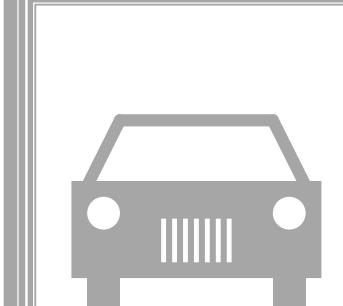
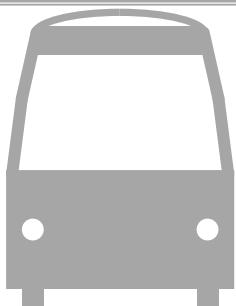
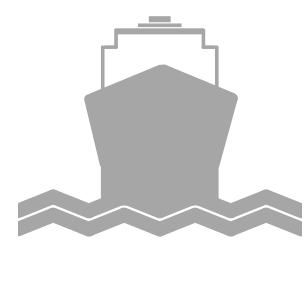
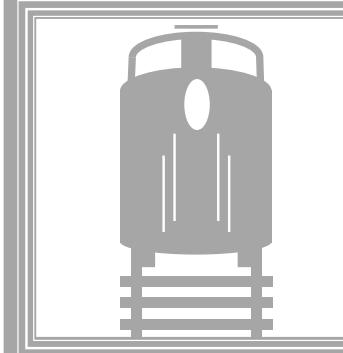
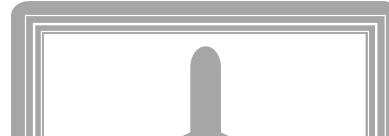
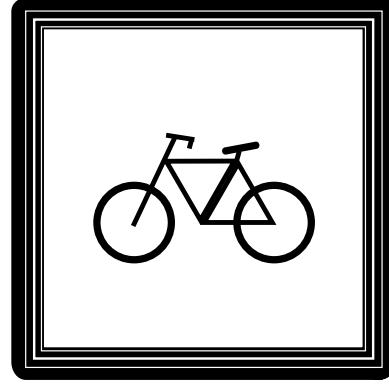
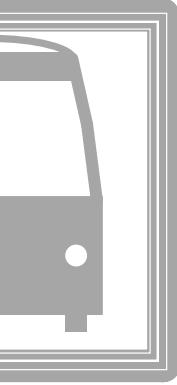
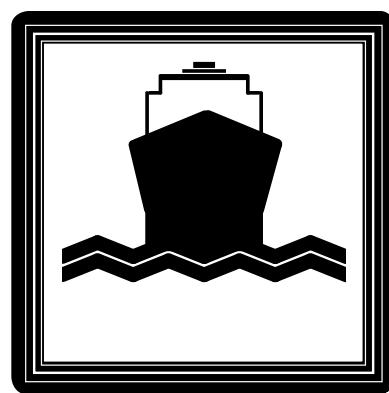
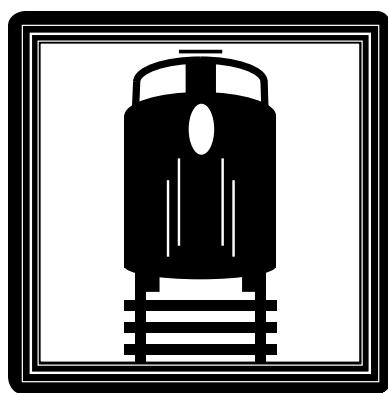
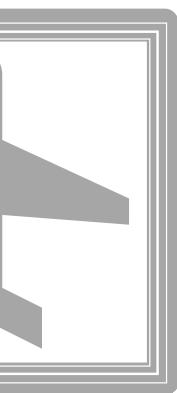


TRANSPORTATION AND ARCHITECTURE: Who Influences Who

Kevin Zachman







Cover image: flickr.com
User: Jhaglin
Title: Piedmont, Duluth MN

TRANSPORTATION AND ARCHITECTURE: WHO INFLUENCES WHO

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

By

Kevin Zachman

In Partial Fulfilment of the Requirements for the Degree of Master of Architecture

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Primary Thesis Advisor

Thomas M. Remstrom 4/12/2010

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May 2010
Fargo, North Dakota



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Date May 2010



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ABSTRACT:

Transportation and Architecture; Who Influences Whom

This thesis provides some answers to the question: how do the advances of technology in the transportation infrastructure predestine how one designs the built environment? The Typology for the examination of this problem is a multimodal transit station. The Theoretical Premise/Unifying Idea that guides the research is the built environment needs to be the forerunner subjecting the transportation infrastructure to the needs of the built environment. The Project Justification is Advances in transportation technology or simply a new development, for better or worse change the mode by which we get there. A cumulative approach with a focus on the built environment provides a better functioning city or town environment.

Planes, trains and automobiles. There are three forms of travel, some obviously are used more than the others. Throughout recent history (the last 50-100 years) the three transportation industries have battled one another for a public buy in. The automobile has gained most support and respect despite its advancement. Reasons are one's own for their interest in the automobile. However, for better or worse, the automobile and its infrastructure, dictates over the organization of the built environment.



STATEMENT OF INTENT

Abstract Continued:

The users will largely be travelers to and from the Duluth area in northern Minnesota. The client and financier is the government on local, state and national levels. The major project elements are those concerning a transit station, visitor center, multi-mode transportation center, and parking garage.

The site is located near the Historic Depot in Duluth, MN off of Lake Superior. This thesis emphasizes the exploration of the relationship the transportation infrastructure has in defining our cities and towns. It does this by looking at urban issues across the board: travel, food, novelties, rental vehicles, parks, parking, and pedestrian ways, to name a few. The building is 70,550 square feet, with a 360 stall parking garage and 4.5 acres of park.

Keywords:

architecture, bicycle, built environment, bus stop, car, high-speed rail, multimodal transit, nodes, park and ride, parking, pedestrian, segway, transportation, transit hub, transit station, urban form





STATEMENT OF INTENT

THE PROBLEM STATEMENT:

How do the advances of technology in the transportation infrastructure predestine how one designs and shapes the built environment at the junctions where they meet?





STATEMENT OF INTENT

THE STATEMENT OF INTENT





STATEMENT OF INTENT

STATEMENT OF INTENT:

Typology:

Multi-Modal Transit Hub

Theoretical Premise/ Unifying Idea. The Claim:

The influence of conditions set by the transportation infrastructure often dictates the design of the built environment at the junction of the two (the infrastructure and the built environment,) the node.

Premises:

The transportation infrastructure allows the transfer of people, products and resources from point A to point B, the endpoints or nodes of a transit system.

Transportation infrastructure lies within the right of way which ultimately influences the design and shape of what happens at the nodes.

Built environments at those nodes must adapt to the demands and changes within the transportation infrastructure for a seamless society to function within the built environment.

The transportation infrastructure ultimately influences a set of conditions upon the built environment at the nodes.

Theoretical Premise/ Unifying Idea:

The built environment needs to be the forerunner subjecting the transportation infrastructure to the needs of the built environment.

The Project Justification:

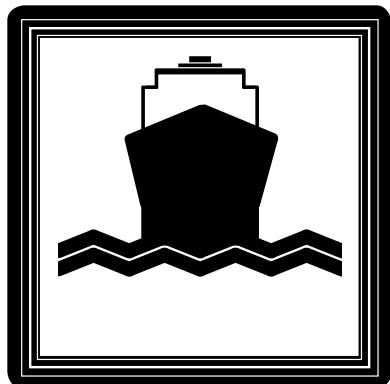
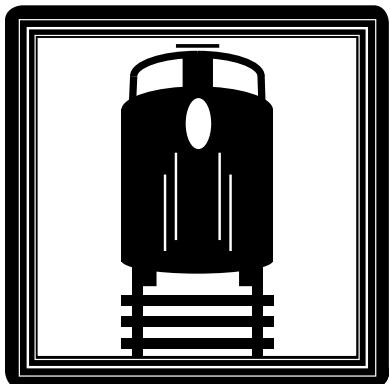
Advances in transportation technology or simply a new development, for better or worse encroach the size and access of an urban site as well as the mode by which we get there. A cumulative approach with a focus on the built environment at these nodes provides a better functioning city or town environment.





THE PROPOSAL

THE PROPOSAL

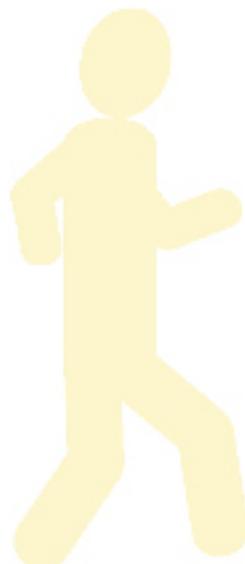


THE NARRATIVE:

Planes, trains and automobiles, three forms of travel; some obviously are used more than the others. Throughout recent history (the last 50-100 years,) the three transportation industries have battled one another for a public buy in. The automobile has gained most support and respect despite its advancement. Reasons are one's own for their interest in the automobile. However, for better or worse, the automobile and it's infrastructure, the current leader in transportation, dictates over the organization of the built environment and the junctions between them.

Transportation infrastructure is a question of mobility, how one moves about. Transportation moves people and goods from point A to point B. There are a couple of issues that always come up when one talks about transportation, cost, safety and who it applies to. When one hopes in a system, there is a lot of money on the line. However, when a system is highly successful there is opportunity for mobile freedom for years to come. That becomes more important when conventional modes become obsolete or too expensive. Could there be a smarter way to deal with transportation? Are multiple modes better than a single (monopoly) mode?

The influence of said infrastructure predetermines a specific outcome. It becomes a framework or organization method supposing other elements. Could there be ways that provide a more flexible organization that integrates multiple modes?



THE PROPOSAL

Transportation infrastructure becomes part of the make-up of the built environment. It is the place where we live, eat, sleep, play etcetera. Ultimately, it is the fabric in which we inhabit or dwell. One deals with it every day, sometimes structuring their day, life, and routines. Does the built environment have to be subjected to reacting to the advances of technologies in its make-up?

These advances in technology culminate in a dictation of how our cities are laid out. It has become the status quo that other modes are overruled by the infrastructure of the automobile. However a city is planned or driven, it does not take responsibility. Are we forgetting to consider the implications this has on our environments, social lives, economy, health, and future?

Is it possible to create a better built environment? Let us say we reverse the roles of the transportation infrastructure with the built environment. In which case, the built environment subjects the transportation infrastructure. This would provide precedence toward the environment, social interaction, health, and the economy. Will that be a vision toward a better future in our functioning cities and towns. These questions are the underlying basis for the research into the character of the theoretical premise/unifying idea.

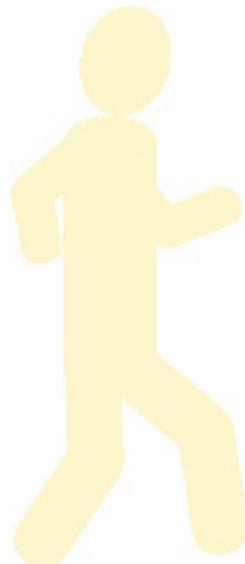


'THE USER CLIENT DESCRIPTION:

The users of this facility will vary in multiple levels. Primarily, it will serve the Duluth citizens, workforce, and visitors. Secondly, the facility will serve the Twin Cities (MSP) area citizens, workforce, and visitors. The other two levels have a potential for users in the upper Midwest and lastly, users from across the nation. These are potential users pending a National High Speed Rail System.

The client, those who will be financing the facility, will include: the city of Duluth, the state of Minnesota, and the U.S. Federal Government. The station is supported in that order of financial input.

Transportation Economics & Management Systems, Inc. (TEMS) has projected 3,000+ users per day on the Northern Lights Express from Minneapolis to Duluth. This shows great potential to send a large amount of users through this facility. Peak user hours are mornings and evenings for businesses and seasonally for visitors or tourists.



MAJOR PROJECT ELEMENTS:

Transit Station
 Loading/Unloading
 Tickets
 Security/Turnstiles
 Rest rooms
 Mechanical

Visitor Center
 Info Kiosk
 Gift Shop

Local Multi-mode Transit
 Info Kiosk
 Car Rental Storage
 Segway Rental Storage
 Other modes Storage
 Bus Stop

Link to Skywalk
Coffee Shop
Deli
Restaurant/Bar
Parking Garage

Maintain min. 325 for DECC
Parking for travelers from Duluth area.

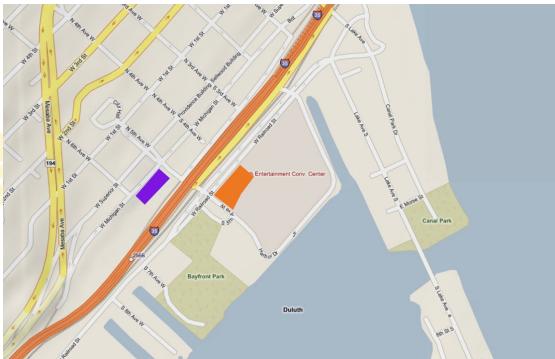
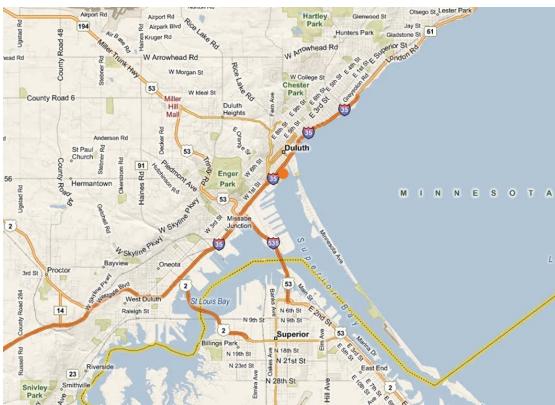


SITE INFORMATION:

Region- Upper Midwest

City-Duluth, MN

Site- A portion of the Duluth Entertainment Convention Center (DECC) parking lot



This site (orange) was chosen because of its location and convenience to a cultural entertainment and tourist center in Duluth. First, it is conveniently located near the BNSF right-of-way, which is important for a high speed rail line. Along with that, it is near the Historic Depot (in purple.) With emphasis towards transportation, it was important and appropriate to be able to link to the skywalk which ends in the DECC.

This site also was of interest because of local circumstances. The proposed site is located in the Duluth Harbor, and it is likely to have a concern about the water table. Also, the harbor implies a specific foundation.

The site is bound by Railroad St. (which runs beside interstate 35) and 5th Ave. West, as well as being bound by the DECC.

Transportation around the site includes streets, roads, interstate, skywalk, and high-speed rail to Minneapolis.

Landmarks and tourist attractions are numerous. Adjacent to the site are: Bayfront Park, Great Lakes Aquarium, The Depot, William Irvin Ship. Other major local attractions include: the Aerial Lift Bridge, Canal Park, Grandma's Saloon and grill, and Enger Tower, to name a few.

Source: Google Maps, Bing Maps, <http://www.decc.org/>

THE PROPOSAL

PROJECT EMPHASIS:

This thesis will look into the relationship between transit and architecture, particularly at the nodes of a transit line. The focus is on the influence they have on our cities and towns. Studying this at the node is important because it is the first impression of the city or town. At this level it is possible to see which entity dictates over the other. The hope is to study the direct relationship between transit and architecture, setting up possibilities of study in employing smarter transportation to better the function of our cities and towns with the least overall negative impacts.

THE PLAN FOR PROCEEDING:

Research will be conducted in the following areas: The theoretical premise/ Unifying idea- The built environment needs to be the forerunner subjecting the transportation infrastructure to the needs of the built environment, the project typology- transit station, the historical context of transportation, site analysis in Duluth, Mn, and programmatic requirements. These are the direct lines of inquiry that will drive the research.



A PLAN FOR YOUR DESIGN METHODOLOGY:

I will be using the mixed method, quantitative/qualitative approach.

I will follow the concurrent transformative strategy. The strategy will be guided by the three to four premises that the Theoretical Premise/Unifying Idea was developed from and that were discussed in the narrative.

Both the quantitative and the qualitative data will be gathered concurrently.

The priority of the research will be toward the positive or negative influence of transportation infrastructure on our cities and towns.

The integration of the data at several stages in the process of the research will depend on the requirements found in the examination of the premises.

The analysis, interpretation, and reporting will occur throughout the research process. The findings will be presented with both text and graphics.



THE PLAN FOR DOCUMENTING THE DESIGN PROCESS:

I plan to scan documents or take pictures and file them digitally. They will be preserved in their digital formats. I will include them at the end of this thesis document for future scholars. I will present the design process either on my boards or through a video animation. I plan on using a biweekly interval for documentation.





THE PROPOSAL

PREVIOUS STUDIO EXPERIENCE:

The Tea House
The Boat House
House for an Ecologist and Philosopher

Montessori School
Prairie Dance Academy

Inuit School
Pediatric Clinic

Chicago Archive Library
Downtown Redevelopment Project

Tehama Garden Towers
Cigar Box

Santo Domingo Urban Plan
A Kagera Village School and Center
Santo Domingo Housing/Market Project

Water Resource Experimentation Station

Transportation and Architecture;
Who Influences Whom

Second Year
Joan Vorderbruggen
Arch 271

Darryl Booker
Arch 272

Third Year
Steve Martens
Arch 371

Ron Ramsay
Arch 372

Fourth Year
Darryl Booker
Arch 471

Frank Kratky
Arch 472

Fifth Year
Mark Barnhouse
Arch 771

Joan Vorderbruggen
Arch 772





THE PROGRAM



RESEARCH RESULTS AND GOALS

Results from the Theoretical Premise or Unifying Idea

This thesis will look into the relationship between transit and architecture, particularly at the nodes of a transit line. The influence of conditions set by the transportation infrastructure often dictate the design of the built environment at the junction of the two, the node.

The focus here is on the influence they have on our cities and towns. At these nodes, or stations, is where one typically meets with the city. Similar to how the doorknob is the handshake to a home, the node is the handshake to the city. Studying this at the node is important because it is the first impression of the city or town. At this level it is possible to see which entity dictates over the other.

The built environment needs to be the forerunner,

subjecting the transportation infrastructure to the needs of the built environment. Advances in transportation technology or simply a new development, for better or worse, encroach the size and access of an urban site as well as the mode by which we get there. A cumulative approach with a focus on the built environment at these nodes provides a better functioning city or town environment greeting one to the city. The hope is to study the direct relationship between transit and architecture., to set up possibilities of study in employing smarter transportation to better the function of our cities and towns with the least overall negative impacts.

Research was conducted in the following areas: The theoretical premise/ Unifying idea- The built environment needs to be the forerunner subjecting the transportation infrastructure to the needs of the built environment, the project typology- a transit station, the historical context of transportation, site analysis in Duluth, Mn, and programmatic requirements. These were the direct lines of inquiry that drove the research. The questions drawn upon came from discussion of the theoretical premise. These questions were divided into four areas. One:

THE PROGRAM

is there a smarter way to deal with transportation, multiple mode integration? Two: could there be ways to provide a more flexible organization that integrates multiple modes? Three: does the built environment have to be subjected to reacting to the advances of technologies in its makeup? Fourth: are we forgetting to consider the implications this has on our environments, social lives, economy, health and future? These questions came to play into how the research was organized.

The first question of the research had a lot to do with human mobility: how we currently get around and what kind of options we have. The second question was concerned with how a multimodal system works within the city, looking to build up to how it influences. The third was to show if in fact there is an influence. The influence was found to be on a greater scale than expected. The last question was to focus in on the effects the current system has on the people, places, animals and others.

SMARTER WAYS TO DEAL WITH TRANSPORTATION

Are there smarter ways to deal with transportation? Or do multiple modes have better possibilities than single mode systems? These are some issues we need to be dealing with today before they become greater problems tomorrow. Across the globe we are finding that our current habits and design techniques are not working out, especially when it comes to transportation and the urban form. At this turning point in time we need to encourage rational designs that incorporate transportation. The designs need to show an importance toward multimodal transportation systems.

It is important to see where we are coming from. In recent history, architects have been trying to find a



niche in what they are supposed to design. Architects have been pushed around in terms of what they are supposed to include or not include in their scope of work. They have become more important to the buildings than perceiving the city as a whole or even architecture itself as collective, connective or shared (Safdie, 1997 pp.21). However, there has been more and more importance on the latter. The architecture begins to work as a web and transportation is what connects the web. The web is often too large to deal with; some would claim it infeasible, or too difficult to work with multiple parties.

The architects recent work has been refraining from full participation, to consider any area outside a given building lot or site

is beyond the sphere of an architect's influence. The focus is then on buildings or self-contained complexes (Safdie, 1997 pp.22). Doing this literally avoids the larger issue by designing in a smaller chasm, letting the city design itself. One could say that the modernists have allowed the city to be designed by a great force, the car, only to find a couple decades later, that it is not what they had anticipated (Safdie, 1997 pp.20). Call it poor design if you wish, it may be best described as a lack thereof. It simply begs for a more responsible approach.

