talents and knowledge I have acquired since I began my study of architecture. The most important academic goal for myself is that I leave NDSU feeling like I am ready to contribute to the profession of architecture. I took advantage of the various lectures and conversations with professors during my time at NDSU. This thesis will display my ability to research and understand a topic and my ability to respond to various influences. I will create a thorough design that displays the lessons learned while in school.

An expertise will be established in this thesis that I can then share with my peers and the academic community. This project should inspire academic reactions. It is a goal of this thesis to invoke curiosity among my peers and academics around the world. Professors and students alike should feel invested in the project when they see it on display or look it up online. This thesis should spark conversation and perhaps get others to think differently about design. I hope to create a project that will be an example for future students of what it means to design a truly wonderful project. People will look at this thesis and learn something they weren't aware of before.

The Professional

The most important goal of my entire academic career has been to prepare myself for the work force after school. I want to be a successful architect someday soon and I believe that this project is one of the first large steps in making that happen. This is my first chance to choose my own topic of interest, create my own program, and design a building that is truly of my own invention. A goal of this project is to learn as much as I can through this process and then inform the professional community of my findings. This thesis project should alter the way people view urban design and transportation in America. At the end of this process, I will be able to bring my new found expertise to the professional community and begin making a difference in the real world. This thesis will create a work that contributes something meaningful to the architectural profession.

The Personal

I remember being in awe of the thesis project when I was first touring NDSU as a high school senior. I couldn't believe that in four years I would be expected to complete a thesis of my own. I have come a long way since then and I now feel very excited to undertake this thesis project. My first personal goal for the thesis

is to design something that is close to my heart. I want to work on something that will be fun for me to explore and learn about as I move through this process. I know that I have chosen a thesis premise and typology that interest me, but I hope that as I discover new things about my project, I can continue to pursue an avenue that will allow me to enjoy working on this project. The most important goal of mine is to simply produce a project that I can be proud of. I want to look back at this semester and smile about the experiences, knowledge and skills that I will acquire through this process. If I am proud of my thesis at the end, I will have succeeded.

A Plan for Proceeding

Research Topics of Importance

1. Theoretical Premise/Unifying Idea
   - Precedents in Train Stations
   - Precedents in successful public spaces
   - Challenges in seamless integration of outdoor public space and the built environment
   - Challenges of drawing the public to a place
   - Challenges of seamless integration with natural site elements within a cold winter climate

2. Typology
   - Precedents in transportation typology
   - Typological Case Studies
   - Users of the typology

3. Historical Context
   - The rise and fall of the passenger rail industry in the United States
   - Revival of the rail industry in Europe
   - Traveling by train in the past, present and future
   - Past, present and future of green design in the urban setting
   - St. Paul in the past, present and future

4. Site Analysis
   - Seasonal site visits
   - Climatic research for the city of St. Paul
   - Site context
   - Vertical oriented design
   - Demographic research for the city of St. Paul
   - Urban design

5. Program Requirements
   - Existing train stations
   - Future of the passenger rail industry
   - Users of the space

Research Methods

Case studies, interviews, site visits, research addressing transportation, research addressing green design and research addressing humanistic qualities of architectural space will all be used in order to address the topics of importance.

Outcome

The topics of importance listed above will provide a framework within which expertise can be gained regarding the theoretical premise and unifying idea. In this manner, 5 major aspects of the project will be thoroughly investigated. The research of these topics will allow a comprehensive and thorough building program to be established, resulting in a clear and concise design process. All of this will result in a design that inspires and informs the community of the possibilities with train station design and urban design.

Design Methodology

A mixed method approach focusing on aspects of both quantitative and qualitative research is the most appropriate for the completion of this design. The process shall be explorative like that of the process described in "Design as Exploration" by Julia Robinson. Robinson states that design should be an exploration of many influences that are constantly shaping how we perceive a design problem (Robinson, 1986). In order to undertake this process, various forms of research and data must be obtained and reviewed.

Quantitative Data

The hard facts of the project will come primarily through research. Statistics and numbers will be gathered through the reading of scholarly and professional writings pertaining to transportation, green design and the humanistic qualities of architectural space. This will be in the form of data sets, programmatic dimensions, usage studies, and scientific experiments. This will provide the scientific backbone that defends the quantitative merits of the project.

Qualitative Data

The intrinsic value of transportation spaces, green spaces and humanistic designs will be developed through more active means of research. The qualitative data will be compiled though personal experience, public testaments and interviews. This will provide the evidence for the success of the humanistic qualities of the project.

Documentation of the Design Process

It is not only important to show the results of academic studies but also how we arrive at our conclusions. Therefore, the documentation of this design project is of utmost importance. Through well documented process, this project will communicate more effectively the lessons that are derived from the research and design methods conducted.

Documentation Methods

- Academic Writing
- Hand Sketching
- Computer Modeling
- Graphical Analysis
- Photography

Documentation at set intervals

Each week throughout the semester, time will be taken to document progress thus far. This will be through the scanning of sketches and notes, screen shots of digital process and photographs of any physical modeling. By doing this at a weekly interval, there will

be a clear path laid out by the end of the project that displays how the final results were discovered.

Availability for fellow Scholars

Though the project is a personal exploration at this point, once it is completed it can act as a diving board for scholars all over the world pursuing similar design problems. The Thesis will be made available online at the NDSU Institutional Repository for worldwide access. It will also be made available specifically for the NDSU community in the form of a hard cover book.

Presentation Method

Besides the publication of the materials for scholarly use, the thesis will also be presented before the public in Fargo, ND. Final products will include graphic and descriptive documentation of an architectural design solution as well as convey the spirit of the project. The final presentation will include the following components:

- A hardcover book presenting all of the background work of the thesis. This will display the research conducted, the programmatic elements, and the sources which contributed to the findings. It will also document the design process along with the final design.
- A physical model displaying the building in relation to the site. The building itself will be better analyzed and displayed through digital representations. Therefore the physical model will primarily be used to show the integration of the building into downtown St. Paul. The project includes aspects of urban design and outdoor public space so its relation to the area surrounding it is of great importance.
- A digital presentation primarily displaying the final design. Some of the process will be included here but for the most part this will be the main method for presenting to the public the academic findings of the thesis. This will include slides containing key research, important process, final graphics and perhaps video presentations.

Project Schedule

Task	Duration	Start Date	End Date
Project Exploration	50 Days	Mon 6/1/15	Mon 8/10/15
Research and Program	94 Days	Tue 8/25/15	Fri 12/14/15
Winter Break	21 Days	Fri 12/18/15	Mon 1/11/16
Conceptual Diagrams	7 Days	Wed 1/13/16	Wed 1/20/2016
Explore Spatial Relationships	7 Days	Wed 1/20/16	Wed 1/27/16
Space Planning	14 Days	Wed 1/27/16	Wed 2/10/16
Structural Planning, Form and Volume	10 Days	Wed 2/10/16	Fri 2/19/16
Passive and Active Systems Concepts	10 Days	Fri 2/19/16	Mon 2/29/16
Site Integration	7 Days	Wed 2/24/2016	Mon 2/29/2016
Material Decisions and Assembly Systems	10 Days	Fri 2/26/16	Sat 3/5/16
Prepare Midterm Materials	3 Days	Fri 3/4/2016	Sun 3/6/16
Midterm Presentations	5 Days	Mon 3/7/16	Fri 3/11/16
Spring Break	7 Days	Sat 3/12/16	Sun 3/20/16
Develop Key Assemblies	14 Days	Mon 3/21/16	Mon 4/4/16
Address Model and Renderings	10 Days	Mon 4/4/16	Wed 4/13/2016
Finalize Board Layout and Graphics	7 Days	Wed 4/13/16	Wed 4/20/16
Submit Digital Thesis Documentation	1 Day	Wed 4/20/16	Thur 4/21/16
Install Thesis Exhibit	4 Days	Thur 4/21/16	Mon 4/25/16

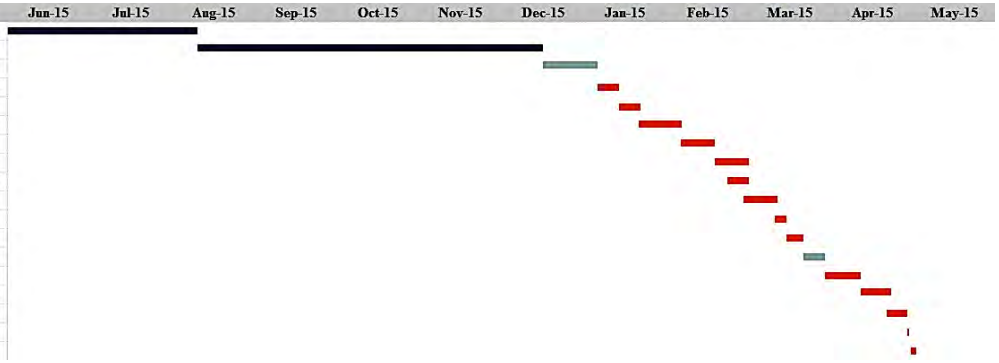

Figure 70: The First half of the schedule is shown in blue and involves the research portion of the thesis. The chart shows how this process started in June, 2015 and will end December, 2015 with the ending of the fall semester. The Second half of the schedule is shown as orange beginning in January and ending in April 2016. The design work on the thesis will begin at the start of spring semester. This process will move quickly with many aspects of the project only having a couple of weeks dedicated to them. Multi-tasking will be of great importance as the design work proceeds. The thesis will culminate in the final presentation of the project in the month of May, 2016.

Summary

Through the exploration of this thesis, much has been discovered that will shape the final design. Experts in a variety of fields have influenced this thesis through their works. The three major points of interest in the research were the connection between the built and natural environment, nature's effects on mental health and how the revival of passenger trains can benefit the city of St. Paul as well as the United States.

Coming into the project, it was expected that downtown St. Paul would benefit from a stronger connection to the natural environment within the urban downtown core. The research conducted has backed this initial idea. Studies such as the one documented by Maas and written about in the article "Green Space, Urbanity, and Health: How strong is the correlation?" show a direct correlation between exposure to natural settings and better mental health. The benefits described in these studies would have a positive impact on an urban core by creating a less stressful environment. Exposure to green elements can enhance productivity and create a more healthy city overall. Also, through the research conducted, it is evident that an integration of architecture and nature can be achieved. The Arch Daily article written by Karissa Rosenfield examines the new Google Headquarters in California which emphasizes the importance of integrating the natural environment with an office setting. This building designed by BIG and Heatherwick is one example of how we can achieve a melding of site and architecture. The thesis project will seek to achieve a similar effect but in a manner that protects the building from the harsh Minnesota winters. This will likely be one of the biggest challenges to overcome in the design.

The research focused on the state of the passenger rail in the United States has revealed valuable information that will influence the design of the thesis project. Preliminary thoughts about the industry in America were much less optimistic than the actual state of affairs. It was very surprising to see that Amtrak has documented more trips via rail from Washington D.C. to NYC than the airline industry has. Obama's monetary contribution and emphasis on high-speed interregional trains also came as a welcome surprise. Based on the overwhelmingly positive research found, the United States is truly in the middle of a transportation revolution that should see high-speed passenger trains as a viable and popular mode of transportation within the next few decades. A disconcerting find was that while most of the nation saw an increase in rail passengers, St. Paul has actually seen a steep decline. However, this could be remedied by the design of a new state of the art facility that puts high-speed rail back on the map in Minnesota. National data shows that this trend can be reversed by increased funding and technological improvements to the existing rail infrastructure. This thesis will look to remedy the

negative trend and prove the value of high-speed interregional passenger trains for the city of St. Paul, MN.

This thesis will explore the transportation typology and will include a high-speed interregional train station, offices and public spaces. Research has shown that these functions would have positive impact on the city of St. Paul and the entire state of Minnesota. By repairing broken connection within our urban fabric, we can create a partnership of mankind, nature and place through transportation.

Design Solution

Figure 71: Afternoon on the Passenger Platforms

Following the Research conducted in the fall of 2015, the final design of a high-speed interregional passenger train station began. In less than four months, the program was analyzed, conceptual designs and process were worked out, and a final design solution was proposed and presented. The following captures the process leading up to and including the final thesis design.

Process

The design of the station began with the analysis of the program and major goals of the project. Once these were well understood, four major design options were sketched and considered. The idea behind this exercise was to begin to examine the site in terms of design opportunities as well as to establish the best course for proceeding.