Meanwhile, supported by a means of supply and demand, we see an attempt to grow. Business and industry try to capitalize on a 'market' and try to expand. It becomes apparent with our malls and freeways, which seem to feed off of each other. Together, the two of them have become major components in the public realm (Safdie, 1997 pp. 44). They have created mini (actually large in land coverage) city centers of themselves. Typically, each building is then surrounded by an expanse of parking lot. However, in our everyday lives we can only see a small sliver of it. Turn it on its side so it is seen from the air, and the extent of it is fully exposed.

THE PROGRAM

One will see an expanse of asphalt, a plethora of parking (Wells, 1999 pp.16). Too much parking can actually encourage poor driving habits and cause greater traffic congestion (Revell, 2009). Also, from an aerial view one can see how the freeways are laid out. It looks like they connected the dots. Freeway alignments are almost purely based on aerial photos, where optimal routes are picked (Safdie, 1997 pp. 105). One can also see the expanse of space used by its cloverleaf ramps. This calls for a better way to deal with how we get around.

We are a mobile society in our car, on a plane, train, in an elevator or even simply walking. Transportation has been a great concern in our cities for quite some time. As we recognize the development of vast new urban forms, and see our limited ability to move around them with ease, “we might find the current need to reexamine the city coincides with a time of extraordinary potential for innovation” (Safdie, 1997 pp. 132).

Today’s problems will guide us to a better future driving design, innovation, and engineering. We will be using new technologies or old technologies in new ways to solve our problems. New technology

allows for positive change in the build environment (Transit Research Board, 1991 pp.11). However, we typically over engineer to try to fix or prevent problems, the problems then, in turn, get bigger. We start making systems more vast and large to siphon the crowds through. The cycle just continues.

We need to evaluate the assumptions that lead us to “super scaled” places (Safdie, 1997 pp. 92). Instead of making things bigger, we should ask ourselves why. Why are people making so many trips? What can we do to eliminate some of those trips? Although, it is true to all design and architecture, always thinking bigger is better. Everything gets scaled up and we lose ourselves, we lose the relationship to the spaces around us. Humans need



to be able to orient themselves. If the environments are more comparable to their bodies then they are better able to project themselves into their surroundings. We need to reason with how it all comes together and make sense of the purpose of such a system. By rationalizing our transportation systems, we will create the opportunity for a new kind of city (Safdie, 1997 pp. 120).

Our cities are made up of a number of people, each with their own beliefs, customs, way of life, etcetera. This goes to show that our cities are a vast collection of diversity. These diverse environments and ways of life require opportunity for choice (Safdie, 1997 pp. 135). It only makes sense for a call to design in such an environment to

have diverse options. Even Moshe Safdie, author of *The City after the Automobile*, claims there is no single method that will be the golden breakthrough for transportation (Safdie, 1997 pp. 135). Most definitely requires a design aspect, otherwise there would be mass chaos and confusion. One would be stuck complaining about traffic. Cities will need thorough design to bring together all the aspects of social, economic, environmental, into an integration of systems. When one designs, it needs to be designed as an extension of the street (Safdie, 1997 pp. 49). In the past, public forum, interaction and markets would have taken place in the streets. The automobile has changed this mindset of the street. “Spontaneous, unplanned, physical interactions are the essential stuff of life; it makes for a better and richer society,” and since we have revamped the notion of the street, we have lost this (Safdie, 1997 pp. 31). We need to do every thing in our power to redesign an urban structure that fosters stimulating and vital interactive cities.

THE PROGRAM

FLEXIBLE ORGANIZATION TO INTEGRATE MULTIPLE MODES

Could there be ways to provide a more flexible organization that integrates multiple modes? As seen above, multiple modes of transportation are very important. It makes for dynamic and interesting city centers. Poor design or no design at all only lends itself to dysfunctional systems. This is a call to action for architects, planners, and engineers to design and rationalize what is going to be constructed. The motive, will lead to successfully designed city centers.

As mentioned earlier, there is no single method that will be the golden breakthrough for transportation (Safdie, 1997 pp. 135). That is why multimodal transportation is necessary. Especially with the diverse populations and ways of life, the opportunity for choice is very important. One should not confuse multimodal transportation with healthy competition. Competition within transportation allows for options as well as maintaining low fares. Multimodal transportation implies an interaction. The competition between the automobile and other

means of transportation is the most obvious type of interaction (Childs, 1999 pp. 33). Although, out of the options in multimodal transportation, most people would complain about mass transit; it adds another leg to the trip. Generally, it is resisted by those who have the ‘luxury’ to choose (Safdie, 1997 pp. 131). What people often forget is that they then lose the social interaction and time when there is traffic congestion.

That alone should cause necessity for better design within multimodal systems. The design will help minimize the commotion of an extra leg of the trip. Since proper pedestrian linkages are often forgotten, they must have an emphasis in the design so that they do not get lost (Transit Research Board, 1991 pp.118). It is transfers then that are what burden us the most.



They need to mesh seamlessly so that one can transfer effortlessly (Safdie, 1997 pp. 145). One could also incorporate kiss and ride/walk systems. These place priority on the pedestrian, not a catchment of the car. We often think of how an automobile will enter a site and never how a person will have access and egress from the site on foot. This is the catchment we want, a catchment of people (Childs, 1999 pp. 89).

One of the more important factors of multimodal systems is the integration of transit systems with the ease of pedestrian movement. Basically, it is creating links of systems in a large network where the pedestrian activity is a major component. It should help provide travelers with a variety of transportation options (Revell, 2009). Historically,

pedestrians, bicycles, and carriages have been a part of rail suburbs. That idea needs to come back and be a primary design consideration that supports characteristics in a multimodal transportation system. In this system; transfer nodes become an important aspect as they would be the transfer points between transportation modes (Safdie, 1997 pp. 152). The nodes have great impacts; they are the crossings and junctions of people, mode and form. The uses of these nodes are important ways to integrate systems and provide the flexibility in organizing transit.

BUILT ENVIRONMENT SUBJECTED TO ADVANCES IN TECHNOLOGIES

Does the built environment have to be subjected to reacting to the advances of technologies that make up the built environment? There is evidence that this has been the case and some may go as far to say that the roles should be reversed. However, it is not that one is greater than the other or can even exist alone, the two need each other; it is based closely to a relationship between them. The built environment

and transportation feed off of each other. Ultimately, it comes down to proper design; complex systems with options must be planned out.

The streets had been used as a place to play, meet people, and sell goods. However, within our modern society in the advent of the car, the notion of the street has completely changed. Automobile traffic has required Americans to change their conception of the street from a public room to a place to drive (Childs, 1999 pp. 2). Anything but the automobile is considered alien in the street. In this emergence of the street there is less and less public interaction; as mentioned earlier, we need public interaction. Some would suggest that the “parceling of land, the size of blocks and the advent of the commercial strip with parking have all therefore been shaped in our modern cities by the dictates of vehicular mobility” (Safdie, 1997 pp. 126). As we see the strain and congestion on this system of the automobile, we attempt to fix it. In doing so, the system gets large and in some cases it squeezes parts of the city out.

As designers, we need to evaluate the assumptions that lead to super-scaled places and systems like our highways (Safdie, 1997 pp. 92).

Even when we provide something as simple and harmless as more parking, we are making it worse. It enables people to maintain the idea that there will be a place to park near their destination. This, in turn, means more people on the road causing more traffic congestion. Excess parking can encourage even greater reliance on personal automobiles as a matter of habit even when traffic congestion is at its worst (Revell, 2009).

There are a number of people who would say the roles of transportation and the built environment should be reversed. Currently, the transportation and site design join the scene as an afterthought. The selection of a site and the role of transportation have always been reversed (Safdie, 1997 pp. 120). We have worked



on the demand side of planning to alleviate congestion, and it is usually behind the curve of when it is needed. However, it may not need to be a complete reversal. There is a dynamic relationship between transportation and the built environment or urban form. One does not solely influence the other without being influenced by it itself. It is a flexible relationship that supports an evolution of different patterns of urban forms (Transit Cooperative Research Program, 1996 pp. 31). These two really feed off of each other just as the highways and the malls do.

Parking, for instance, is only an intricate piece. The various types of places to park interact with each other, with other means of transportation and with the buildings and the street

(Childs, 1999 pp. 33). It is a complex interaction even down to the instinctual parts of design. The site design and its relativity to the other parts play a role on the urban form. Michael Dyett confirms this in his essay Site Design and Its Relation to Urban Form, which is why traditional standards in some regions are in place for placement of a building on site. In fact, it is an integration of several elements of the city. In the public plaza, success is linked to the location of space and its relationship to the street (Childs, 1999 pp. 89). One could call it city weaving, to bring in places for people to interact or rest.

Again, transportation infrastructure helps determine our options by either enabling or constraining the way the city shapes itself. It is this interaction designed or otherwise, that has a relationship with property values, intensity of development, development around stations or nodes, and timing which may help accelerate development (Transit Cooperative Research Program, 1996 pp.26). One of these may include the ability of transportation to link employment centers. Ultimately, it comes down to proper design. While technology changes everyday, new technology allows for positive change

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in urban form. For example, high speed rail can connect metro areas and automatic vehicle control can allow closer vehicle spacing increasing the capacity of systems (Transit Research Board, 1991 pp.11). In this world of interconnectivity through the internet, a physical connection is important for world wide business options. We need to provide travelers with a variety of transportation options.

IMPLICATIONS ON ENVIRONMENTS, SOCIAL LIVES, ECONOMY, HEALTH AND FUTURE

Are we forgetting to consider the implications this has on our environments, social lives, economy, health and future? There are many things to consider when dealing with large systems. The environment has been on our minds for some time, however, do we take the time to look at it on another level? Even within the makeup of a place we forget about the reasons we enjoy a place and come back time and time again.

There are a number of implications transportation has on the environment, social lives,

economy, health and future. On the environment, we can talk about a number of different things. Take pollution for instance, there are air and water qualities, ozone depletion, and the list could go on. Anyone can argue one way or another as to what kind of transportation best; however one thing is for sure, people will still be traveling. Everyone has been pushing for eco-friendly products. The fact is the efficiency in our automobiles has been getting better. The problem is we are disrupting our ecosystems. Currently, the nature of transportation is a hard line that separates and divides. Until we can teleport or have any independent personal rapid transit devise, we are limited to hard lines and elevated systems.

As mentioned earlier, one can look at aerial photos and see how transportation is designed.



They weren't at least not with any rational. Freeway alignments have been mostly based on aerial photos for optimal routes and intersections. One begins to see a number of cloverleaves and malls spawn off. These two major components: highways and malls, rip through the landscapes having no dismay for ecosystems (Safdie, 1997 pp. 44). Hillsides have been flattened, valleys filled in, rivers have been fixed with culverts and filled over just for efficient construction (Safdie, 1997 pp. 105). Instead of flattening and filling in, the hills and valleys can be used to our advantage. They can be used to create dynamic and interesting cities (garden21). They can also help spur options within the multimodal transportation system. On a small scale, one can also see from above these

hard lines creating separations in the cloverleaves. Dividing ecosystems even more into islands and sub-regions, it makes one wonder what happens at the larger scale. Perhaps elevated systems are better?

The other implications get lumped together because they are closely related and fall within property values, intensity of development, areas around stations or nodes being developed, or timing which could accelerate development (Transit Cooperative Research Program, 1996 pp.26). All of which have to do with the quality of life now and into the future of a given area. A boost in development provides a boost in the regional economy. It then allows people to spend money. Typically, when people can spend money they would be more content. The development only proves that an area is growing. The

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use of money and development plays into the ability of an urban form to be great. It is up to the designers to create greatness through one's experience in these areas. The designer must promote an interactive center. Elements of personal psychology, well being, and social interaction promote successful places that people will want to come back to. People will want to come back if: they have a good time, time spent was efficient with low cost, there was diversity in options and flexibility, and if there were activities available to partake.



Conclusion

The research for this thesis has been supportive to the theoretical premise. Transportation and multiple modes are some of the issues we need to be dealing with today before they become greater problems tomorrow. Results have shown that across the globe we are finding that our current habits and design techniques are not working out, especially when it comes to transportation and the urban form. The research would suggest that at this turning point, we need to encourage rational designs that incorporate transportation. These designs need to show an importance toward multimodal transportation systems.

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The results above have shown that multiple modes of transportation are very important. It makes for dynamic and interesting city centers. Poor design or no design at all only lends itself to dysfunctional systems that deter people. The research has brought a call to action for architects, planners, engineers to design and rationalize what is going to be constructed. The motive of reason shall provide for successfully designed city centers.

There is evidence showing that the built environment has been subjected by transportation infrastructure and some may go as far to say that the roles should be reversed. However, contrary to the premise, it is not that one is greater than the other or that one can even exist alone. The two need each other. The research shows that it is based most closely to a relationship between the two of them. The built environment and transportation with its infrastructure feed off of each other. Ultimately, it comes down to proper design; complex systems with options must be planned out.

Conclusively, there are many things that need to be considered when dealing with large systems. The environment has been on our minds for some time; we know if we do not respect the environment, it will return to us in a worse form. The research asks us to take the time to look at the environmental issues on another level. The research also suggests other benefits in cultural, social, economical, aspects. Even within the makeup of a place, we forget about the reasons we enjoy a place and come back time and time again.

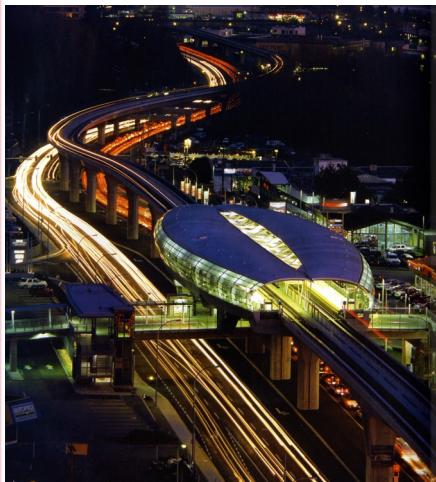


Metro Station Vancouver, Canada Busby + Associates

This project is a metro station for an overhead rapid-transit system in Vancouver, Canada. This project is relatively small compare to the others. The intent of this project was to be transparent to its users to avoid confusion as well as to attract new users to the transit

type. Some program elements include a platform, vertical circulation, a bridge, and a ramp to the parking garage.

What makes this project common to the others is its desire to relink a community and its attempt to offset users from the traffic congested automobile mindset. What makes this project different from others of this typology is that it not multimodal. Its



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basic element is a transit station. However, it has a pedestrian bridge incorporated to rejoin the city which is split by the highway.

This case responds to the site very well. Nearly its only option was to be elevated. The rail is elevated, and they needed to pass over the highway. The project is a tool to reconnect the city as well as be a catalyst for new transit options. The architects

were asked to create a town center piece to focus development.

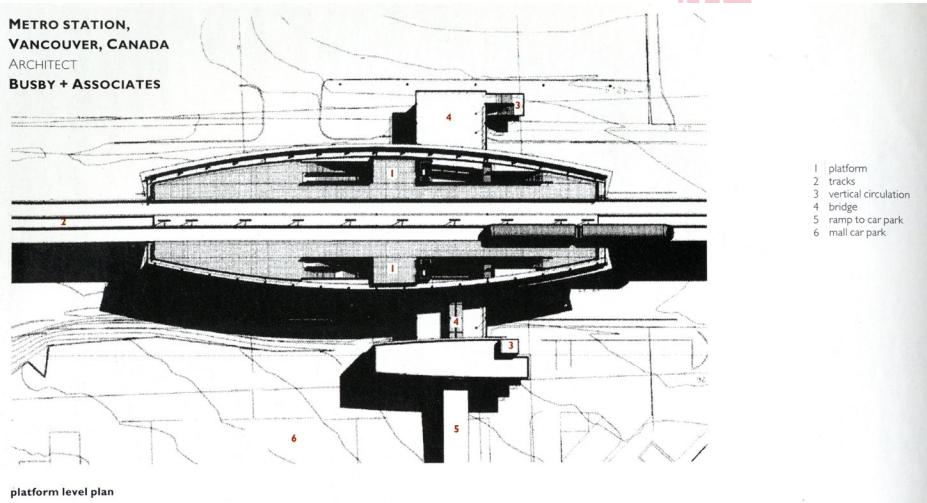


Metro Station Vancouver, Canada Busby + Associates

The conceptual underpinnings of this project are very successful. It has a potential to be an icon for the city. The convergence of parts on these axis have become very apparent in its

form. The station itself projects the feeling of being able to move along the tracks themselves.

The structure itself being elevated, sits atop large concrete columns. The structure of the facility is a combination of steel with glulam bents. It is one aired building with glass walls and softwood roof membrane. The building acts as a beacon of light

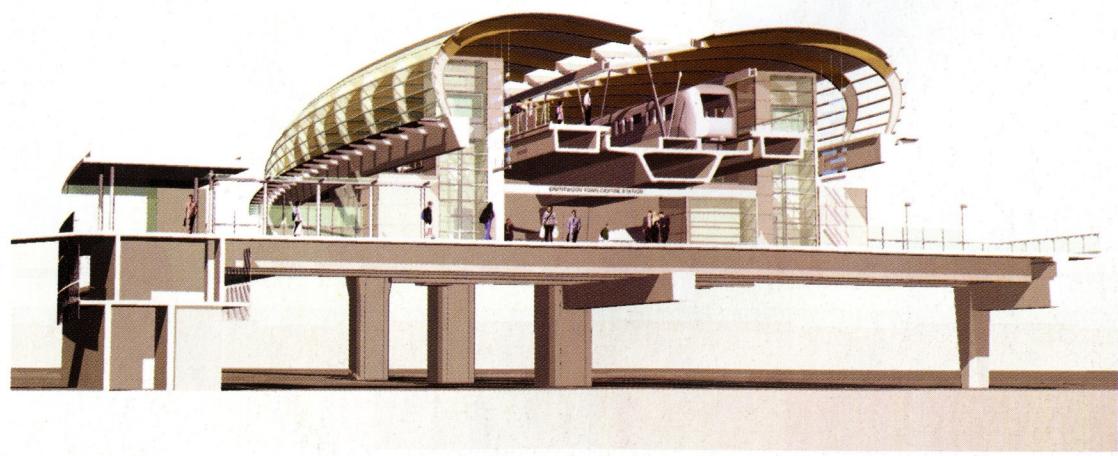


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at night and allows transparency for daylighting. It has a simple hierarchy where the platform resides at the highest point in the facility. The building is very symmetrical as a form that reads as a whole.

This case study shows the possibility to use the site and infrastructure conditions as an opportunity. It shows the infrastructure has influenced how things

happen in the city, however does not strictly influence the form. This would suggest again that they go hand in hand with each other, not just informing each other.



Underground Station

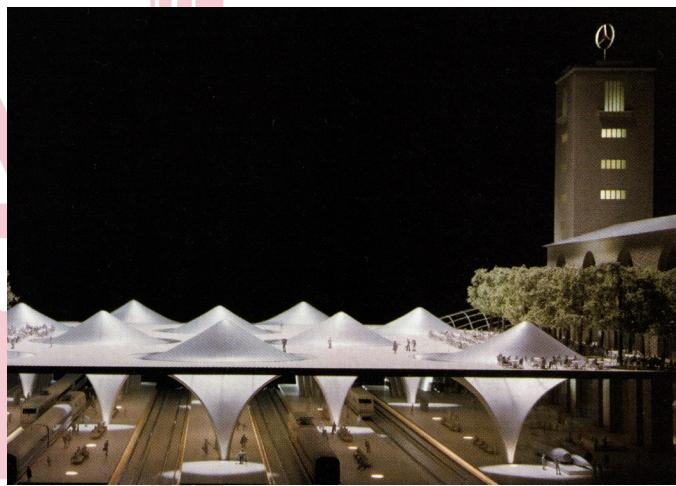
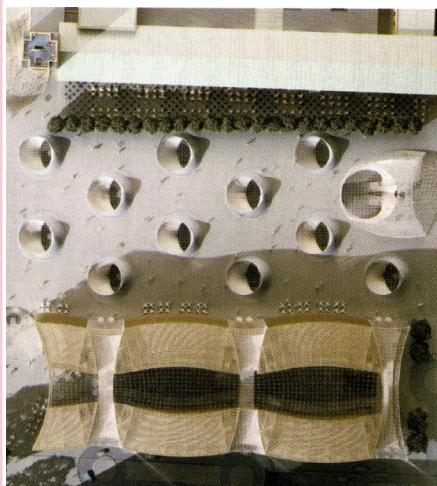
Stuttgart, Germany

Ingenhoven Overdiek & Partner

This is an underground station in Stuttgart, Germany. It is a very large station covering a town square. While this project still remains unbuilt, its most distinguishing feature is its large plaza which is pierced by 'light eyes' that form part of the structure. The program includes an underground train shed, a park on the roof, platforms, and a commercial development.