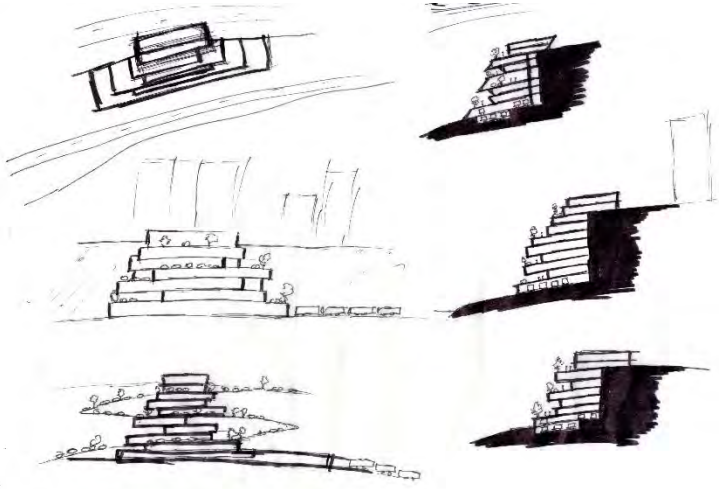

Figure 72: Design Option A

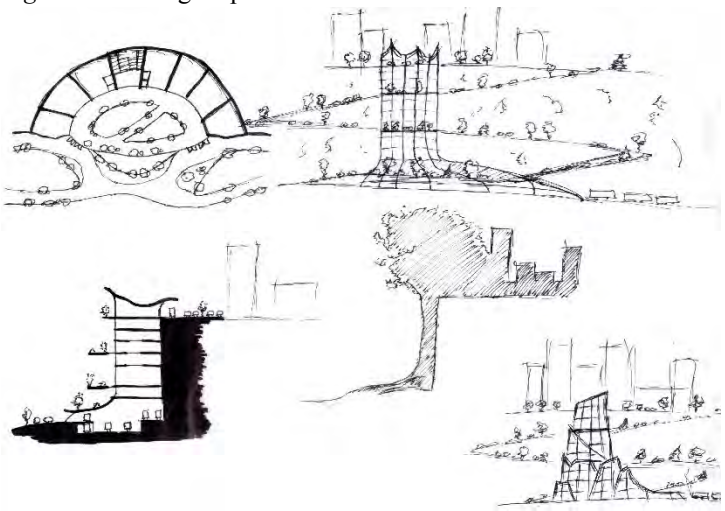

Figure 73: Design Option B

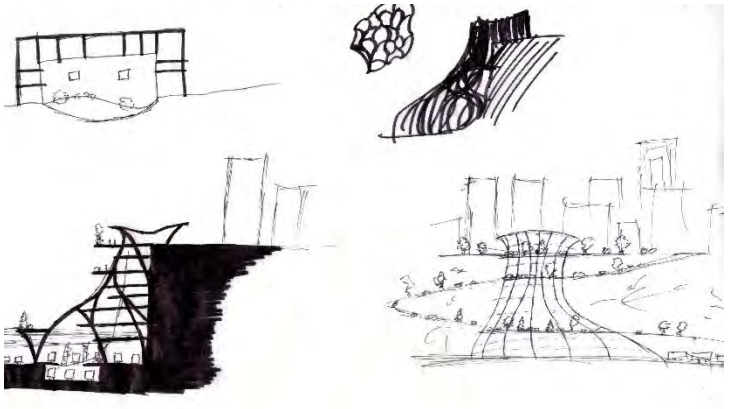

Figure 74: Design Option C

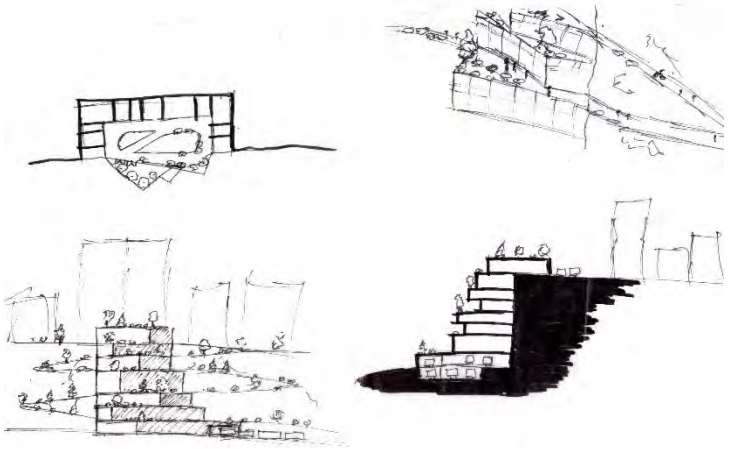

Figure 75: Design Option D

Many of the early thoughts included a station that was integrated almost entirely into the Cliffside and featured a pedestrian bridge that wound through the design and down to the riverside. In all of these options, views to the riverside, inclusion of the bluffs and pedestrian access were key features.

The most important aspect of these initial sketches was that they were informative in terms of site relationships and aspects. Once a design was put onto the site, it was found that there was more space to work with than initially thought. This altered the original concept of stacked platforms since there was enough space on the site to fit all rail lines and platforms on the ground floor. It was also found that the site offered distinct lines that informed the overall layout and form of the building in plan. The street scape above the bluffs worked to form the east and west boundaries of the design, whereas the bluffs and the rail lines formed the north and south edges. Because of the fairly strict requirements of a functional passenger rail platform, the train shed became a focal point in the design that influenced the rest of the station layout.

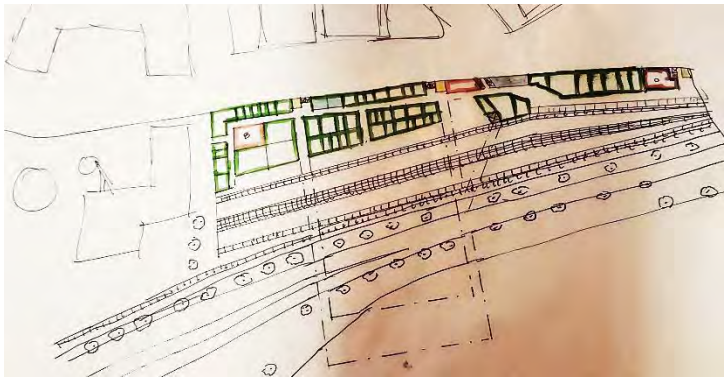

Figure 76: Early Spatial Planning

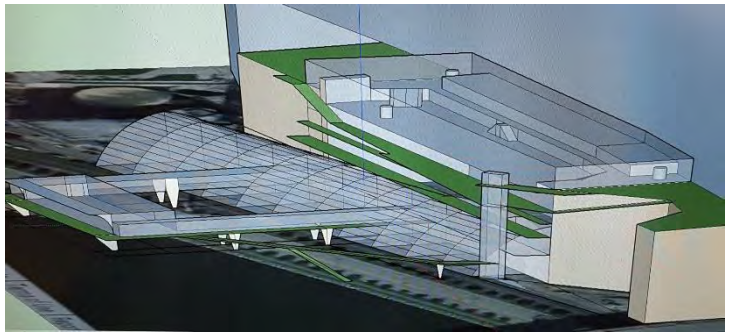

Figure 77: Early Form Study

Once a general spatail layout was established, a form study was conducted in order to understand how the station would fit contextually with the site. Through the use of a form study, it was determined that the east and west ends of the station would be designed to pay tribute to the historical and general context of the city of St. Paul, meanwhile the train shed and station functions would break away from tradition and embody the future characteristics of high speed trains in America. Through the spatial study and form study, it was also determined that a major bridging aspect of the design that would bring people to the water would be of great importance. This component woud influence the means of pedestrian traffic through the station as well as the structural pattern and character.

The structure of the station would be key to the design as it would not only influence the form of the station but it would be one of the major evocative elements of the station, establishing the essence of the passenger rail industry. Early drawings featured a traditional, barrel-vaulted train shed structure. These forms are beautiful and rich, yet it didn't feel appropriate for the station. It was important that the station embody the futuristic and modern nature of the high speed train. So a form that was unique, storng and active in nature became the goal of this process. Angular forms emody an inherent energetic nature that supported the active character of the space, so this became a focus of the structural sketches. Another important aspect of the form of the building was that it begin to bridge the divide between the urban and natural portions of St. Paul. Therefore it was determined that the structure should gradually descend from the bluffs until finally reaching out over the Mississippi. Also, the form of the structure was meant to subtly change as it moved from urban to natural, creating structure that featured hard and soft edges. Many studies and sketches were done in order to design a structural system that would be active and engaging throughout the entire station. The following images depict some of this process.

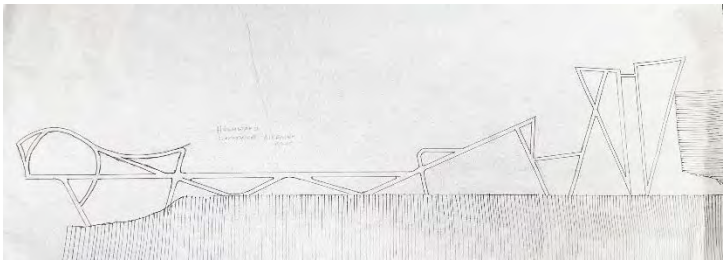

Figure 78: Sectional Study of Structure

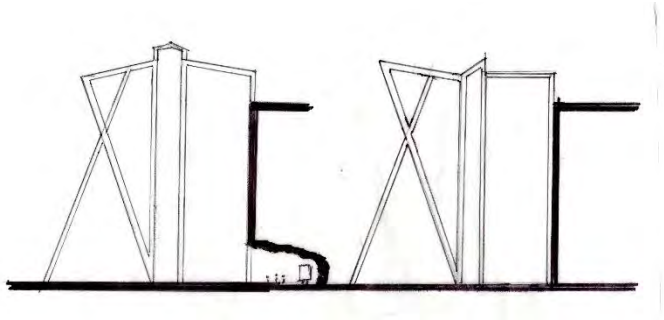

Figure 79: Structural Form Study A

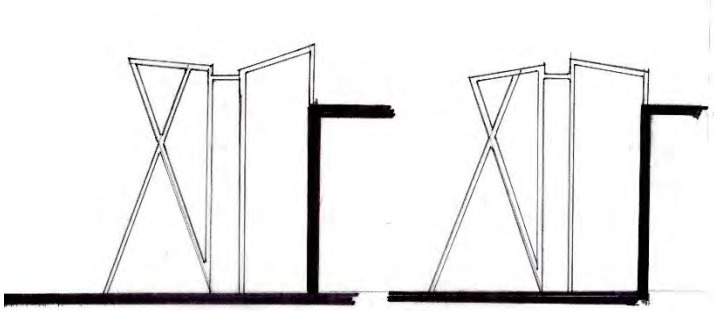

Figure 80: Structural Form Study B

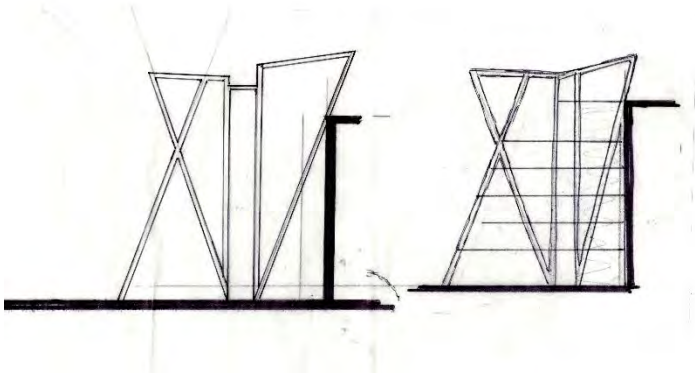

Figure 81: Structural Form Study C

After many iterations of form sketches, the drawing on the left of Study C became the launching point for further exploration. This sketch provided clean, angular lines that formed the exterior of the building and carried that active nature further into the station. The roof design also provided opportunities for water collection and shading for the design.

Through the process of structural sketches, a larger building section was drawn with the structure included. This drawing was helpful in envisioning how the structure might feel in the spaces as well as examining how spaces would function within this unique form. Figure 82 was one of the biggest turning points of the design as it became confirmation that the spatial, structural and form design could come together to create a very intriguing space for the city of St. Paul.

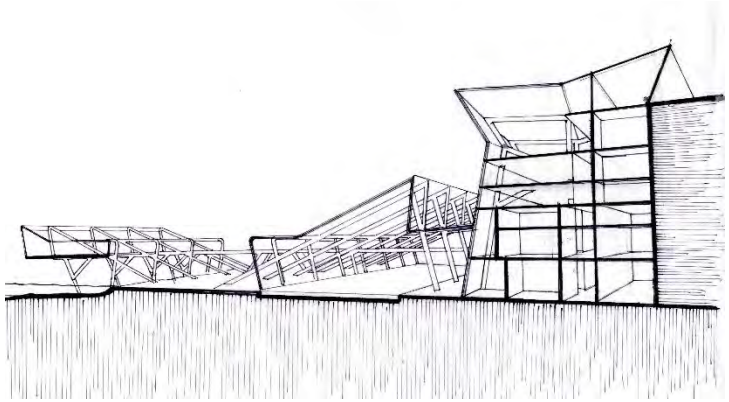

Figure 82: Sectional Study with Structure

Midterm Progress

Figure 83: The Station Design Viewed from the South

After months of exploration through sketching and digital modeling, a midterm report on the project was presented. At this point in the process, the major issues and design decisions were made and a more detailed vision of the project was beginning to emerge. Though functional floor plans had not been developed at this point, the structure, building form, general spatial layout and site response were well developed. It was decided that the multi-function elements such as retail and dining would be primarily located on the bottom three levels where more space would better accommodate these functions. Station functions and services would be located at both the top and bottom of the station to accommodate passengers coming into the station by train as well as travelers entering the station from downtown St. Paul. On the west end of the station, a parking structure would act as a buffer between the station and the steam plant next door, as well as provide parking for the staff working throughout the building. On the east side of the station, an office building would serve not only station operations but also oversee the high speed passenger rail industry in the Midwest region. Mechanical Services would be centrally located in order to reduce the overall size of mechanical systems ranging throughout the building.

The structural design had been refined and integrated into the digital model. The east and west bays of the building would feature more traditional structural bay construction while the heart of the station would feature the active structure studied earlier. The lines created by the structure not only influence the interior space but they also extend out into the site to form the main pedestrian, vehicular and freight train pathways alongside the station. The structure continues from the bluff and extends out over the Mississippi River to form a community event space that embodies the nature of the river and captures the movement occurring there.