Like the previous case study, the architect of this rail station hopes to revitalize a town center. This project links two rail lines with the pedestrian. There is a stress in this project on the pedestrian creating linkages throughout while still incorporating a massive public park.

This project shows the importance of design integration of systems, pedestrians and urban fabric. With the ability to have retail development spill into the plaza to help establish an important relationship. This supports what was found in the research, there is a great relationship between infrastructure and urban form and not just one informing the other.



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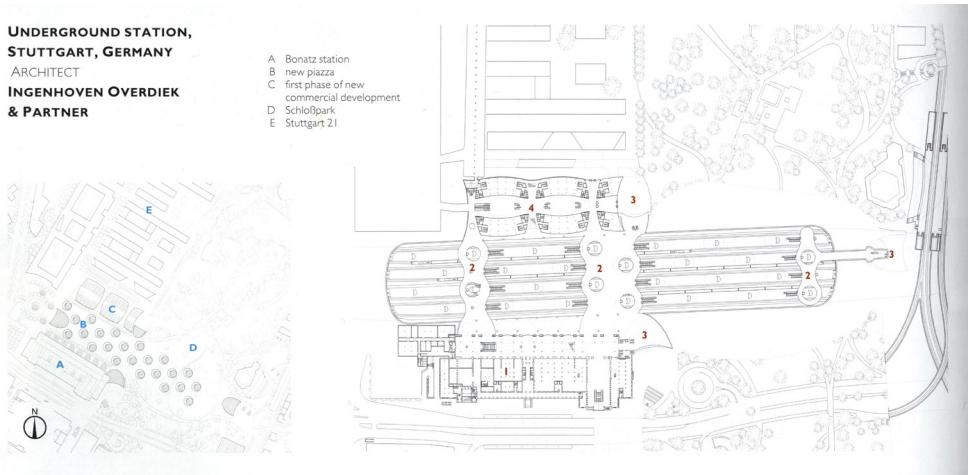


Underground Station Stuttgart, Germany

Ingenhoven Overdiek & Partner

UNDERGROUND STATION,
STUTTGART, GERMANY
ARCHITECT
INGENHOVEN OVERDIEK
& PARTNER

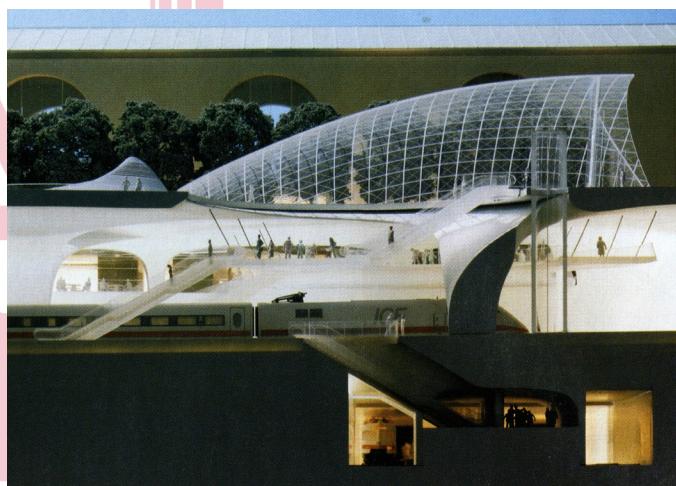
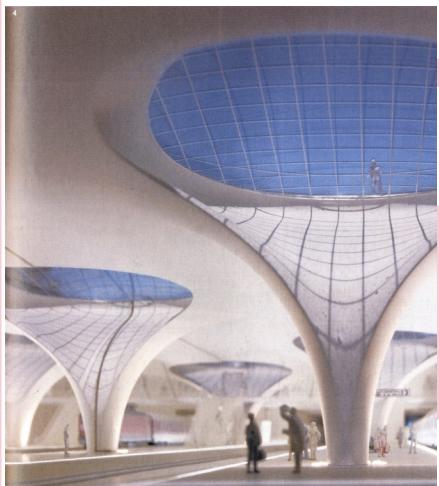
A Bonatz station
B new piazza
C first phase of new
commercial development
D Schlosspark
E Stuttgart 21



The park and 'light eyes', may in fact be its uncommon characteristic. It integrates the structure with the openings in the roof structure. Also, like the previous study, this structure is open aired. The architects pride themselves in a minimal energy consumption for the building, relying entirely on natural cross

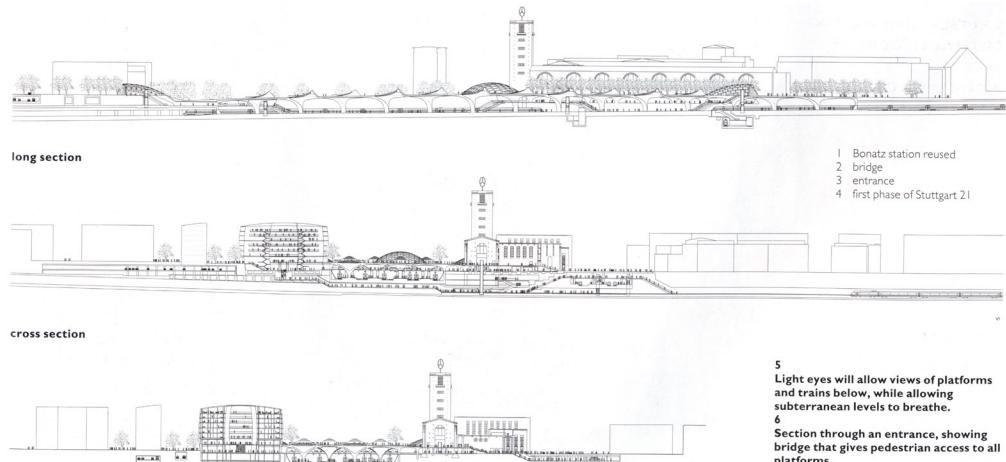
ventilation and daylighting. There is no need to heat or cool the building since the year-round average temp is fairly constant.

This project does a relatively good job of responding to the site. In regard to the environment, it consumes minimal energy. This project is looking at addressing social, cultural and economical realms. Creating a link to a line perpendicular to the current line is a hope to create a central hub. With new commercial development part of the design, there is



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Case Studies

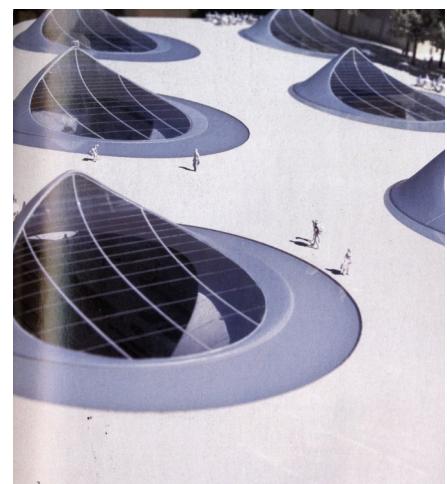
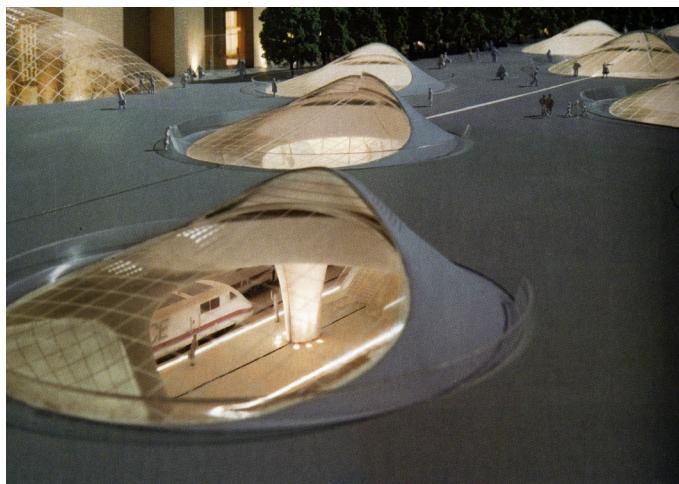


hope to reboot this city.

The conceptual underpinning for this design, the ‘light eye,’ is very unique. However, the idea of creating a plaza above the station is not. Chicago’s Millenium Park comes to mind, where the industrial train yard has been covered by a large park. This design does not show any green spaces on the plaza level; there are, however, trees.

The structure for this project is cast in place concrete in steel forms. Light seems to be optimized

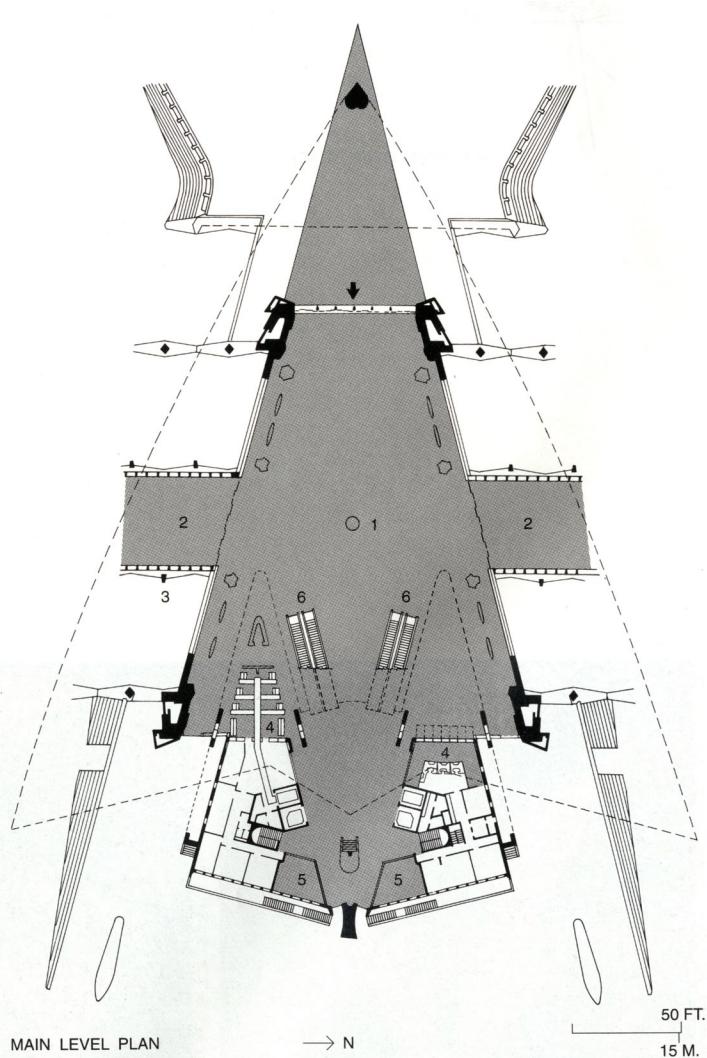
in this case study with the ‘light eyes.’ This project integrates itself into the city very nicely, reading as a whole. There are not any symmetries in the design, but the ‘light eyes’ present a pattern.



Lyon Airport Railway Station

Lyon, France

Calatrava Valls, Architect



This project is located in Lyon, France. It is nearly 5,000 square feet in size. Its distinguishing factor is perhaps its visual metaphor of an enormous bird with its wings stretched out. The programmatic elements include a main hall, station platforms, parking, a link to the airport, retail spaces and a mezzanine.

Research findings show that this project has similarities with those of its type. There are obvious items like the station platform, for instance. However, the large glassed atrium space of the main hall resembles those of history, the Pennsylvania Station in New York. The dynamic form here in Lyon sets it apart from the crystal cathedrals of the past. One characteristic that sets it apart from most stations is its rural setting several miles from Lyon city center.

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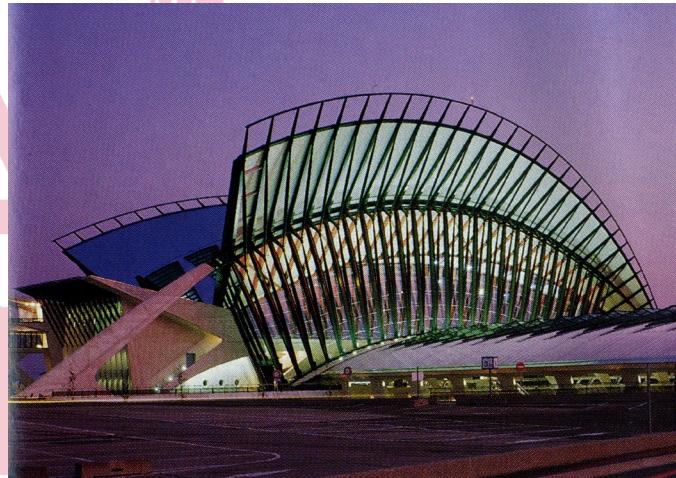
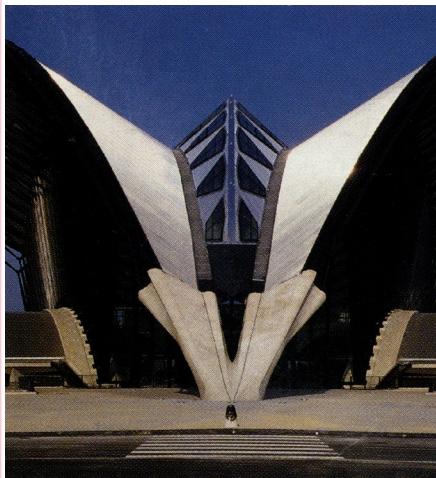
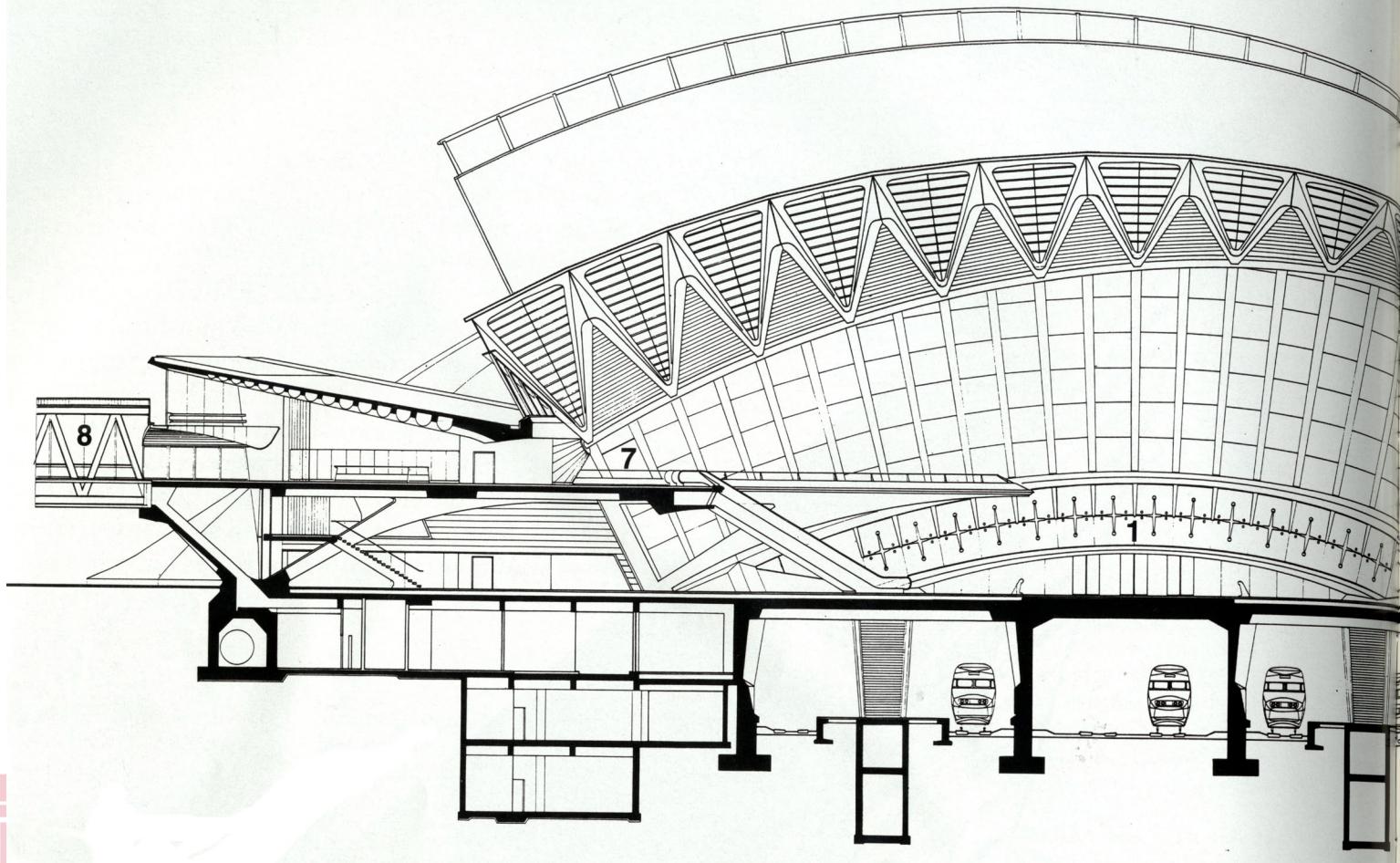
Case Studies



Lyon Airport Railway Station
Lyon, France
Calatrava Valls, Architect

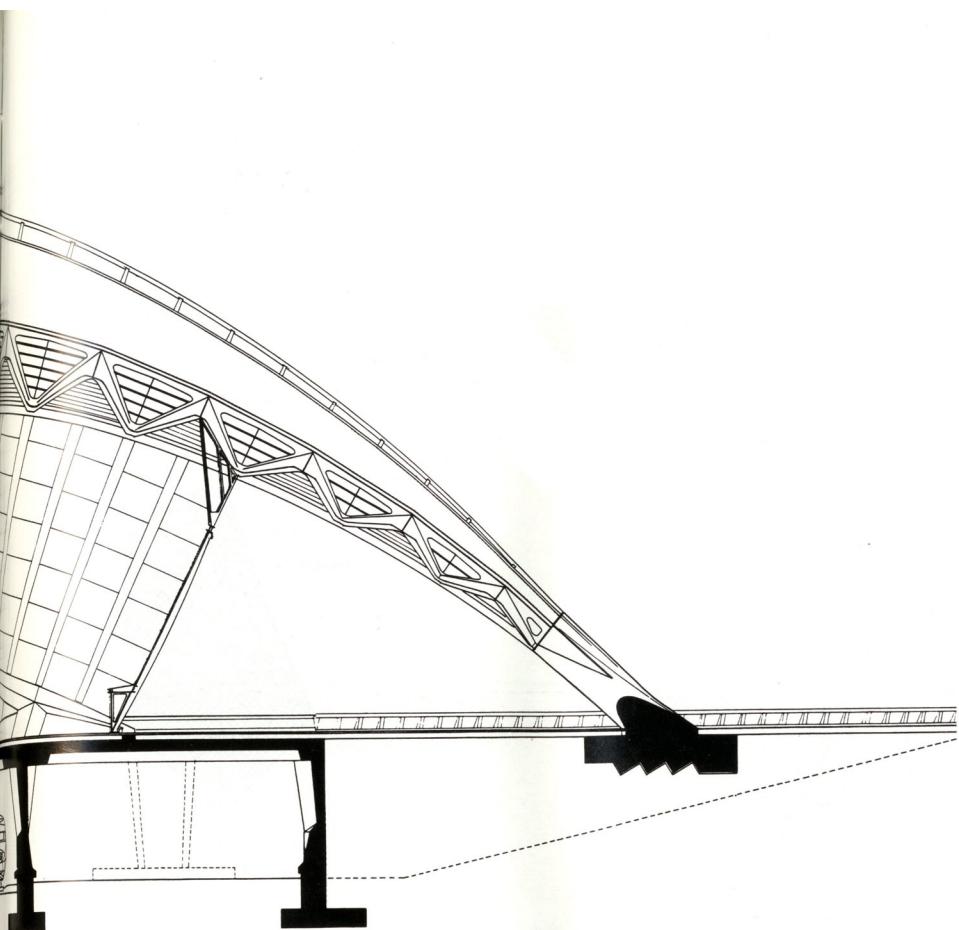


Lyon Airport Railway Station
Lyon, France
Calatrava Valls, Architect



THE PROGRAM

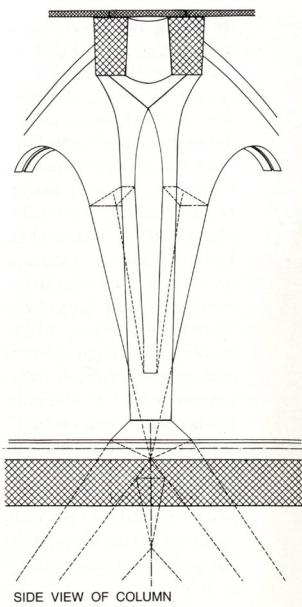
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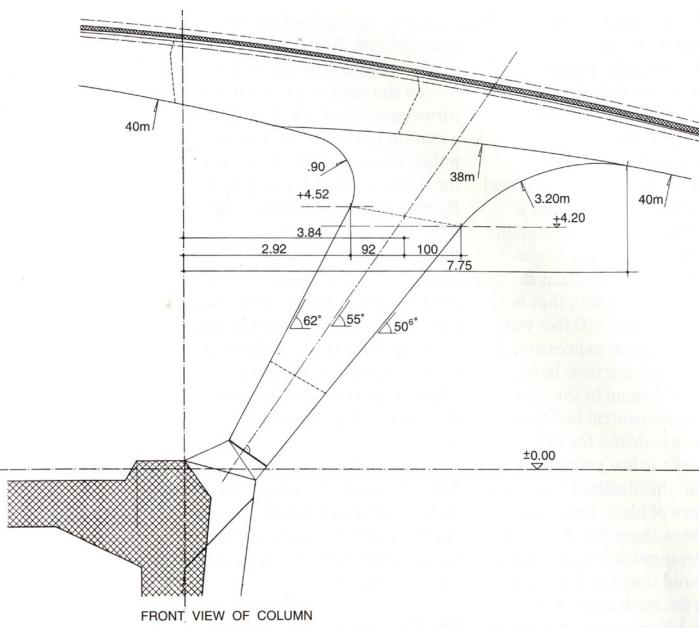
Lyon Airport Railway Station