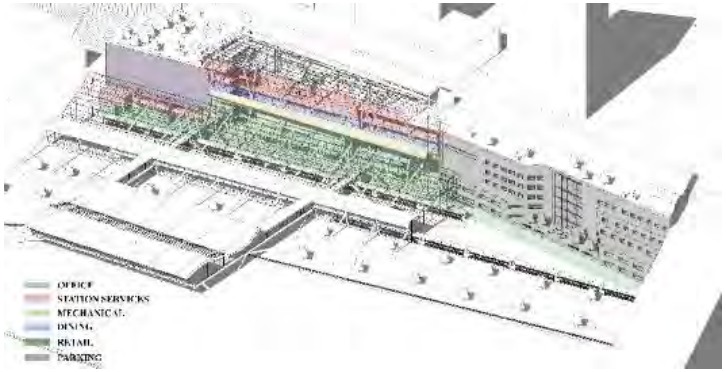

Figure 84: Form and Function of the Station

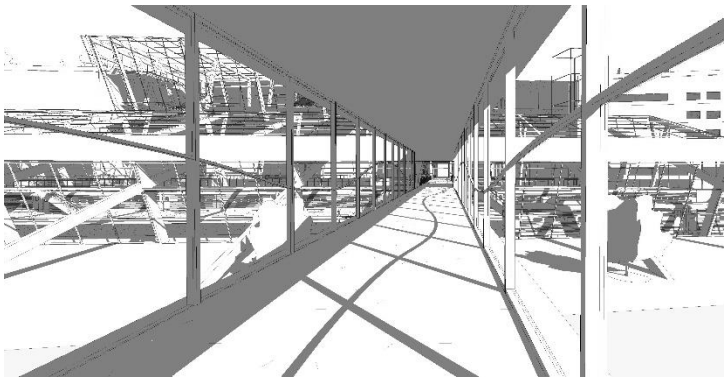

Figure 85: Pedestrian Bridge to the Riverside Event Center

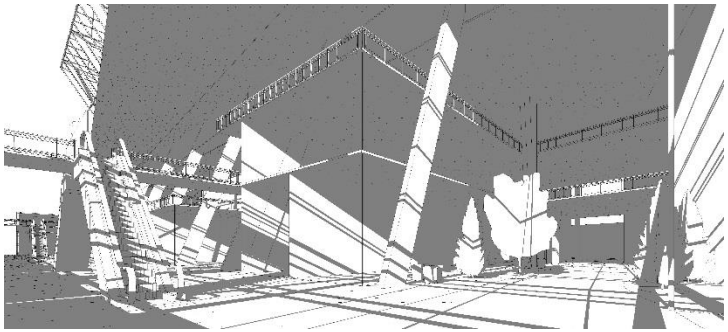

Figure 86: Interior Park Space and Retail

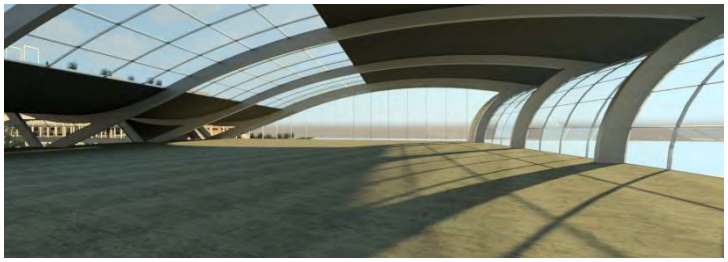

Figure 87: Riverside Community Space

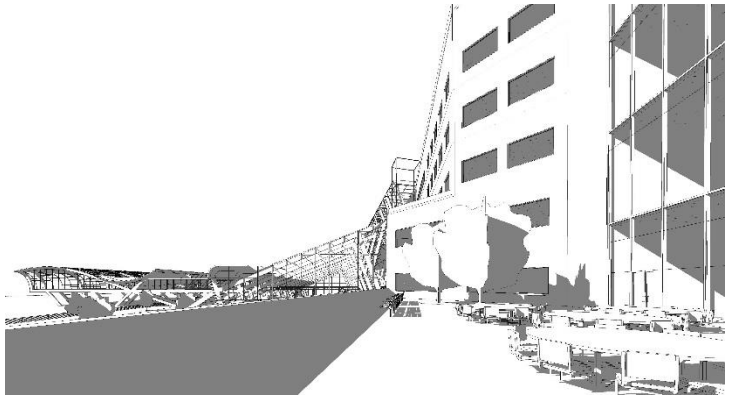

Figure 88: Green Roof Space for Office Users

Figure 89: Vertical Circulation in the West Atrium

Riverside Station Design Solution

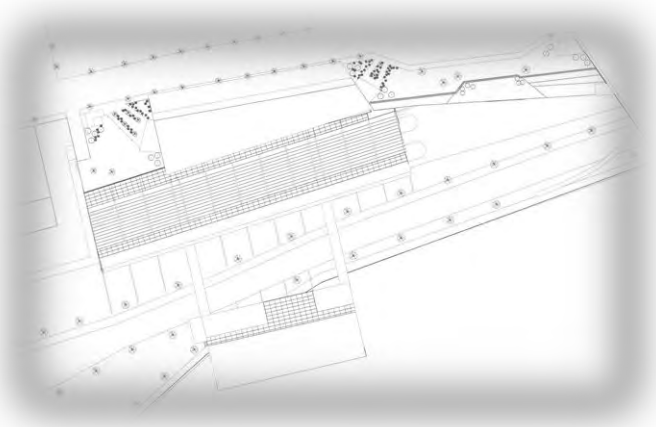

Figure 90: Station Site plan

Reconnecting the Urban and Natural Environments

There is an existing void between the urban downtown fabric of St. Paul and its natural surroundings. Because of the research conducted on the benefits of green space in the city, it was important that this design bring these elements into the everyday workings of the site. The first goal was to create a connection to the riverside so that pedestrians could more easily access the riverside walkway from downtown.

The station design features glass on the southern side that orients people using the space to the riverside and creates a strong focus on the natural side of St. Paul. The design then reaches out over the river in order to create an event space that hovers over the Mississippi River. This space would be used by anyone living, working or visiting the Twin Cities area. The station not only acknowledges the riverfront through its design, but it actually give people direct access to the water. From the second floor mall spaces, pedestrians can utilize an outdoor bridge that safely transports them over Shepard Road and the train tracks to the riverfront walkway. People could now easily enjoy these beautiful outdoor spaces while shopping at the station, during lunch breaks, or while waiting for their next train. Also, for pedestrians not using the station but still wanting to access the riverfront, a pedestrian elevator along Wabasha Bridge integrates with the design. This large elevator could transport people along with recreational equipment such as bikes down to the water's edge.

Figure 91: Riverside Park View of the Station

The design also brings green space back to this site. Green roofs are an integral part of the design as a passive system and an element that can be enjoyed by users of the space. The office portion of the design features an accessible green roof that can be enjoyed by employees in the station. The dining on the fifth level features an outdoor balcony overlooking the station and Mississippi River. The roofs of the parking and office structures are green roofs that become urban park space for downtown St. Paul as well as acting as an entry condition for the east and west ends of the station. Along with exterior green space, the design feature interior park spaces. The interior parks feature foliage native to Minnesota and are an element that will create a sense of place. Visitors coming to Minnesota for the first time will be presented with the natural elements that make this area of the United States so unique. These spaces also work to create an enjoyable indoor atmosphere during the winter months for people living and working in downtown St. Paul.

The design also mitigates its negative effect on the natural environment by implementing passive systems. The roof design collects runoff water into cisterns which can then be used within the building. Roof overhangs and solar shades help to keep heat out in the summer months, meanwhile the glass southern façade lets in plenty of sunlight in the winter. The green roofs also act as passive elements that can be enjoyed by the public.

Figure 92: West Entrance Green Roof

Figure 93: Interior Green Space within the Retail Circulation.

Active Space

Another Important aspect of the project was the creation of a space that would embody the active, modern and futuristic aspects of high speed passenger trains. This station design will redefine the image of passenger trains in America by creating a space that is clean, welcoming and technological.

The structural system was one element of the design that contributes to the creation of an active space. The angular structure embodies energy and movement as it causes the human eye to travel across the spaces. These strong forms also pay tribute to the strong history of the train while also supporting a modern and clean glass façade that creates spaces that can be influenced by the activity occurring around the building. Another element used to create active space is the use of atrium spaces on either end of the station. The vertical circulation rises up through these spaces so that the vertical paths of movement are on display for all. Movement and activity were even brought into the details of the station in order to create an active character with many layers.

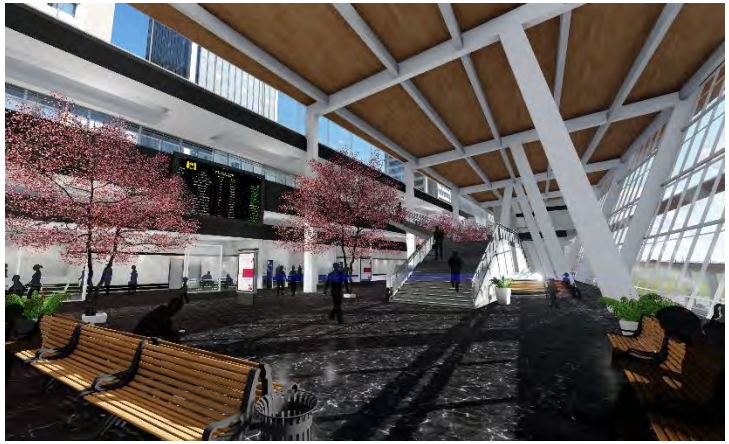

Figure 94: Great Hall Space

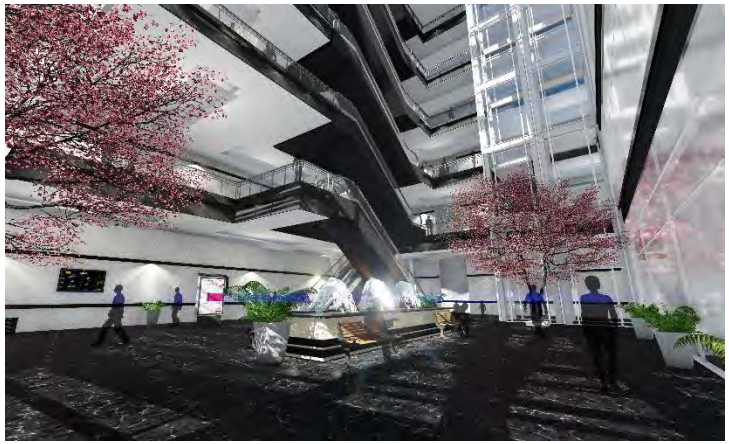

Figure 95: West Atrium with Vertical Circulation

Figure 96: Active Details in the Office Space

Figure 97: Pedestrian Bridge with Active Mullion Details

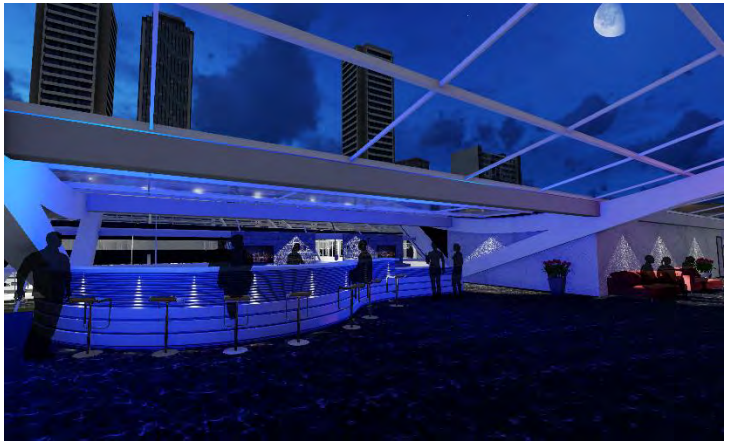

Figure 98: Evening at the Event Bar

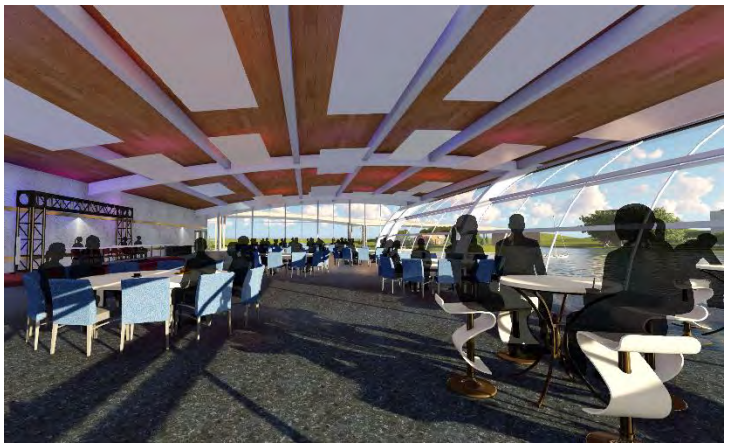

Figure 99: Wedding in the Event Center

Design Summary

When the program was written, a set of goals emerged for this design thesis. Those goals were based upon four main ideas including:

- Revitalization of the passenger rail in America
- Reconnecting the urban core of St. Paul to its natural surroundings
- Creation of a space whose architectural qualities embodied the active, modern and technological nature of the high speed passenger rail
- Creation of a design that strengthens St. Paul's connection to its greater national context.

The research conducted before the design of this thesis proved the validity of the passenger train in America. It showed that a revival in this mode of transportation is occurring on the east and west coast and that given time, this revival will impact the Midwest. Therefore, the station will breathe new life into downtown St. Paul by connecting the city to major cities all over the Midwest such as Rochester, Duluth, Fargo and Chicago. Connecting St. Paul to its greater national context will create a constant flow of traffic through the city, making it a healthier and livelier urban landscape.

The design elements outlined previously in the Riverside Station Design Solution show how the design meets the remaining two goals. The station uses structure, design details and intersecting paths of movement to create an architectural space that embodies the nature of the high speed train. Meanwhile the station incorporates the natural elements of the surrounding area through passive systems, view corridors, interior park spaces and enhanced site connectivity. All of these come together to create a place in the urban fabric that celebrates the natural beauty of St. Paul, Minnesota.

Riverside Station took four months of dedication and hard work to create a design solution that was appropriate and successful. The station features more than 700,000 square feet of designed space, 60 escalators, 12 elevators, and two passenger platforms that are 600 feet in length. The station was an enormous undertaking in the amount of time provided to design it. Although it is not perfect, the design of this station accomplished the goals put forth based upon the research and program. The design of this station takes a void in the urban fabric and fills it with life.

Building upon the revival of the passenger train in America, this design creates a partnership of mankind, nature and place through transportation.

Figure 71: Afternoon on the Passenger Platforms

Figure 100: Sunset over the Mississippi

About the Student

Previous Studio Experience

2nd Year Studio

Fall Semester: Stephen Wischer
- Tea House – Fargo, ND
- Boat House – Minneapolis, MN

Spring Semester: Rhet Fiskness
- Dance Studio – Moorhead, MN
- Sense Pavilion – Fargo, ND
- Culinary School – Rio de Janeiro, BRA

3rd Year Studio

Fall Semester: Milton Yergens
- Guitar Center – Healdsburg, CA
- Literary Center – Glasgow, SCT

Spring Semester: David Crutchfield
- Mid America Steel Office - Fargo, ND
- VOICE – Chicago, IL

4th Year Studio

Fall Semester: Bakr Aly Ahmed
- High Rise Project – San Francisco, CA

Spring Semester: Paul Gleye
- Inter Beton Urban Plan – Brussels, BEL

5th Year Studio

Fall Semester: Mark Barnhouse
- Wetlands Laboratory – Ulen, MN

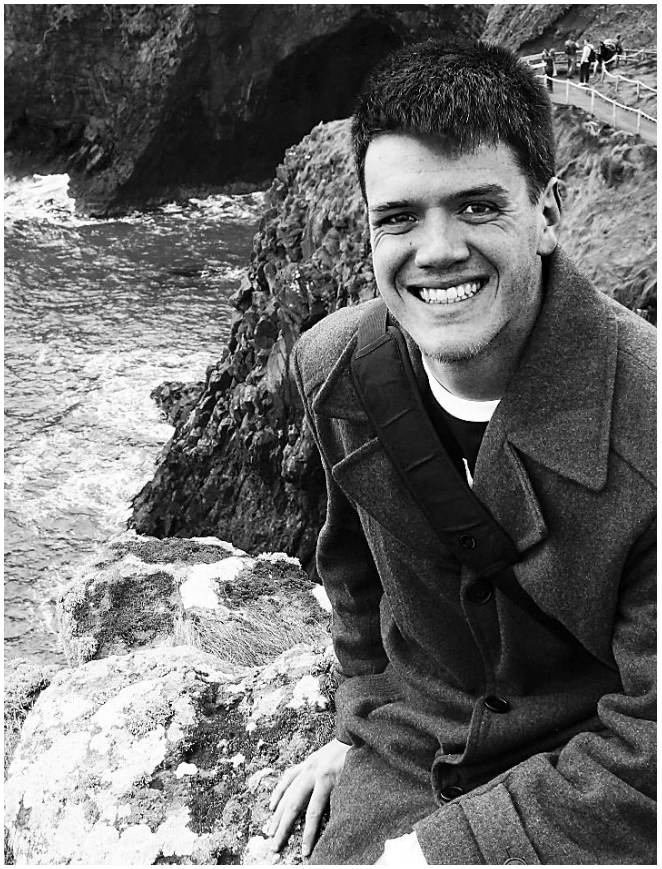

Figure 101: Portrait of Author

Justin M. Warner
Hometown – Lakeville, MN
Primary Email – justinmwarner81@gmail.com
Primary Phone – 952.288.6449