Lyon, France

Calatrava Valls, Architect



SIDE VIEW OF COLUMN

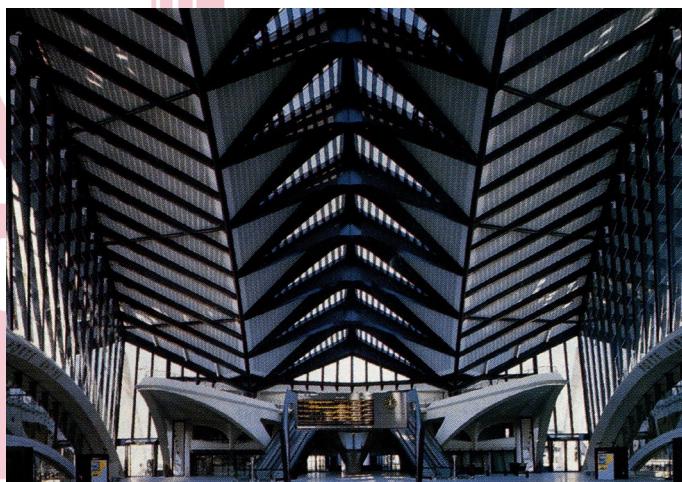
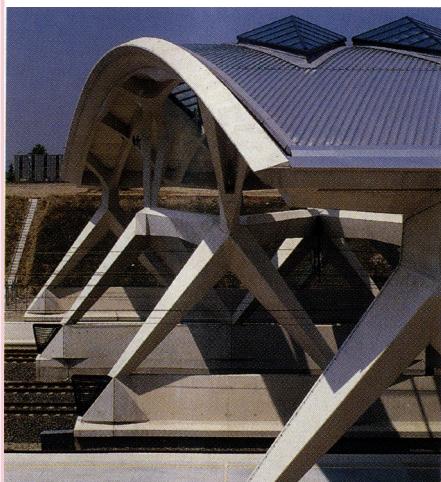


FRONT VIEW OF COLUMN

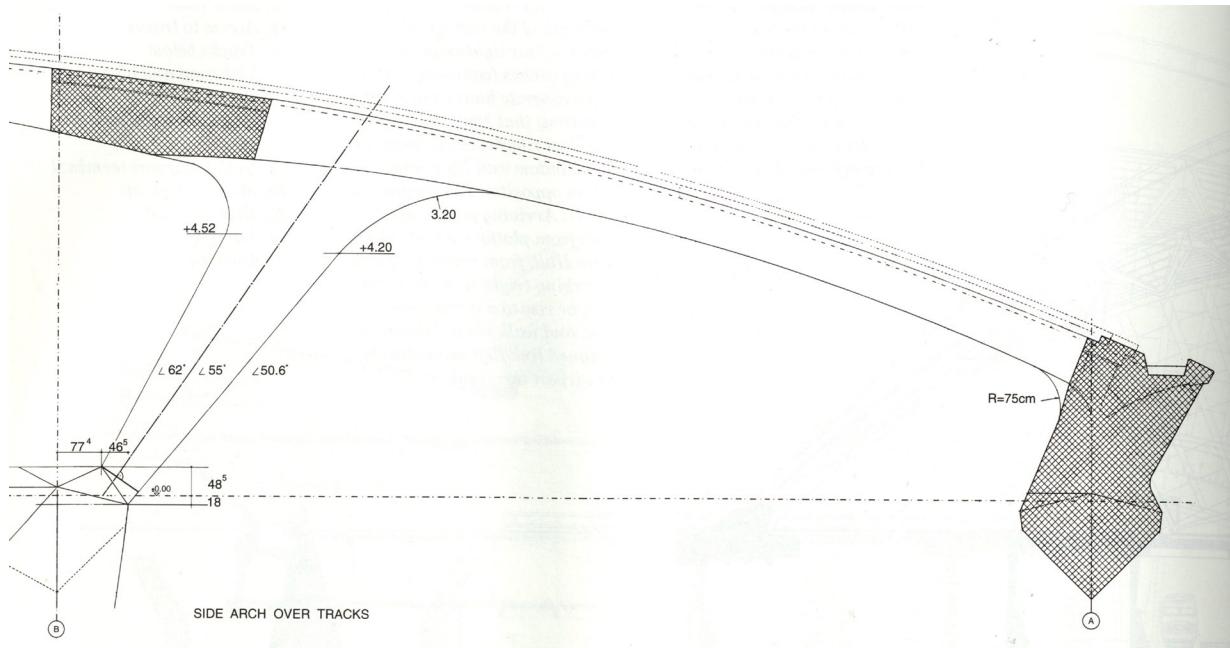
This project responds well to the site. Nestling around the tracks, the design is respectful to what is going on. This station's purpose is to relink people back to the city as well as to the rest of Europe. It may not have met its projected users since it has been built, but it has done one thing right. It has created a greater interest in architecture, escalating

it to a higher standard of art. Before the station opened, people were invited to see it and more than 40,000 people came.

The conceptual underpinnings of the project have been very graceful. The idea of a bird's outstretched wings are carried throughout the building. Calatrava speaks about the self-evident logic of the tectonics of construction as an understanding and logic of materials that drive his designs. It is this understanding that allows him to bring his concepts into reality. These are some



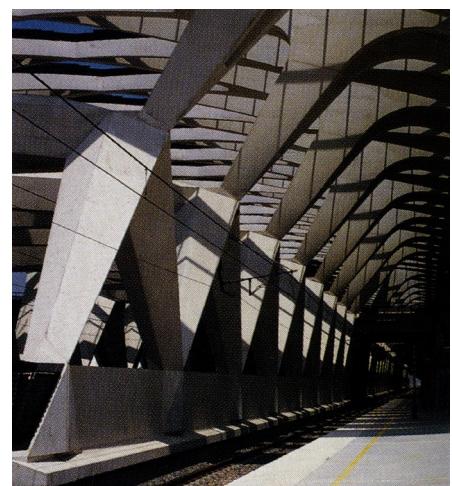
Case Studies



expressed characteristics of Frank Lloyd Wright or Mies van der Rohe as well.

The structure for this project is very expressive of tensions and compressions. The use of both steel and concrete show effortless ways to span great distances. The light is used very nicely in this project, relating again back to the glass cathedral stations of the past. The project has respective parts that come together as a whole. The structures themselves display and start to frame space and shapes that are pleasing.

This project also shows the importance of connections between different modes and the pedestrian. It also reinforces the other research which suggested high integration and a necessity to be designed.



These case studies are an exploration into the transit station typology. The study has shown similar results as the theoretical premise research which enforces what is stated in the theoretical premise. The first case study is a metro station for the overhead rapid-transit system in Vancouver, Canada, designed by local architects. The second project is an unbuilt station in Stuttgart, Germany, and

also designed by architects local to the area. The last case study is a rail station and airport link in Lyon, France, designed by Calatrava Valls Architects.

They all share common characteristics of connections and reconnecting elements. The connections of different modes is most apparent. There is a value of reconnecting a city in cultural, economical and social aspects. Each has their own ability to bring about revitalizing a center. Incorporating public space and the importance of the pedestrian resound in each of these.

The uncommon characteristics generally speak towards the theoretical premise. Uncommon to typical transit stations, each of these have dynamic forms. Though they have been informed

Summary

by the transportation infrastructure, they are not explicit to standard platform appearances. Each uses the circumstances of their given site to bring us something that is of the site and not a station that can be placed anywhere. Each case has become an icon of architecture elevated above the general need of the program displaying architecture as an art form while being completely functional.

What is interesting about these case studies is the fact that they each have different types of sites. The first is in a large city split by a major highway. The second is in a small city with hope of creating a new retail district. The last one is set several miles outside of the city in a rural area. This shows the ability of architecture to use the means of the site

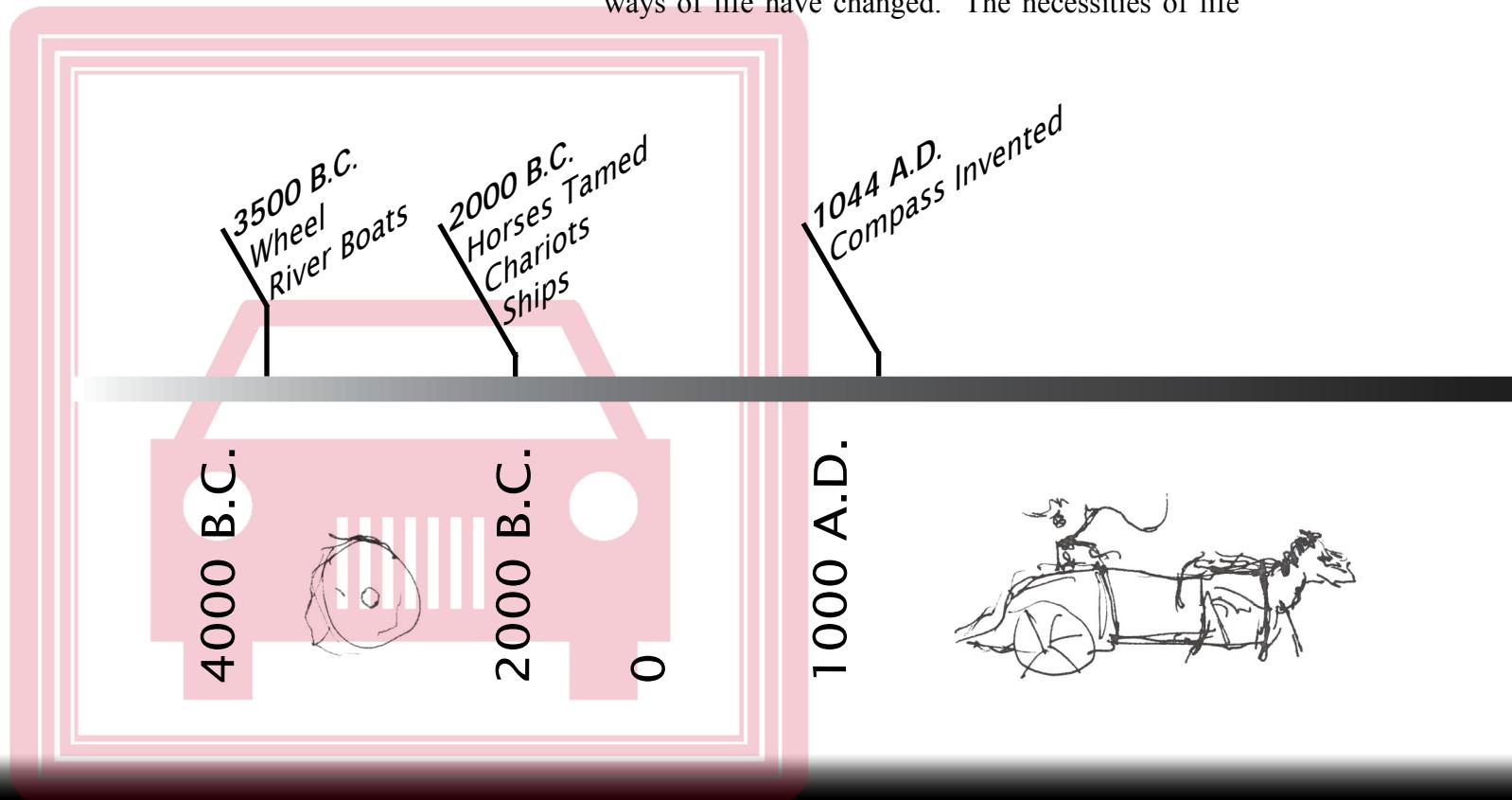
and transportation infrastructure to create dynamic forms that are not solely influenced or dictated by the infrastructure itself.



Historical context

Since before the invention of the wheel more than 5,000 years ago, man has traveled the globe. The wheel and other inventions have made traveling easier. Domesticating animals to pull carts or sleighs has made travel with other objects easier. The concept has remained constant, however, we use travel today for different reasons. There is always a starting point with a destination in mind. The only variable is how.

The most significant changes within transportation have taken place in the last 200 years. With the growing human population, major stresses were put on villages and cities. People's habits and ways of life have changed. The necessities of life

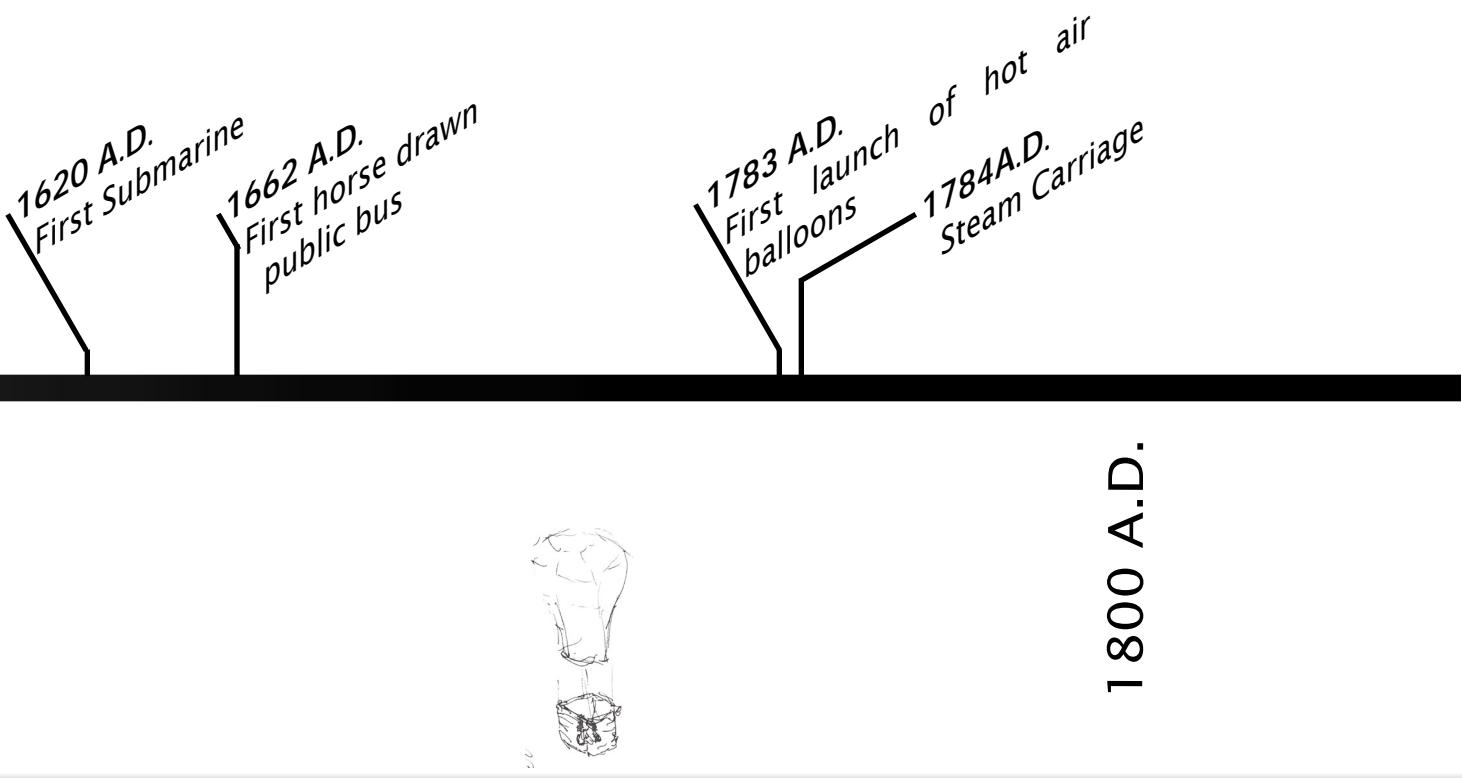


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are found further and further away from their homes. Places to work, sources for food, and entertainment, have all been a part of our lives. When it comes to transportation, it has been a matter of where they are in comparison to where one lives.

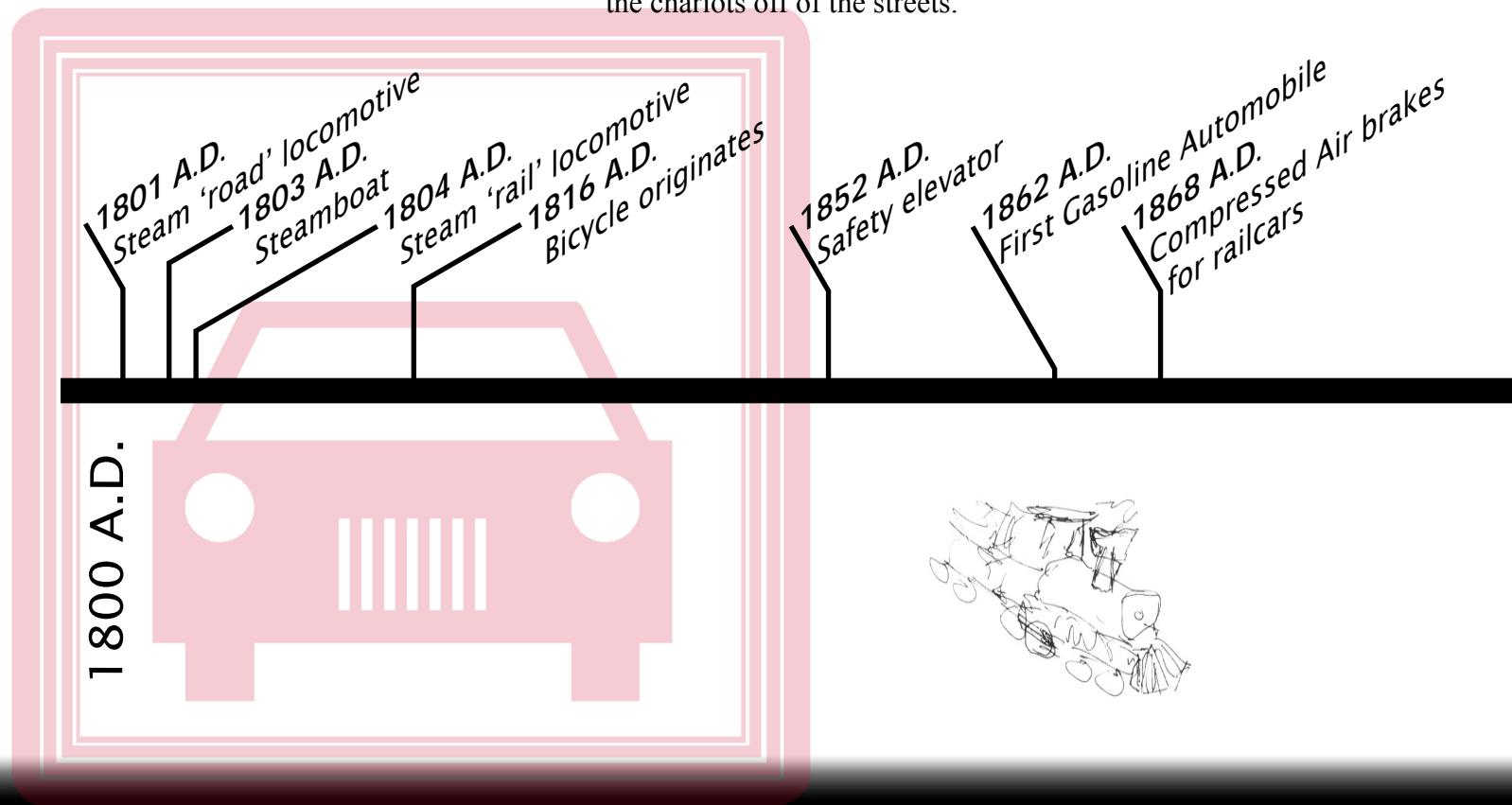
We can find even in ruins of ancient cities the remains of transportation infrastructure. We as humans have understood for some time, the importance of connections in our world. We find ourselves at times reinventing the wheel (sorry for the cliche) or returning to former means.

It really was not until large populations of a workforce lived outside of city centers that



transportation became important. Many people traveled to the towns to work or do business. Traveling was a commodity of the businessman. The horse and carriage was the main mode used to get around from town to town, while walking was the most common mode within.

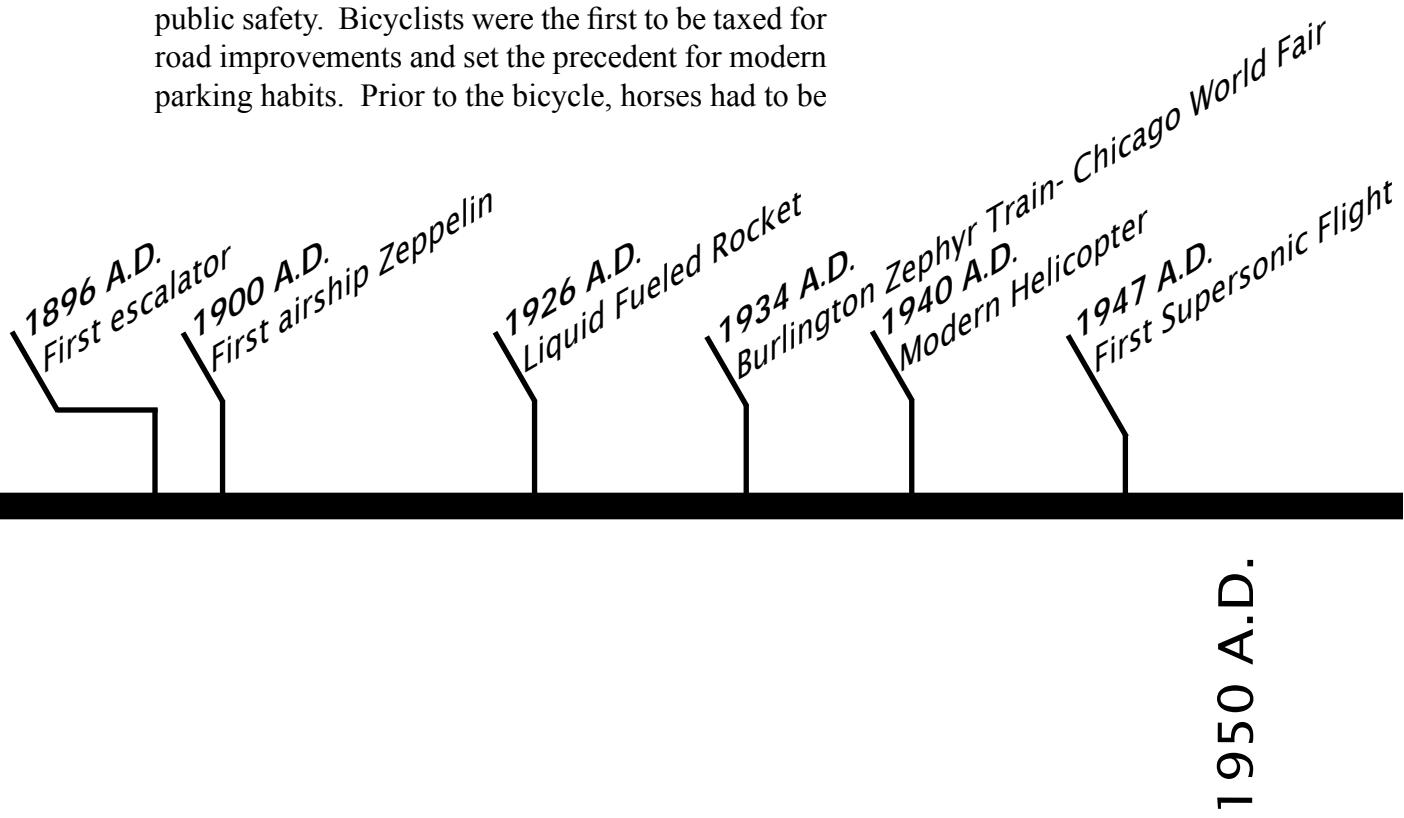
It is with horses in which we see the origin of parking. Business owners would leave open grassy areas out in the front yard of their business to accommodate the horses. It became more apparent how our parking habits adapt from here as the automobile became popular. In Roman times, they also had parking structures. It was a means to keep the chariots off of the streets.



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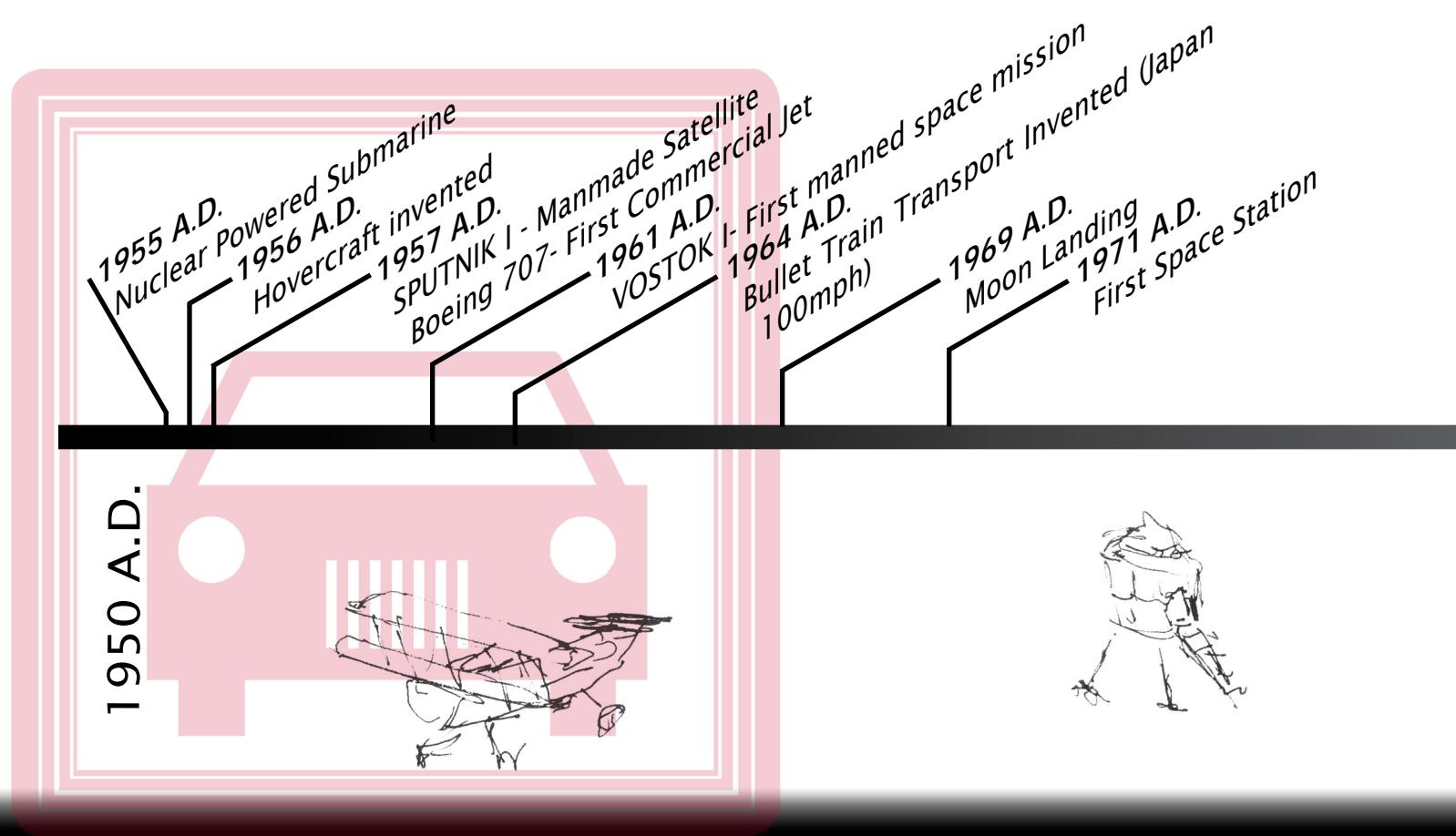
The 1800's represented a transit battle over where mass transit needs to take place. There are reports of riots and fights in New York city when people disagreed with locomotives on city streets (Jakle, 2004).

The bicycle, along with the carriage and of course the motor, set the story for the automobile. With the addition pedals and gears to the bicycle in the 1880's, the bicycle was a major threat to other modes of transportation. In some cities, stones were thrown at bicyclist because they were a threat to public safety. Bicyclists were the first to be taxed for road improvements and set the precedent for modern parking habits. Prior to the bicycle, horses had to be



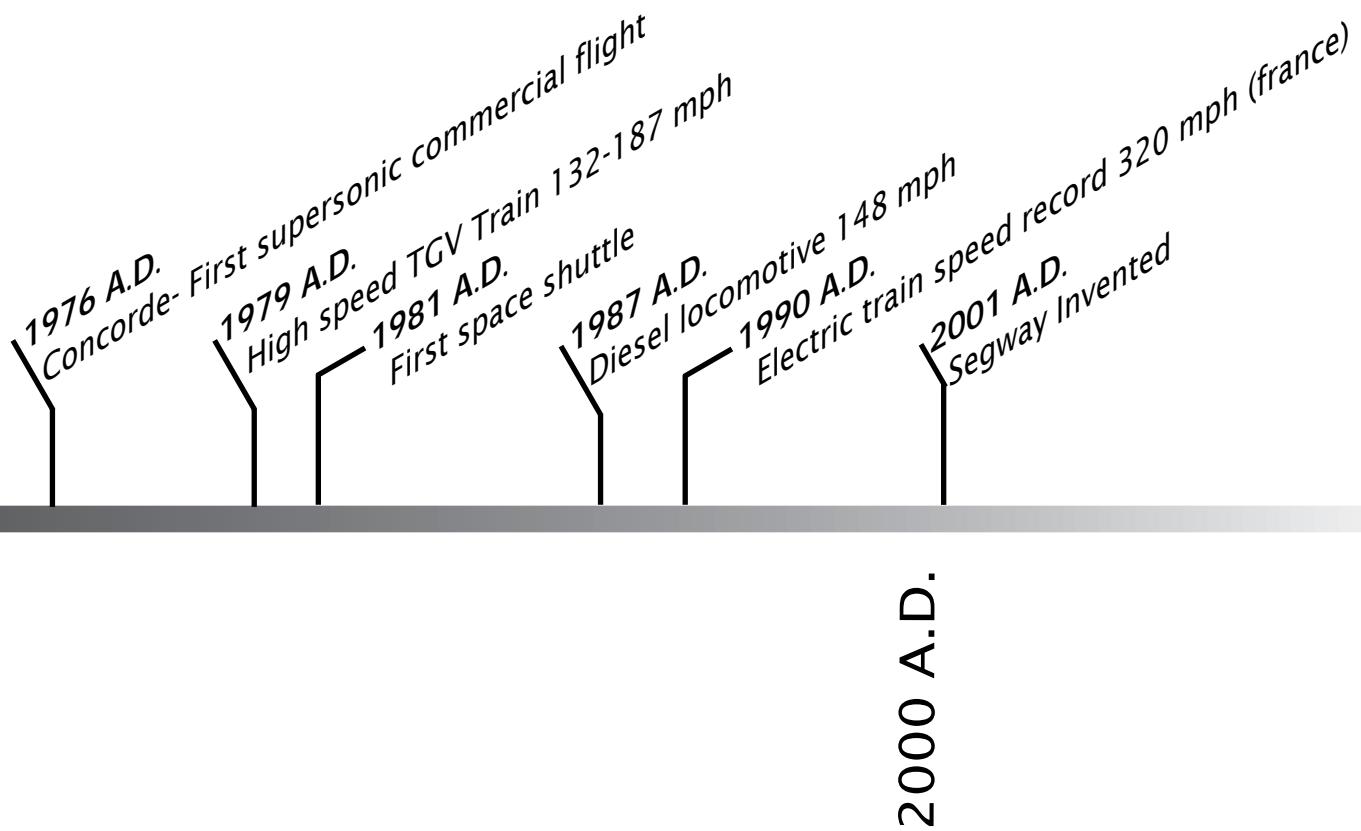
tended to. The bicycle could be left unattended for a long period of time.

The bicycle was soon overcome by the luxury of automobiles which invaded the streets. Fords invention of the assembly line brought the automobile to a new level, allowing lower classes the ability to afford it. The car, time and time again has reshaped the way we think about how we get around. Providing the luxury of availability, and mobility the car was here to stay and will continue to be.



THE PROGRAM

Congested streets and the desire to park as close as possible to the front door has pushed mass transit to the forefront in today's world.



Goals of the Thesis Project

Overall

Look at integrated systems.
Explore the relationships in the built environment.
Explore exterior influences on design.

Academic

Produce a knowledge base.
Produce a product useful for future research.
Create a starting point for others.
Explore an issue that is applicable.



THE PROGRAM

Professional

Produce quality work.

Express Professionalism.

Display a functional work of progress.

Display an understanding of the topic.

Display an awareness of issues involved with architecture.

Display a development in professional practice.

Personal

Explore and share my abilities.

Explore an area of interest for a better understanding.



SITE ANALYSIS

Upon any entry to Duluth, one is greeted with majestic views into Lake Superior. One is surrounded by natural beauty; the poplar and pine forests dust over the hillside of outcropping rocks. The city is interlaced into the hillside with its ox bowing Skyline Parkway, parks and hiking trails. It is not just full of beauty; the area is rich of history. The North Shore has a geologic history that has prided itself in one of the nation's oldest mountain ranges, the Saw Tooth Mountains. Duluth and Superior are the twin ports; the

innermost port of the country serving Minnesota's iron ranges. The area's history has rooted the local tourist attractions. Enger Tower and Park sit 600 feet above Lake Superior and is a symbol of the relationship and friendship with the Norwegians. The Aerial Lift Bridge is the gateway to the twin ports lifting nearly 30 times a day to allow 1000 foot freightliners to enter the harbor. These, among other parks, trails, and attractions are scattered about the area.

The site itself is located on the harbor flats, presenting views into the harbor, the mouth of the St. Lawrence River, and the Duluth hillside and skyline. It is interlocked between S. 5th Avenue West, Railroad Street and the Duluth Entertainment and Convention Center (DECC). The buildings around the site include the DECC facility, a parking structure,



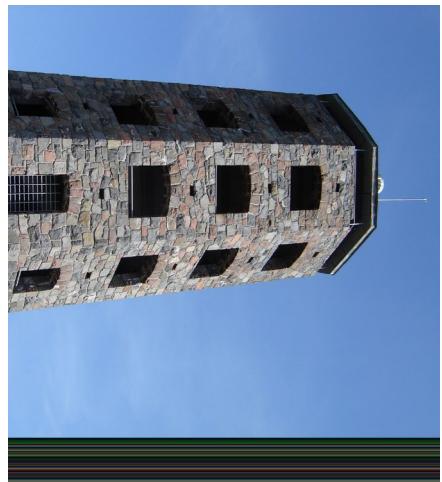
the Great Lakes Aquarium, and the Duluth Cinema. Their materials include concrete, stone, masonry, as well as metal panels. There are fairly general forms nearby, with the exception of the aquarium, which is fairly abstract in form.

The vegetation in the area is quite dynamic. There are many species of evergreens and grasses. Other trees include poplars and birch. The colors vary through season: greens through the summer with vibrant fall colors. The winters and spring can be dressed in white.

There is a presence of water nearby Lake Superior, it is relatively clean. There is no moving water on the site, it drains nicely. Though the water level has fluctuated it is permanent. The wind is relatively minor on the site, the hill to the west

helps shelter the site. The DECC structure and parking facility block the winds off of the lake.

The site has been compromised by human activity. Currently, there is a parking lot on the site. There have been several construction projects that the site has been used as a staging ground for. The harbor area is actually a sandbar divided by the Aerial Lift Bridge. The Minnesota Point is east of the bridge while the site I am working with is on the west. There does not seem to be any signs of distress on the site.



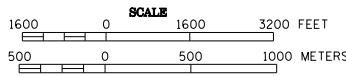


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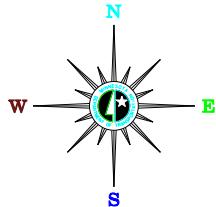
PREPARED BY THE
MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRANSPORTATION DATA & ANALYSIS

IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



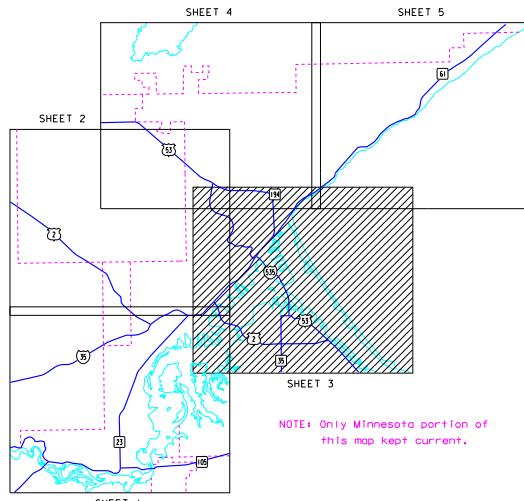
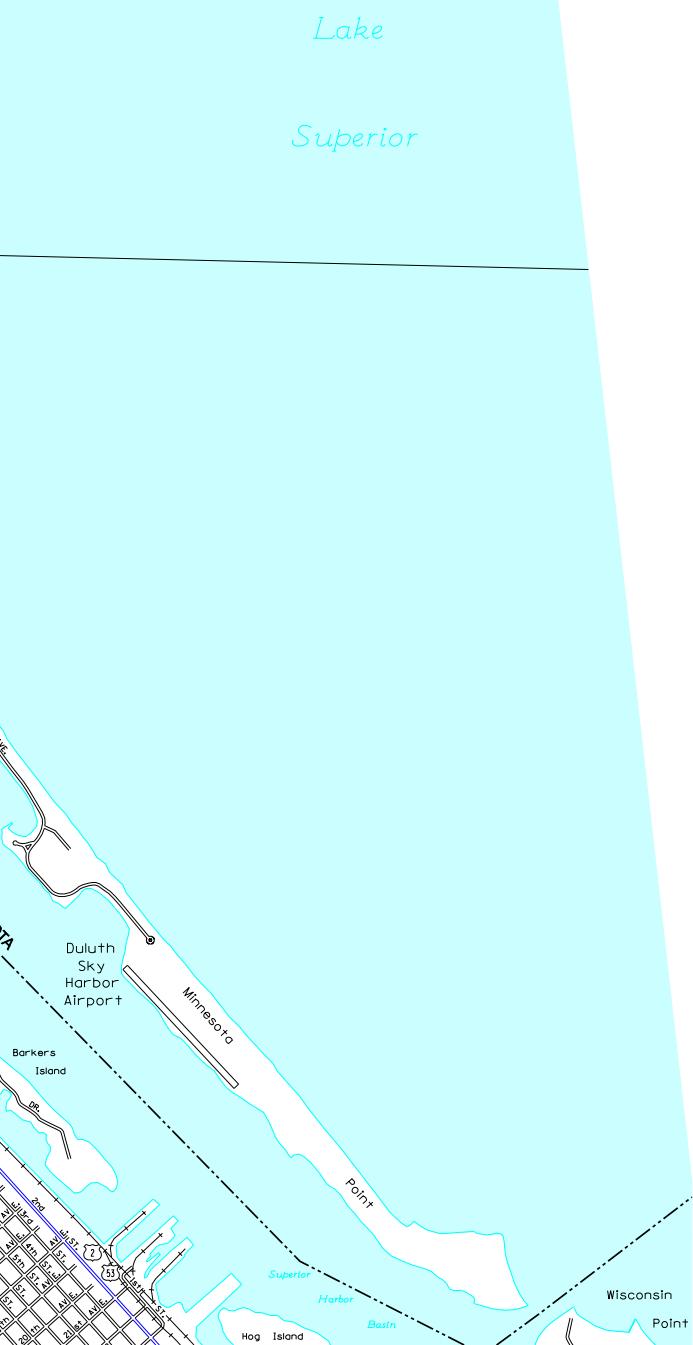
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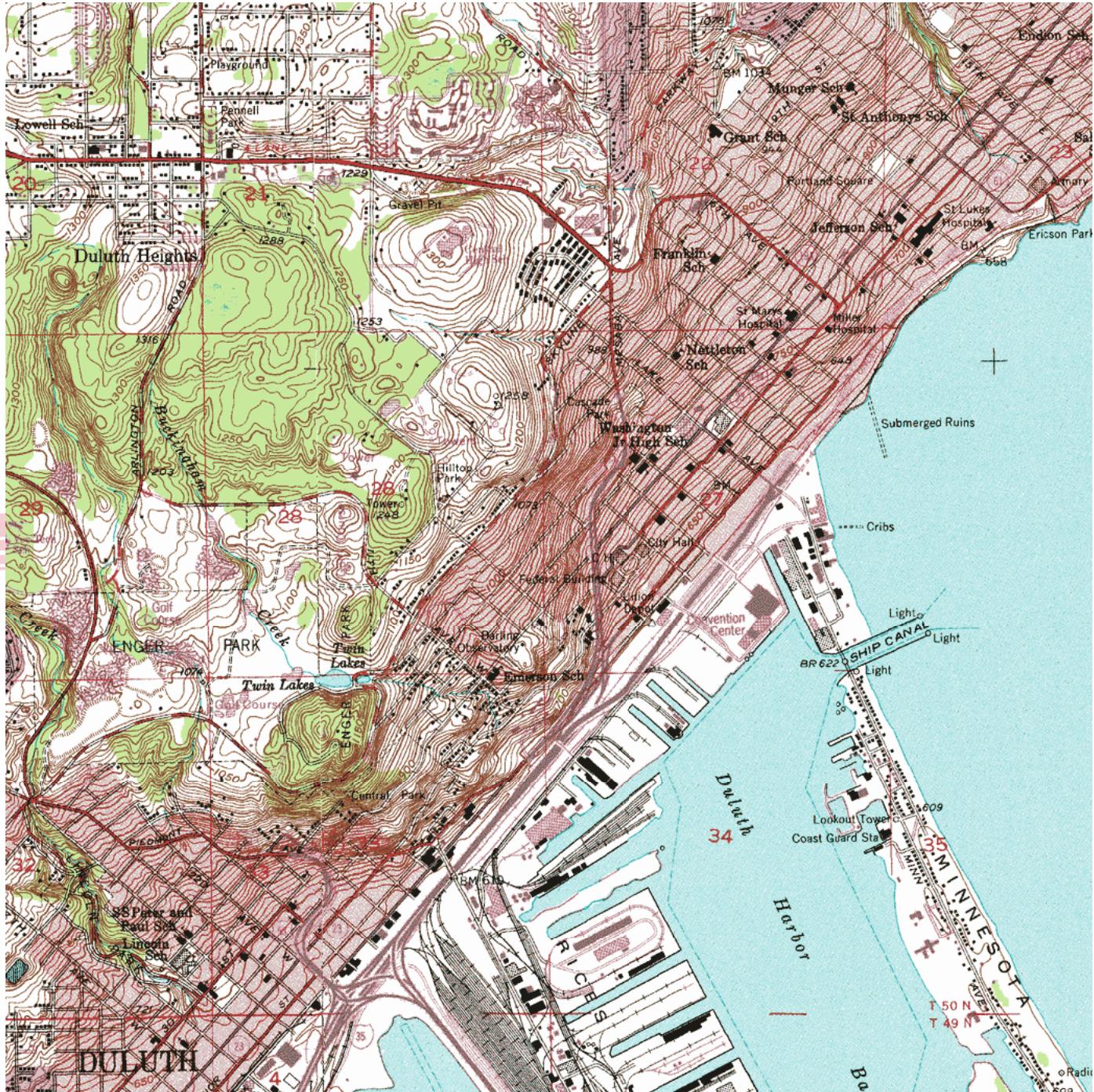