"From the time I first stepped onto campus as a freshman, the university has treated me with respect, dignity and genuine caring. I will be sure to show the same level of caring and respect to the people I work with as I move into the architectural profession."

Appendix

Reference List

Abbott, J. (2000). Louis Sullivan, Architectural Modernism, and the Creation of Democratic Space. *The American Sociologist,31*(1), 62-85.

Amtrak. (2013). *Amtrak: Station Program and Planning Guidelines*. Retrieved from http://www.nrvpassengerrail.org/resources/research/national/Amtrak_Station_Program_Planning_Guidelines.pdf

Amtrak. (2014). *Amtrak's Economic Contribution*. Retrieved from http://www.amtrak.com/ccurl/256/745/Amtrak-Economic-Contribution-Brochure-051915.pdf

Amtrak. (2015). *Amtrak National Facts: Basic Amtrak Facts.* Retrieved from http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1246041980246

Amtrak. (2015). *Long Distance Train Facts.* Retrieved from http://www.amtrak.com/ccurl/374/876/Long%20Distance%20Trains.pdf

American Public Transportation Association. (2012). *Opportunity Cost of Inaction: High-Speed Rail and High Performance Passenger Rail in the United States.* Retrieved from http://www.apta.com/resources/reportsandpublications/Documents/HPPR-Cost-of-Inaction.pdf

Chicago Department of Transportation (CDOT). (2012). *Chicago Union Station Master Plan*. Chicago IL.

Coleman, C. B. (2015). *Saint Paul 2015: The Most Livable City in America*. Retrieved from http://www.stpaul.gov/DocumentCenter/Home/View/9052

Encyclopaedia Britannica. (2014). *Saint Paul, Minnesota, United States*. Retrieved from http://www.britannica.com/place/Saint-Paul-Minnesota

Gaston J. Kevin, Irvine N. Katherine, Devine-Wright Patrick, & Warber L. Sara. (2013). Understanding Urban Green Space as a Health Resource: A Qualitative Comparison of Visit Motivation and Derived Effects among Park Users in Sheffield, UK. *International Journal of Environmental Research and Public Health, 10*(1), 417.

Kos, Drago. (2008). Nature in the city or the city in nature? *Urbani Izziv,* (19(2)), 129–132.

La Gare het Station. (2011). Welcome to Antwerp Central: *The Railway Cathedral of the 20th and 21st Century*. Brussels, BE. SNCB Holding.

Lomholt, Isabelle. (March, 2014). TGV Railway Station Belgium. Retrieved from http://www.e-architect.co.uk/belgium/liege-guillemins-tgv-railway-station

Maas, J., Verheij, R., Groenewegen, P., De Vries, S., & Spreeuwenberg, P. (2006). Green space, urbanity, and health: How strong is the relation? *Journal of Epidemiology and Community Health, 60*(7), 587-92.

Martin, Judith. (1984). If Baseball Can't Save Cities Anymore, What Can A Festival Market Do? *Journal of Cultural Geography,* 55, 1.

Melo, Frederick. (2015, May 30). A Last Look Inside former Ramsey County Jail, West Publishing. *Pioneer Press.* Retrieved from http://www.twincities.com/localnews/ci_28214609/st-paul-demolition-way-west-publishing-ramsey-county

Midwest High Speed Rail Association (2014). *Minnesota.* Retrieved from http://www.midwesthsr.org/minnesota

Minutillo, Josephine. (March, 2010). Liege-Guillemins TGV Railway Station: Santiago Calatrava's out-of-this-world high-speed-train station puts an ancient city back on the map. *Architectural Record.* Retrieved from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

National Association of Railroad Passengers. (2014). *Amtrak Fact Sheet: State Supported Sector*. Retrieved from https://www.narprail.org/our-issues/ridership-statistics/

National Association of Railroad Passengers. (2015). *Long Distance Trains: Multipurpose Mobility Machines.* Retrieved from https://www.narprail.org/site/assets/files/1036/nationalnetwork.pdf

National Association of Railroad Passengers. (2015). *NARP's Vision for Trains in America*. Retrieved from https://www.narprail.org/our-issues/narps-vision-for-trains-in-america/

Robinson, J. W. (1986). Design as exploration. *Design Studies*, *7*(2), 67-79. 10.1016/0142-694X(86)90019-0

Rosenfield, Karissa. (2015, Feb. 27). See BIG & Heatherwick's Design for Google's California Headquarters. *Arch Daily*. Retrieved from http://www.archdaily.com/603947/see-big-and-heatherwick-s-design-for-google-s-california-headquarters

Soul of America. (2015). *Interstate High-Speed Rail Progress – Part 1*. Retrieved from http://www.soulofamerica.com/blog/interstate-hsr-network/

Thi Thanh Hien Pham, & Dong-Chen He. (2008). How do People Perceive the City's Green Space? A View from Satellite Imagery (In Hanoi, Vietnam). *Geoscience and Remote Sensing Symposium, 2008. IGARSS 2008. IEEE International, 3*, III - 1228-III.

Union Station: Chicago. (2012). Room Specs. Retrieved from http://www.chicagounionstation.com/room_specs.html

United States Census Bureau. (2014). *Quick Facts United States: St. Paul, Minnesota.* Retrieved from http://quickfacts.census.gov/qfd/states/27/2758000.html?cssp=SERP

Wachs, M. (2013). Turning cities inside out: Transportation and the resurgence of downtowns in North America. *Transportation, 40*(6), 1159-1172. 10.1007/s11116-013-9501-6

Walsh, J. (2015, May 30). Ramsey County officials mark the beginning of demolition at former West, jail sites. *Star Tribune.* Retrieved from http://www.startribune.com/ramsey-county-officials-mark-the-beginning-of-demolition-at-former-west-jail-sites/305544311/#1

White, William H. (1980). Life of Plazas. *The Social Life of Small Urban Spaces.* (p. 16-23). The Conservation Foundation.