LEGEND

INTERSTATE TRUNK HIGHWAY.....	(35)
U.S. TRUNK HIGHWAY.....	(10)
STATE TRUNK HIGHWAY.....	(5)
COUNTY STATE AID HIGHWAY.....	(20)
COUNTY ROAD.....	(◇)
CORPORATE LIMITS.....	△ - △ -
PUBLIC ROAD	=====
PRIVATE ROAD	—



Minnesota DNR - ToMO Service



THE PROGRAM

St. Louis County, Minnesota, Duluth Part

1028A—Urban land-Udorthents-Aquents complex, 0 to 8 percent slopes

Map Unit Setting

Elevation: 490 feet

Mean annual precipitation: 25 to 34 inches

Mean annual air temperature: 37 to 43 degrees F

Frost-free period: 100 to 140 days

Map Unit Composition

Udorthents and similar soils: 35 percent

Urban land: 35 percent

Aquents and similar soils: 30 percent

Description of Urban Land

Setting

Landform: Spits, shores

Parent material: Loamy alluvium, sandy beach materials and dredge materials

Description of Udorthents

Setting

Landform: Rises on spits, rises on shores, flats on spits, flats on shores

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy alluvium, sandy beach materials and dredge materials

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Description of Aquents

Setting

Landform: Depressions on spits, depressions on shores, flats on spits, flats on shores

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy alluvium, sandy beach materials and dredge materials

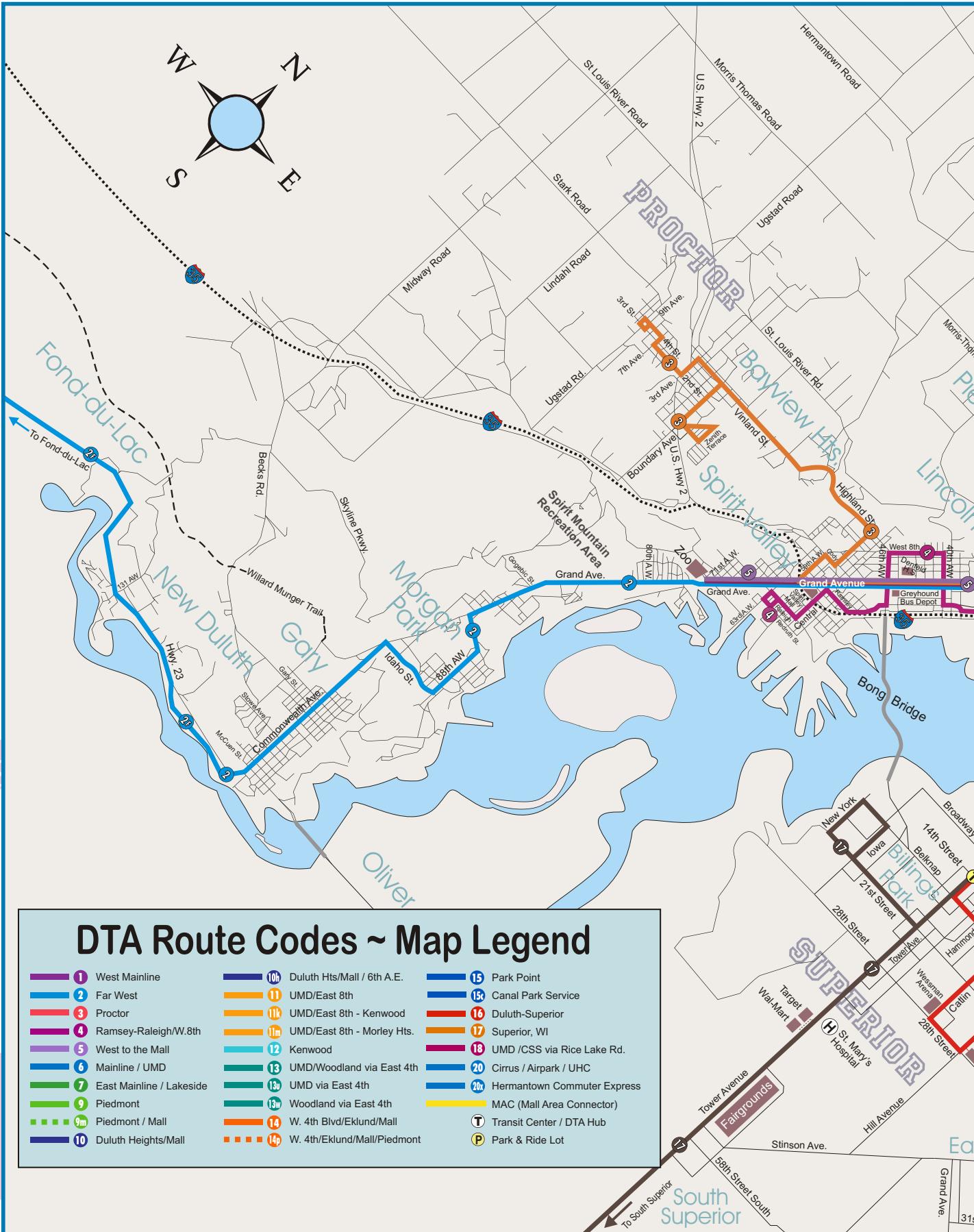
Properties and qualities

Slope: 0 to 2 percent

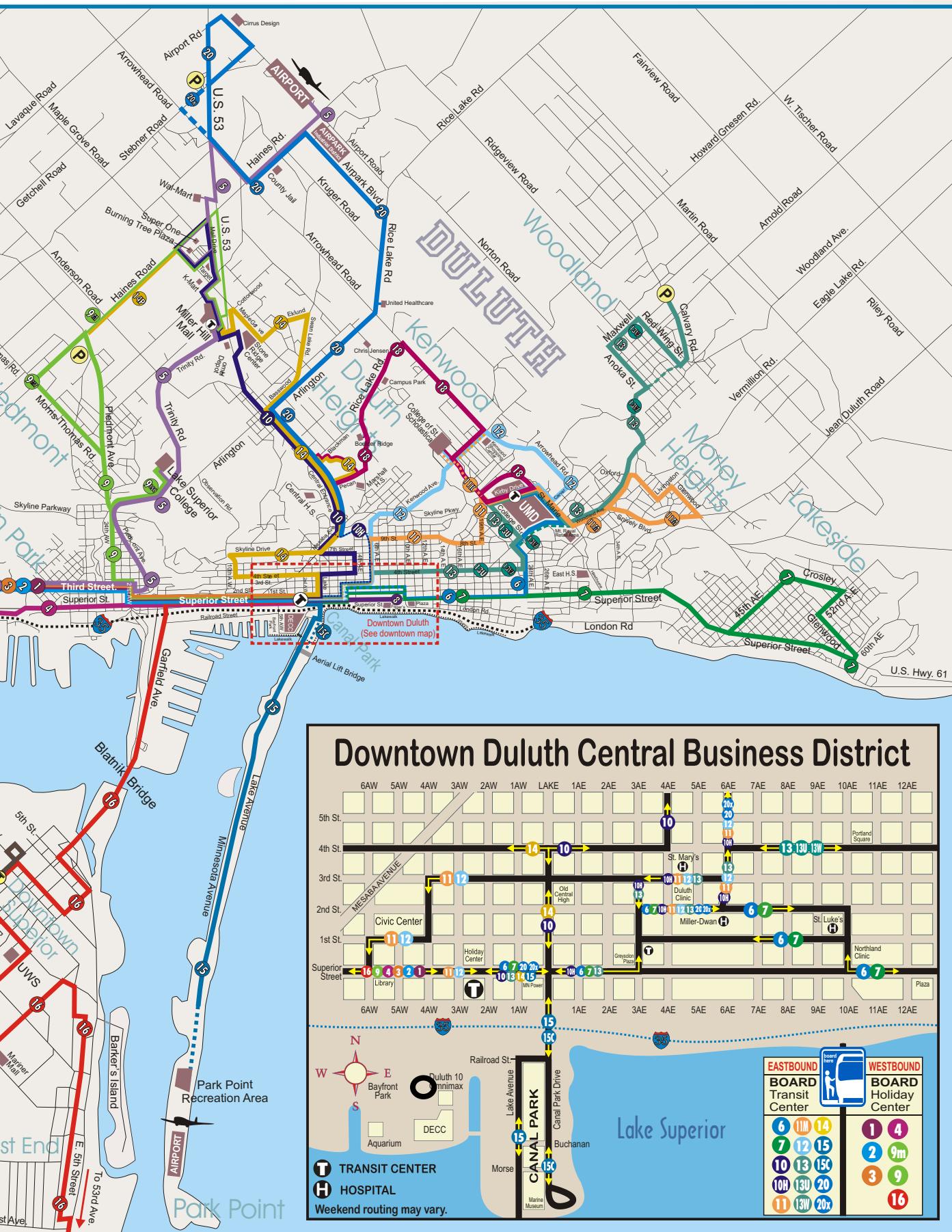
Depth to restrictive feature: More than 80 inches

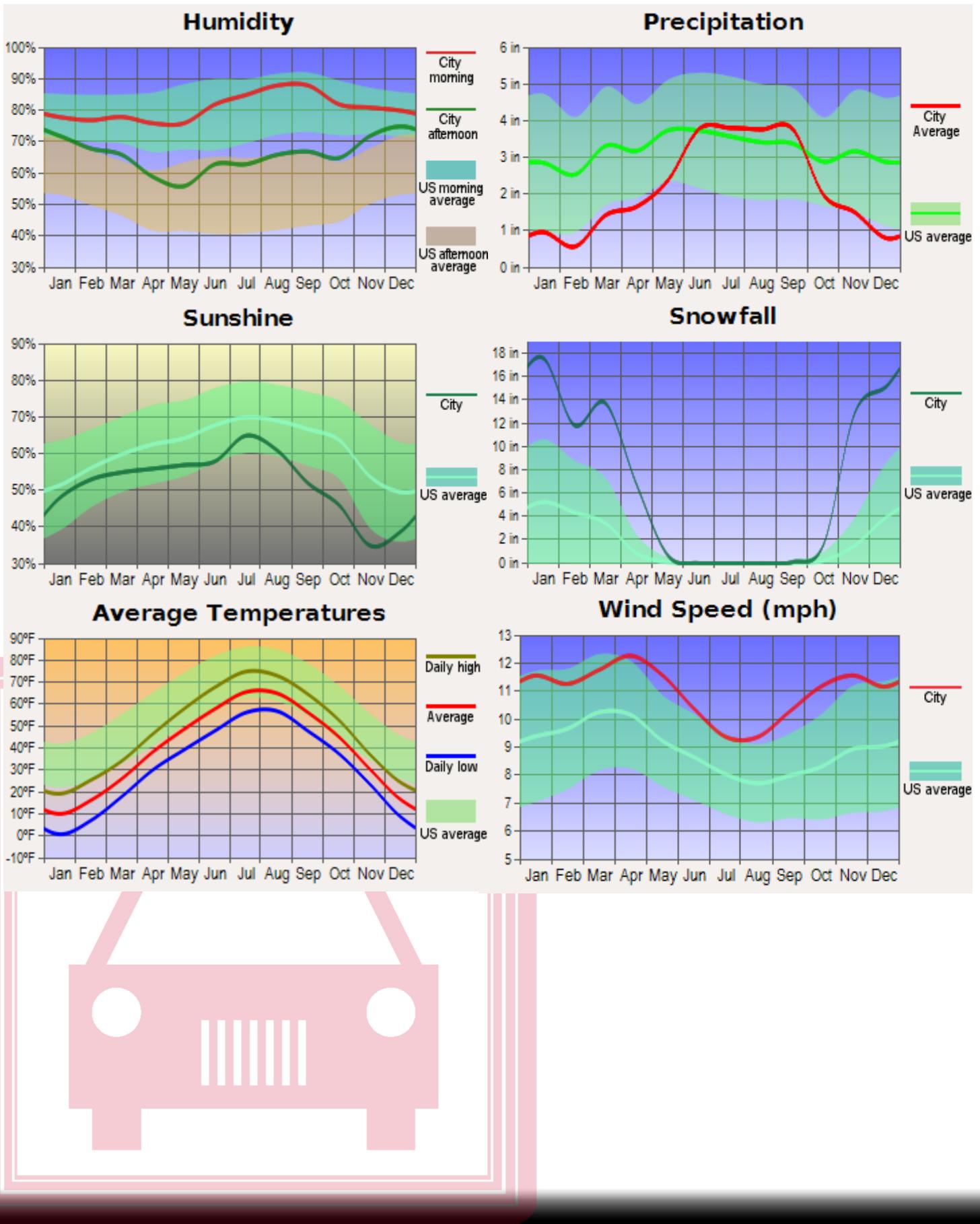
Drainage class: Poorly drained



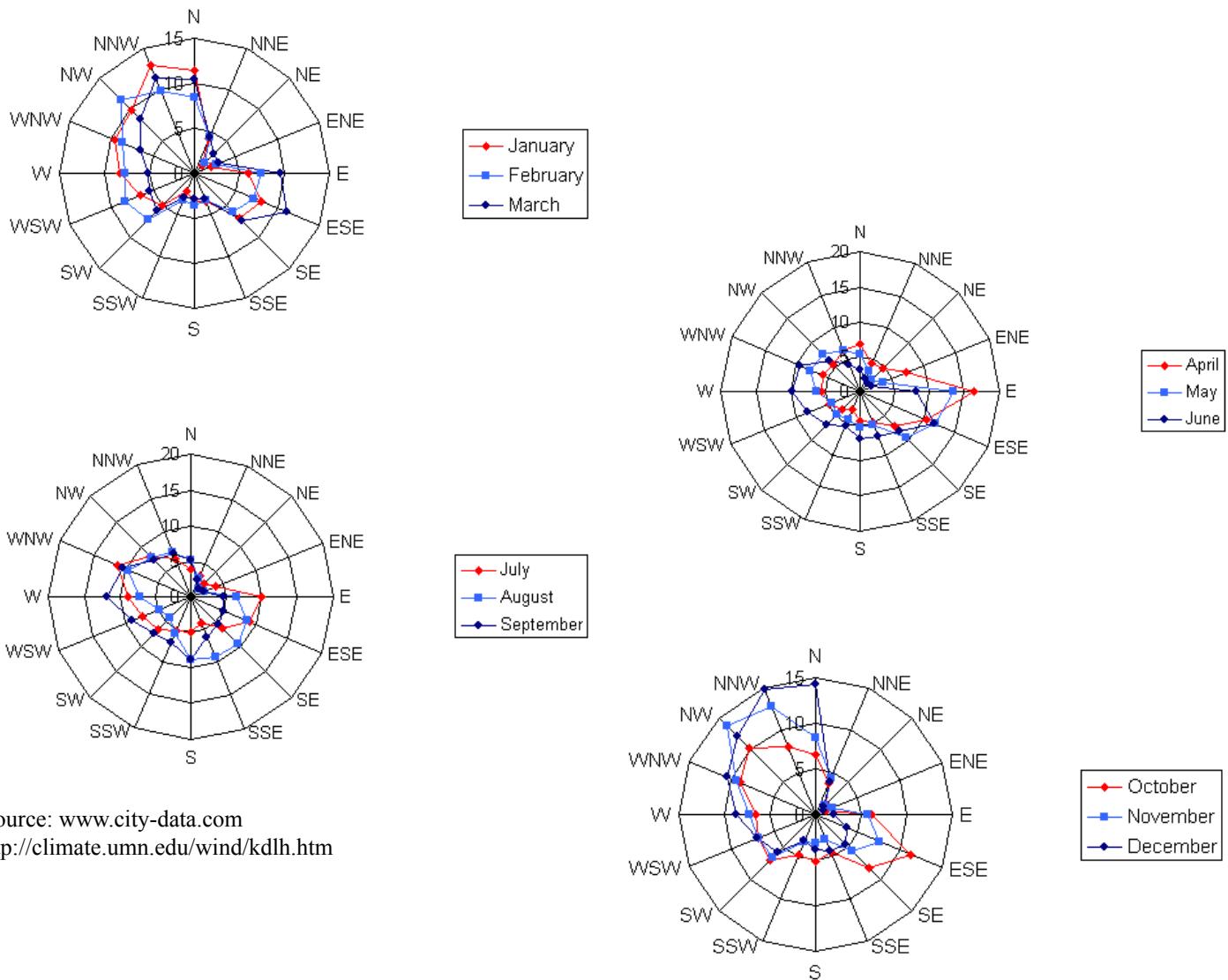


THE PROGRAM



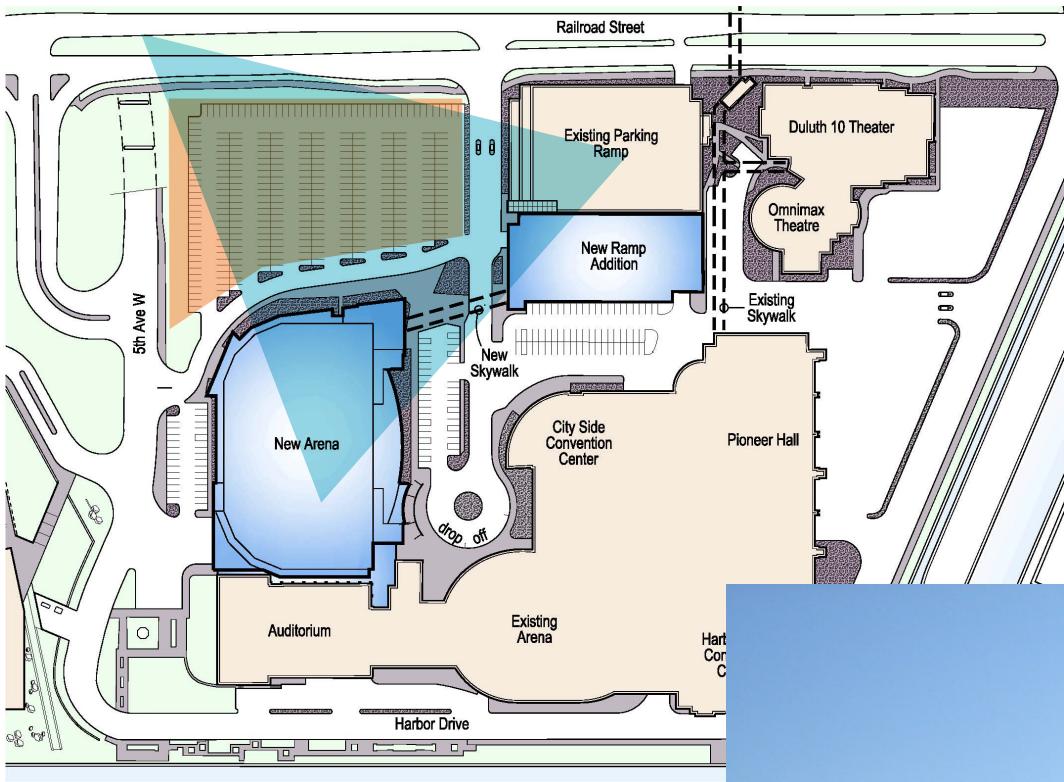


THE PROGRAM



Source: www.city-data.com
<http://climate.umn.edu/wind/kdlh.htm>





THE PROGRAM





THE PROGRAM





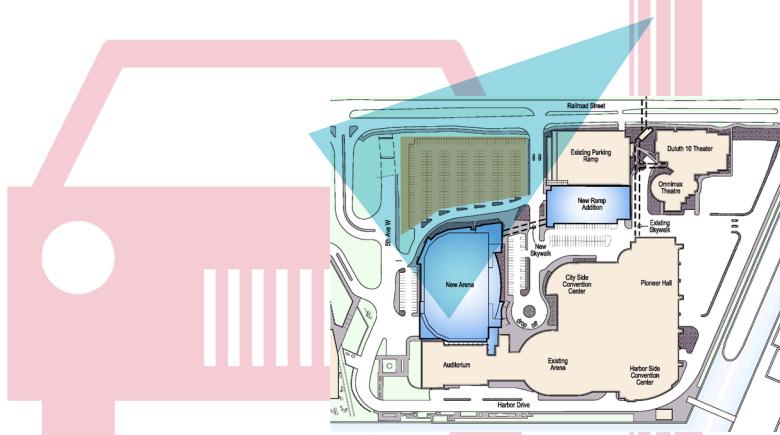
THE PROGRAM





THE PROGRAM





THE PROGRAM

View from Skyline Parkway



Possible View Upon Entry By Train



THE PROGRAM





THE PROGRAM

PROGRAMMATIC REQUIREMENTS

Support Spaces 6,750

Gift Shop	2,500
Information	250
Main Office	1,000
Restrooms	3,000
Mechanical 1	1,500
Mechanical 2	3,000

Transit Spaces 13,000

Changing Rooms	500
Multi Storage	3,500
Train Platform	5,000
Skywalk	4,000

Main ATRIUM 36,000

TOTAL 70,550

Food 10,300

Freezer	700
Cooler	500
Dry Storage	1,200
Kitchen	2,500
Deli	1,000
Restaurant/Bar	4,000
Office	400

Parking Ramp
Spaces 108,000
 360

Park 4.5 Acres

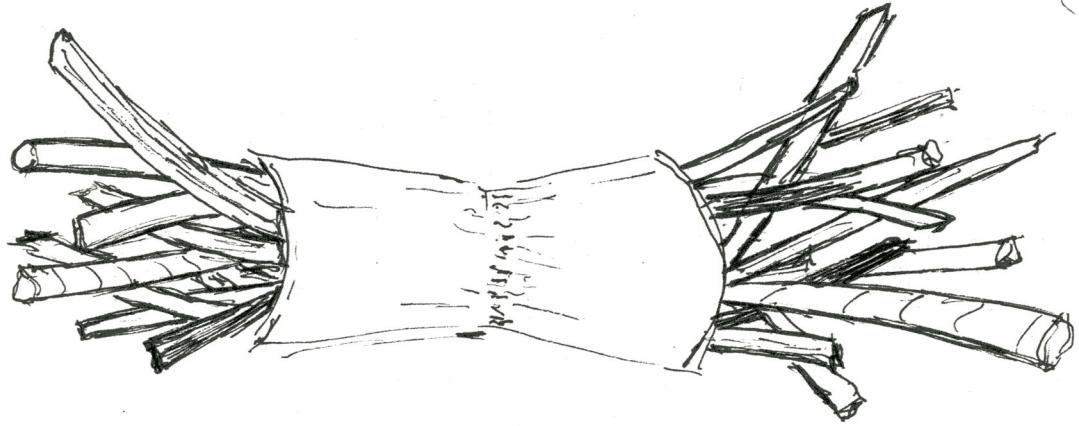




THE DESIGN

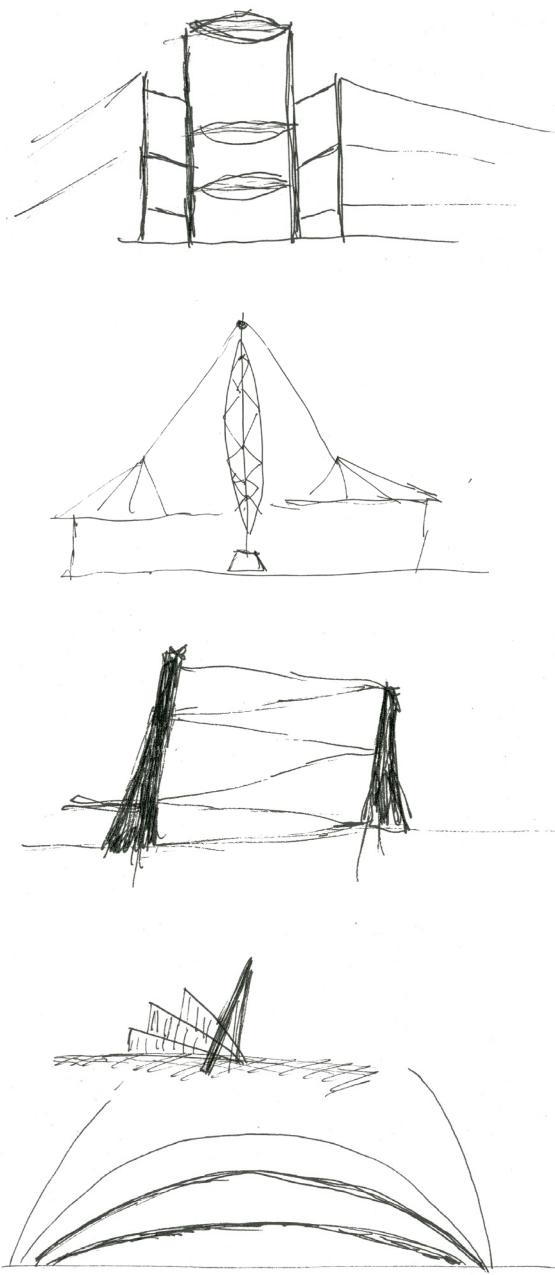
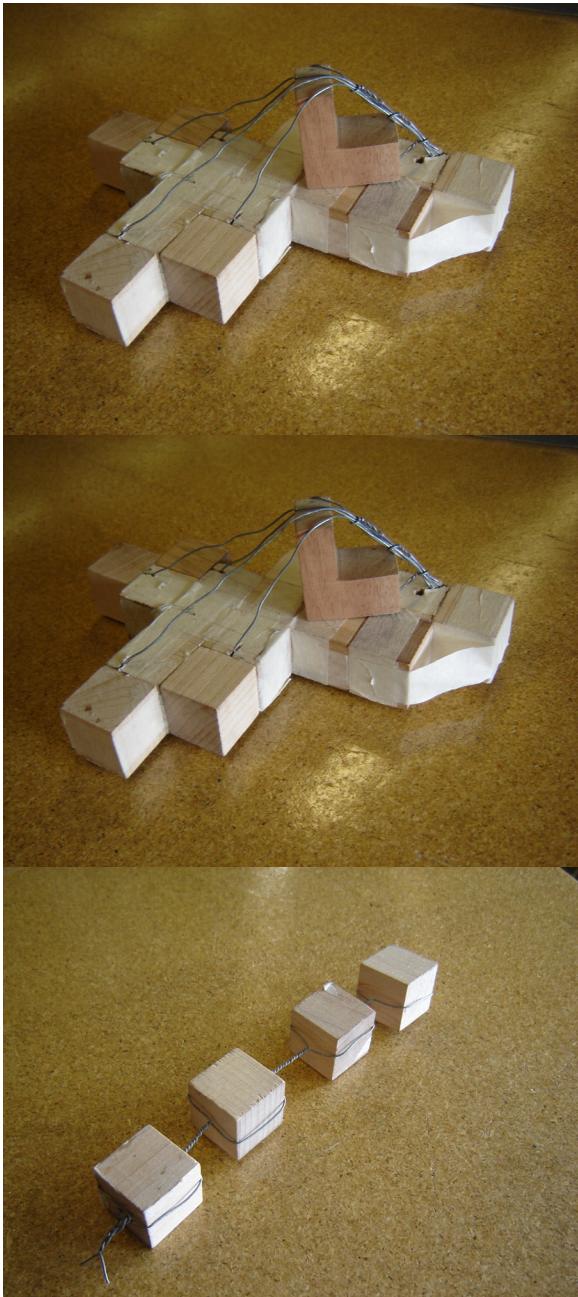
THE DESIGN

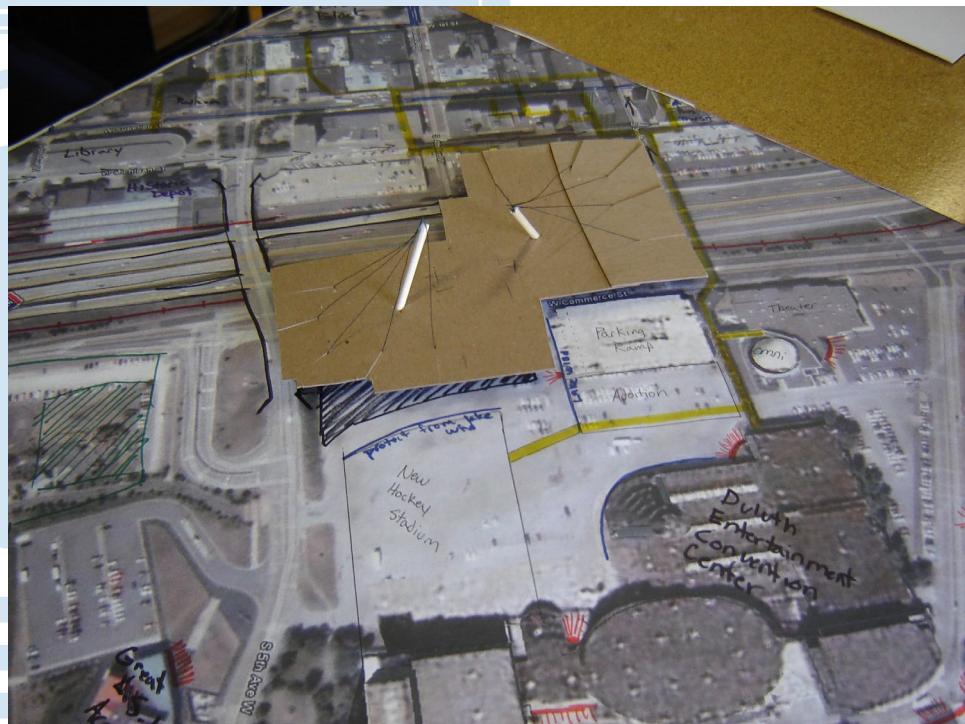




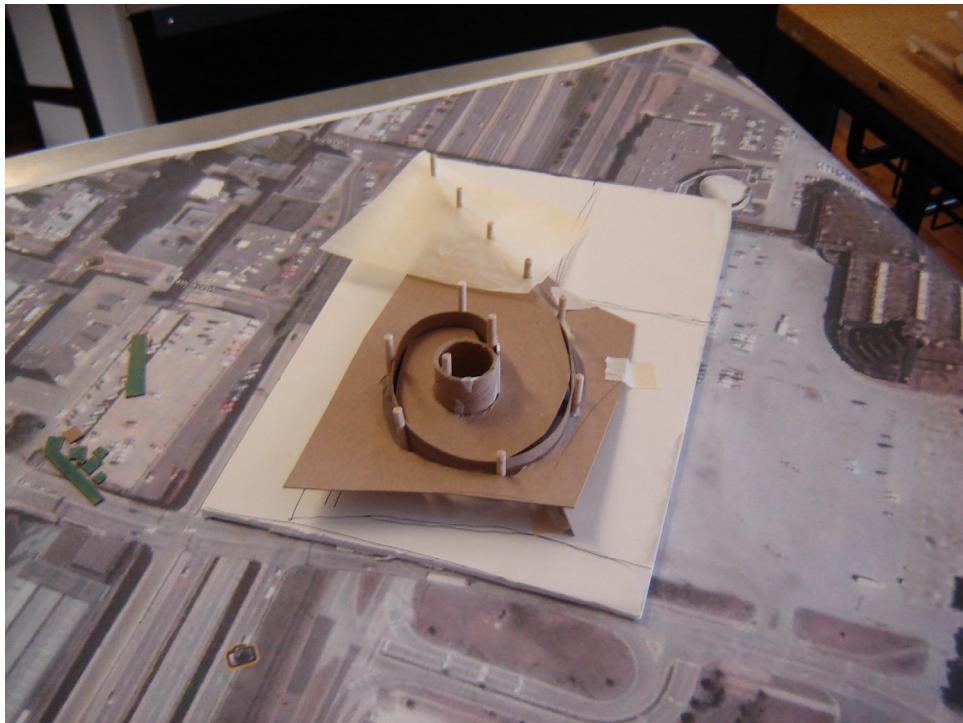
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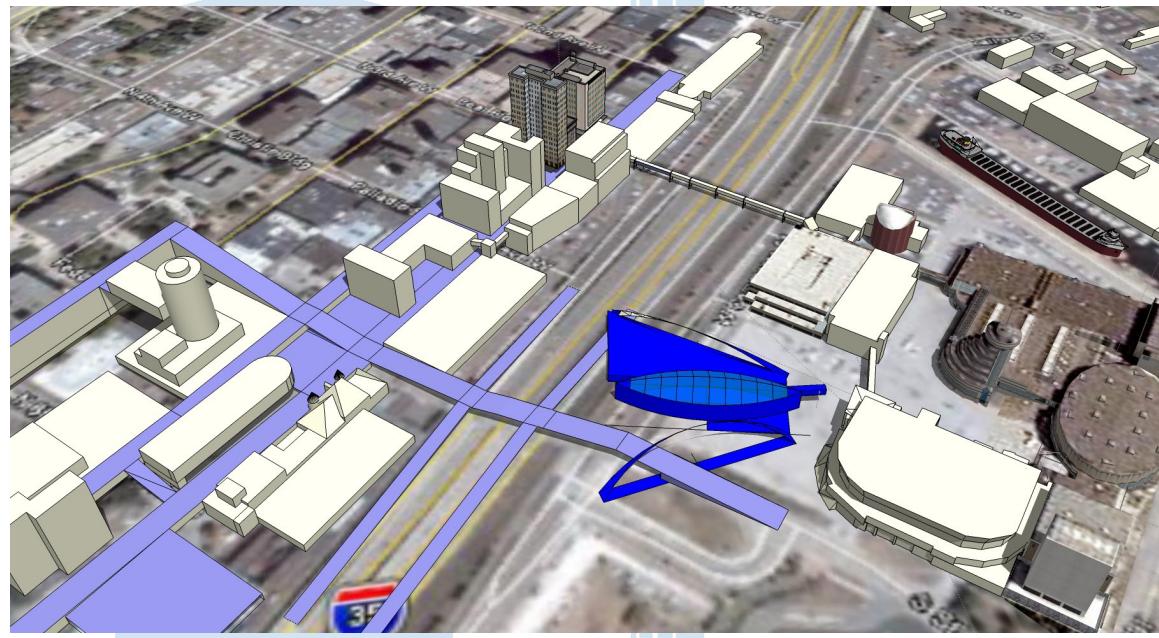
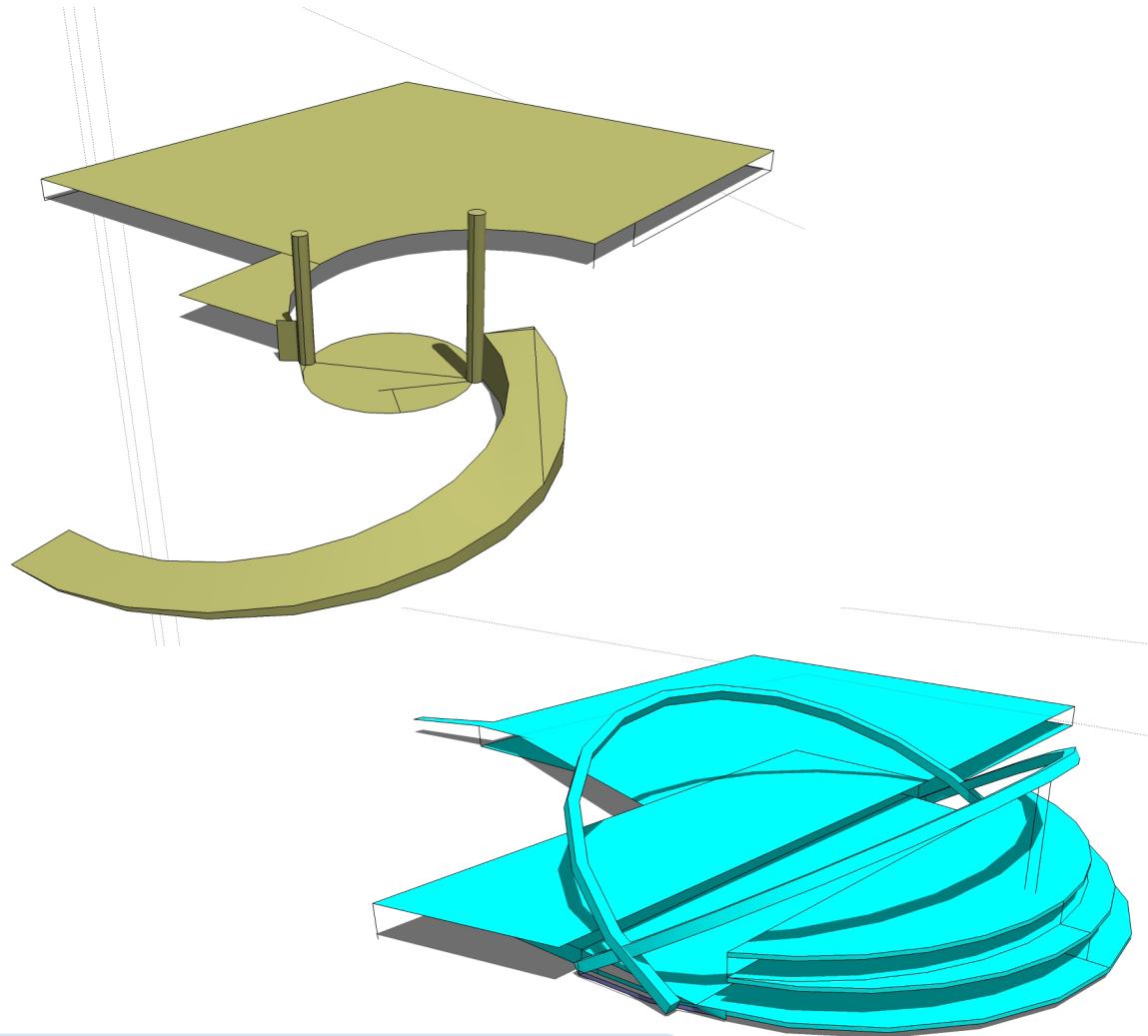
PROCESS