Wikipedia. (2015). History of Saint Paul, Minnesota. Retrieved from https://en.wikipedia.org/wiki/History_of_Saint_Paul,_Minnesota

Reference List Photos

(Aerial map of West and jail buildings). Created September 2, 2015 using https://www.mapbox.com/

(Antwerp Central Station). Retrieved October 6, 2015 from http://www.romania-insider.com/company-behind-the-railway-cathedral-in-antwerp-to-work-on-bucharests-gara-de-nord/68690/

(Antwerp Central Station Platforms). Retrieved September 18, 2015 from http://www.hotels-belgium.com/albums/antwerp/antwerp-104-centralstation.htm

(Atocha Station in Madrid, Spain). Retrieved October 28, 2015 from http://swimimingsuit.blogspot.com/2014/10/the-most-scenic-train-stations-of-world.html

(Baggage Carousel at Chicago Union). Taken October 31, 2015 in Chicago, Illinois.

(Chicago Union Baggage Check). Taken October 31, 2015 in Chicago, Illinois.

(Chicago Union Station). Retrieved October 6, 2015 from https://www.planning.org/greatplaces/spaces/2012/

(Commercial Space at Chicago Union Station). Taken October 31, 2015 in Chicago, Illinois.

(Conductor Helps Passengers Board). Retrieved October 14, 2015 from http://articles.dailypress.com/2011-06-26/news/dp-nws-amtrak-ridership-20110626_1_amtrak-ridership-amtrak-figures-passenger-rail

(Customer Services at Liege-Guillemins). Retrieved October 27, 2015 from http://www.fr.regus.be/locations/business-lounge/liege-guillemins-railway-station-regus-express

(Departure Board Showing Typical Destinations). Retrieved October 14, 2015 from http://www.paris-architecture.info/PA-080.htm

(Depth to Bedrock in downtown St. Paul). Retrieved December 4, 2015 from http://www.mngeo.state.mn.us/chouse/geology/county_regional.html

(Downtown Luxembourg City outlook). Taken April 26, 2015 in Luxembourg City, Luxembourg.

(Downtown St. Paul Built Elements). Created December 5, 2015 using https://www.mapbox.com/

(Downtown St. Paul Traffic at 9:00 AM on a Weekday). Created using https://www.google.com/maps

(Downtown St. Paul Traffic at 12:00 PM on a Weekday). Created using https://www.google.com/maps

((Downtown St. Paul Traffic at 4:30 PM on a Weekday). Created using https://www.google.com/maps

(Exposed bluffs to the east of the site). Taken September 7, 2015 in St. Paul, Minnesota.

(Exterior of Google Headquarters). Retrieved November 22, 2015 from http://www.archdaily.com/603947/see-big-and-heatherwick-s-design-for-google-s-california-headquarters

(Flash Mob in Antwerp Central Station). Retrieved October 28, 2015 from http://www.stikkymedia.com/blog/while-lipdubs-reach-new-heights-awesomeness-flash-mobs-wreak-havoc

(Future Google Headquarters in California). Retrieved November 22, 2015 from http://www.archdaily.com/603947/see-big-and-heatherwick-s-design-for-google-s-california-headquarters

(Golden Pass Scenic Train). Retrieved September 7, 2015 from http://www.europerailstar.com/plan-your-trip/

(Grand Central Terminal). Retrieved October 14, 2015 from https://en.wikipedia.org/wiki/Grand_Central_Terminal

(Green Space in Amsterdam Schiphol Airport). Retrieved October 27, 2015 from http://www.psfk.com/2011/06/amsterdams-new-airport-park-pics.html

Holt, Jerry. (St. Paul Saints Stadium). Retrieved October 14, 2015 from http://www.startribune.com/st-paul-saints-new-ballpark-gets-high-marks-for-sustainability/304062301/#8

(James J. Hill). Retrieved September 5, 2015 from http://www.railroads-of-montana.com/Marias_Pass.htm

(Liege-Guillemins TGV Railway Station Exterior (1)). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Liege-Guillemins TGV Railway Station Exterior (2)). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Liege-Guillemins TGV Railway Station Retail). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Liege-Guillemins TGV Railway Station Plan). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Liege-Guillemins TGV Railway Station Platforms). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Liege-Guillemins TGV Railway Station Section). Retrieved October 11, 2015 from http://archrecord.construction.com/projects/bts/archives/transportation/10_TGV_Railway_Station/default.asp?bts=TR

(Light Rail Line in Minneapolis). Retrieved October 28, 2015 from http://www.burandoburando.net/light-rail-minneapolis-park-and-ride-extraordinary-proposed-light-rail-transit/

(Looking east of the site underneath Wabasha Bridge). Taken September 7, 2015 in St. Paul, Minnesota.

(Looking north of the site down St. Peter St.). Taken September 7, 2015 in St. Paul, Minnesota.

(Looking south across the Mississippi River at Harriet Island). Taken September 7, 2015 in St. Paul, Minnesota.

(Looking west of the site at the Smith Ave. S. Bridge). Taken September 7, 2015 in St. Paul, Minnesota.

(Midwestern Annual Average Temperatures). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Midwestern Average Heating and Cooling Periods). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Midwestern Average Hours of Daylight). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Midwestern Average Relative Humidity). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Midwestern Basic Climate Condition). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Minnesota Annual Precipitation Averages). Retrieved December 2, 2015 from http://climate.umn.edu/img/normals/81-10_precip/81-10_precip_norm_annual.htm

(Morning on the Platform). Taken March 7, 2015 in Frankfurt, Germany.

(NARP's Vision of a Passenger Train Network). Retrieved November 18, 2015 from https://www.narprail.org/our-issues/narps-vision-for-trains-in-america/

(Natural Areas surrounding the site). Created November 28, 2015 using Photoshop.

(Percentage of African American citizens in St. Paul, MN). Retrieved December 1, 2015 from http://www.census.gov/

(Percentage of Asian citizens in St. Paul, MN). Retrieved December 1, 2015 from http://www.census.gov/

(Percentage of Hispanic citizens in St. Paul, MN). Retrieved December 1, 2015 from http://www.census.gov/

(Section of the Headhouse and Concourse). Retrieved October 6, 2015 from https://chicagology.com/1920buildings/unionstation/

(Soils Map of downtown St. Paul, MN). Retrieved December 4, 2015 from http://www.mngeo.state.mn.us/chouse/geology/county_regional.html

(Solar Diagram for 44 Degrees North Latitude). Retrieved December 8, 2015 from Heating, Cooling, Lighting: Sustainable Design Methods for Architects.

(Solar Diagram Site Overlay). Created December 4, 2015 using Photoshop.

(Station Level Plan of the Headhouse and Concourse). Retrieved October 6, 2015 from https://chicagology.com/1920buildings/unionstation/

(St. Paul's West Publishing Site in 1964). Retrieved December 2, 2015 from https://www.minnpost.com/politics-policy/2015/05/downtown-st-paul-if-you-unbuild-it-will-they-come

(The Great Hall of Chicago Union Station). Retrieved October 3, 2015 from http://trainweb.org/henrykisor/Zephyr/

(Twin Cities Aerial). Created September 2, 2015 using https://www.mapbox.com/

(View Corridor of downtown looking north on the site). Taken September 7, 2015 in St. Paul, Minnesota.

(View from Wabasha Bridge looking east). Taken September 7, 2015 in St. Paul, Minnesota.

(View from Wabasha Bridge looking west). Taken September 7, 2015 in St. Paul, Minnesota.

(Wabasha Street in 1909). Retrieved November 12, 2015 from http://www.shorpy.com/node/10124?size=_original

(West Publishing). Taken August 12, 2015 in St. Paul, Minnesota.

(West Publishing buildings and downtown St. Paul, MN). Taken September 7, 2015 in St. Paul, Minnesota.