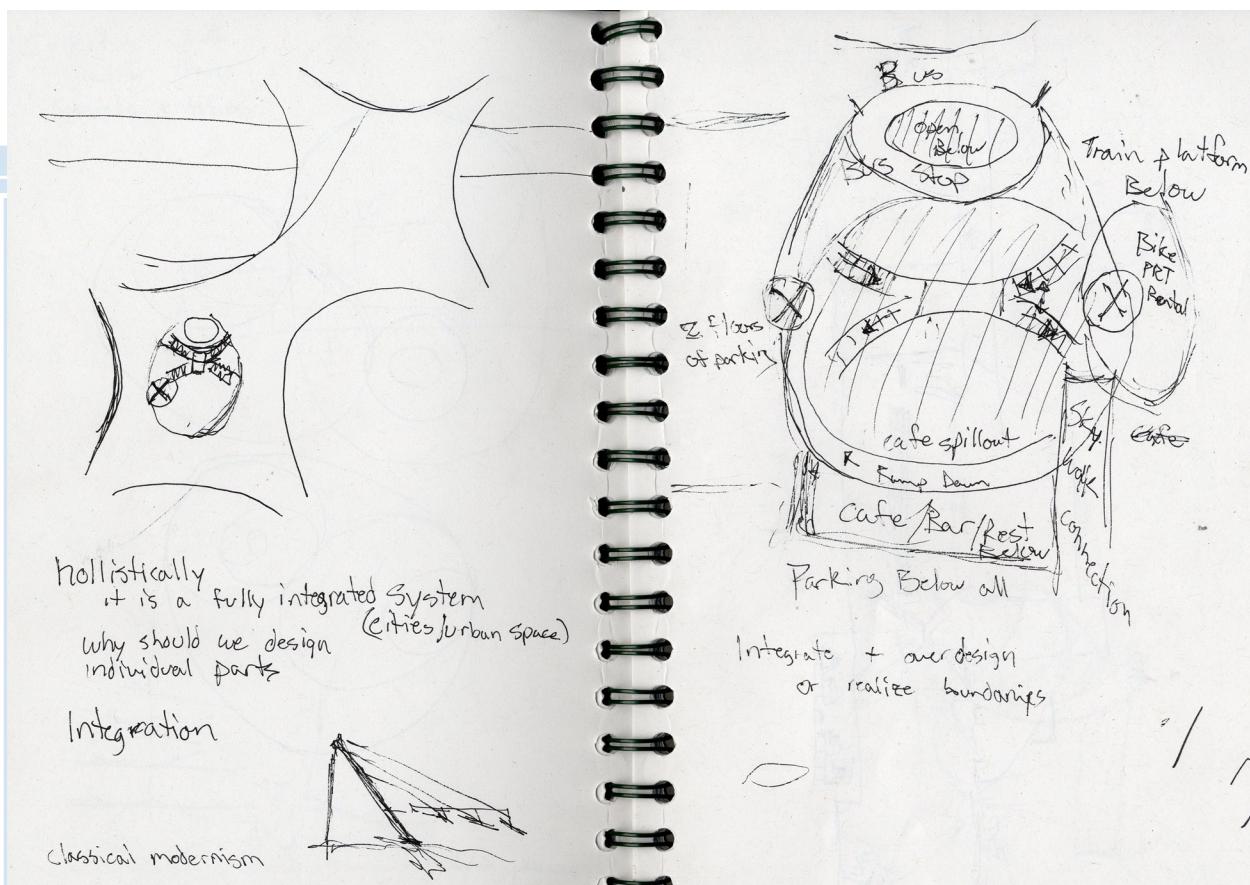
THE DESIGN





THE DESIGN





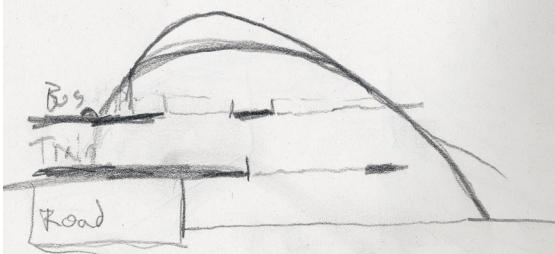
Connecting to the City

Functions

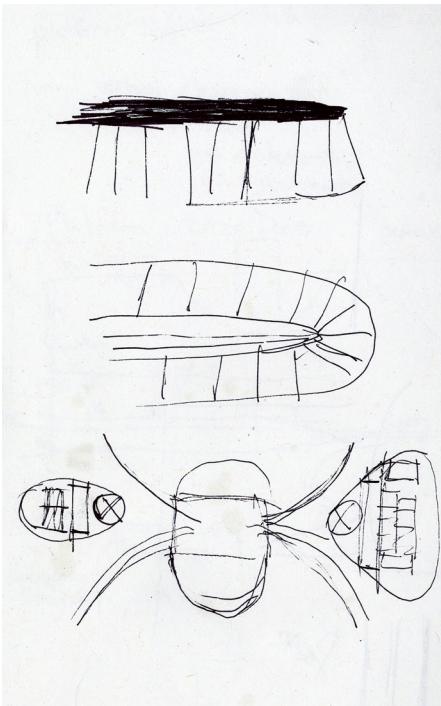
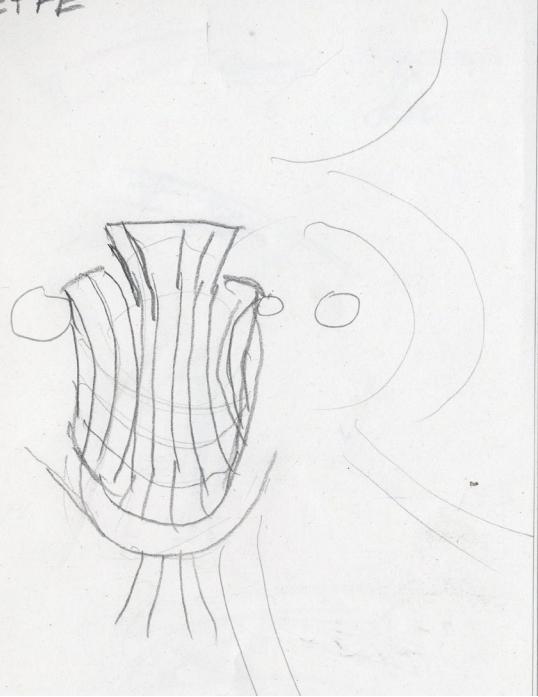
Total Design

Use one singular system

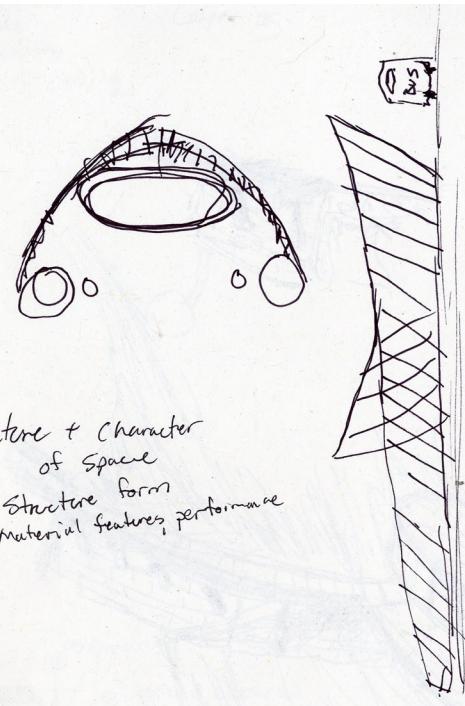
One sweep

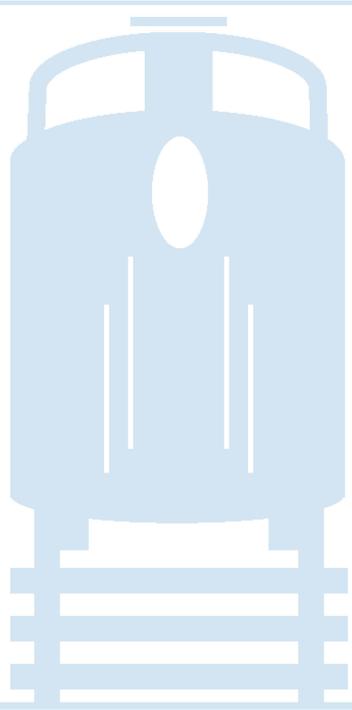


ETFE



Nature + character
of Space
Structure form
Material features, performance





THE DESIGN

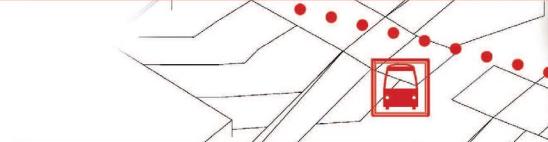
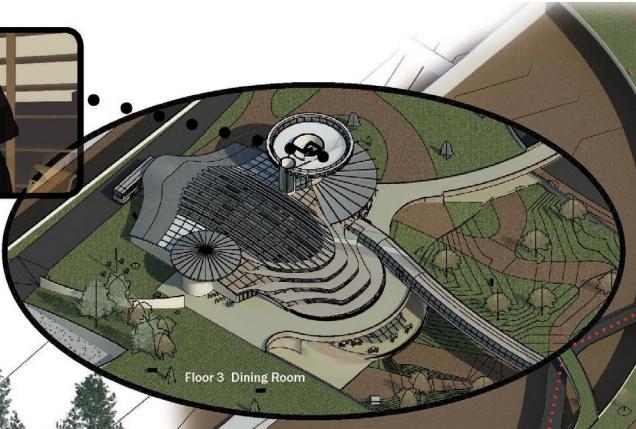
FINAL DESIGN



Duluth Multimodal

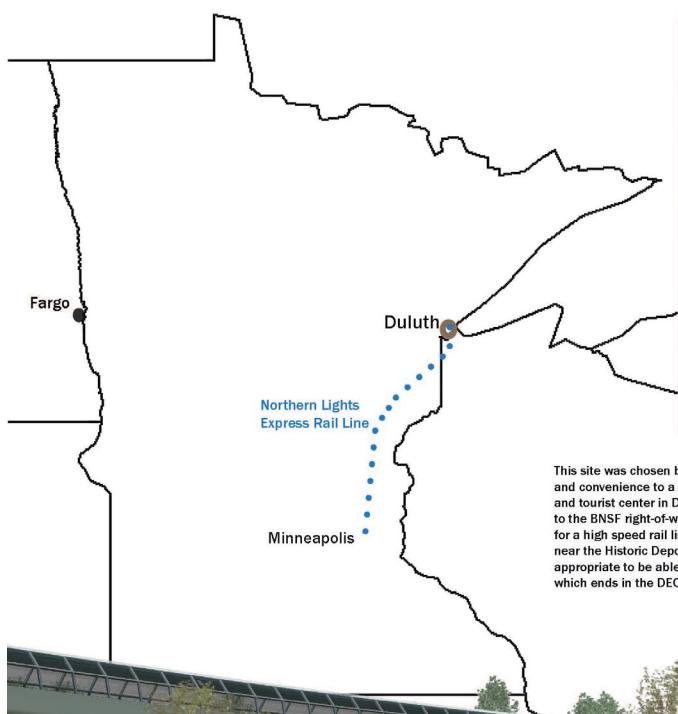
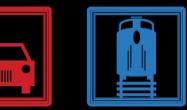


Incorporated in the design are places to rest and eat. These spaces vary from small intimate spaces to large open areas for people watching. Snacks and novelties are worked into the design to allow for convenience, while bars and restaurants create meeting places to make trips more efficient.



THE DESIGN

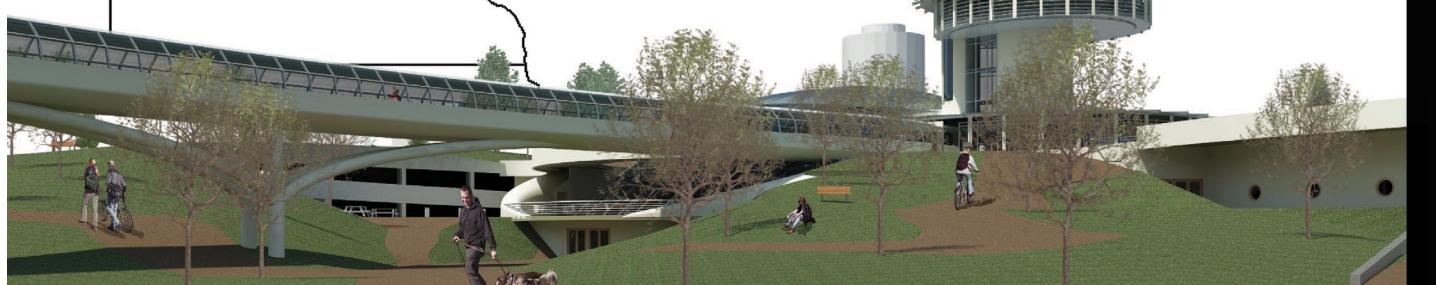
Duluth Transit Hub



Northern Lights
Express Rail Line

Minneapolis

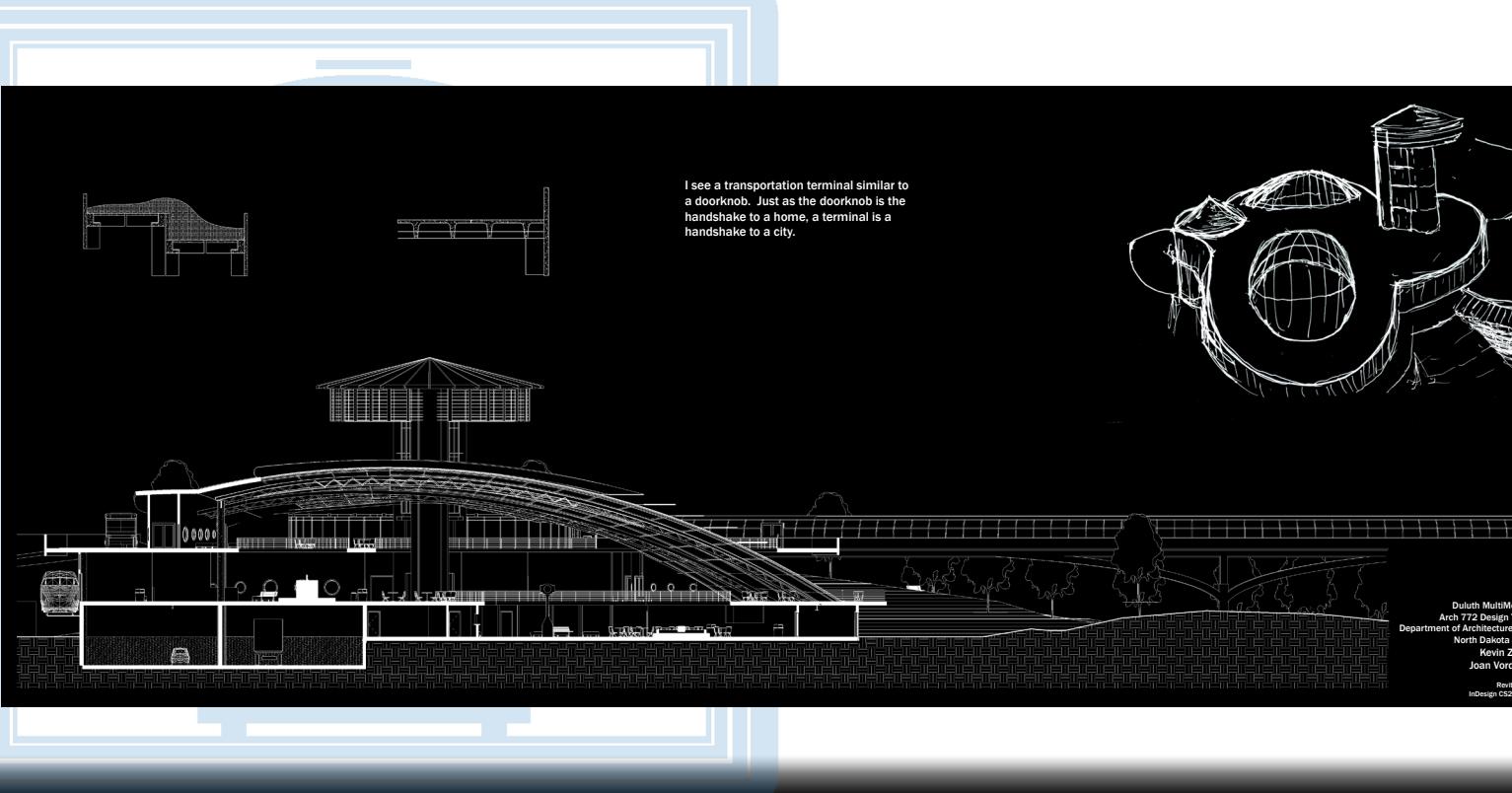
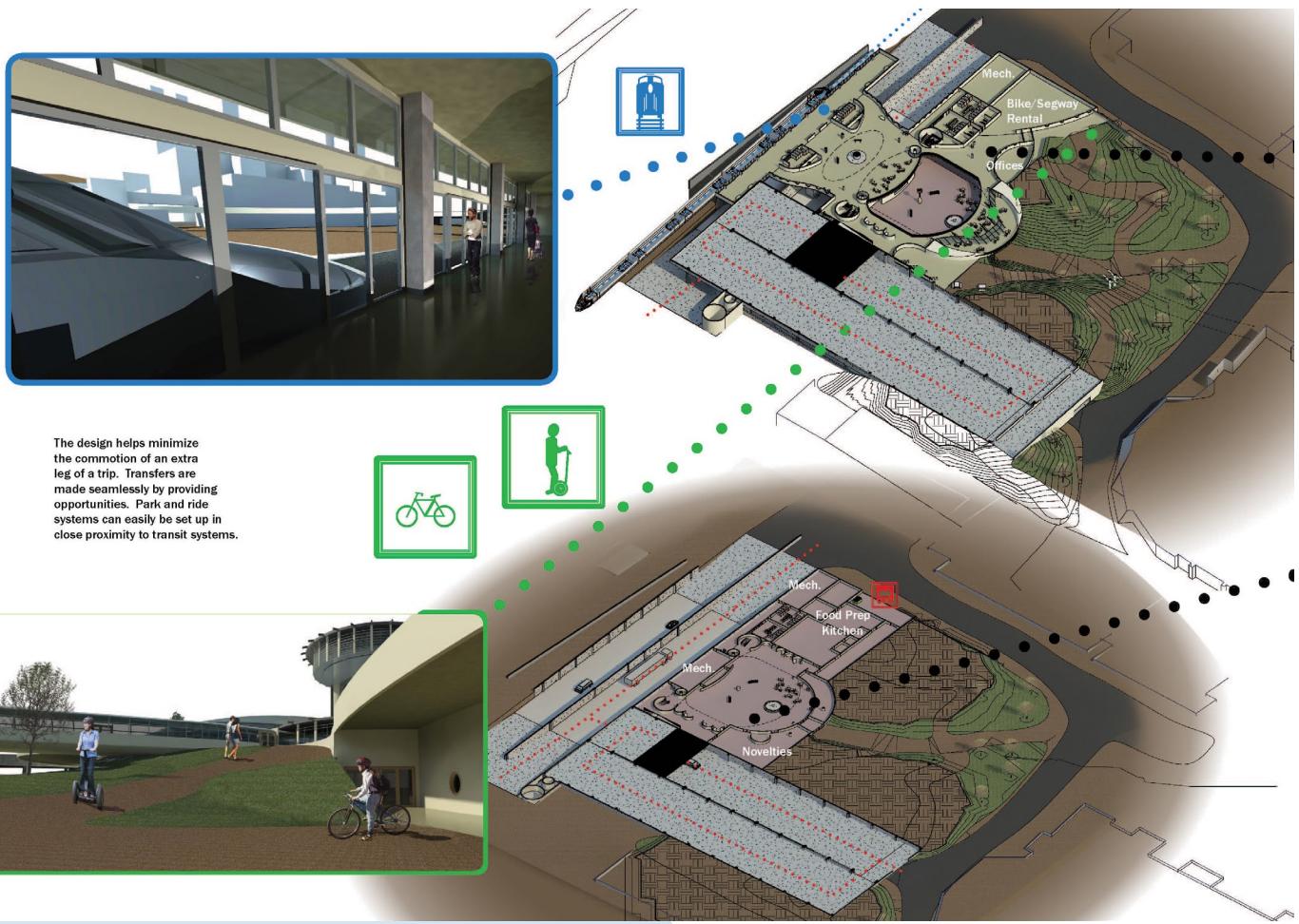
Duluth



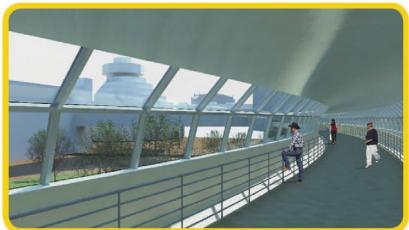
This site was chosen because of its location and convenience to a cultural entertainment and tourist center in Duluth. First, it has local to the BNSF right-of-way, which is important for a high speed rail line. Along with that, it is near the Historic Depot. It was important and appropriate to be able to link to the skywalk which ends in the DECC.

Landmarks and tourist attractions adjacent to the site are: Bayfront Park, Great Lakes Aquarium, The Depot, William Irvin Ship, the Aerial Lift Bridge, Canal Park, Grandma's Saloon and grill, and Enger Tower to name a few.





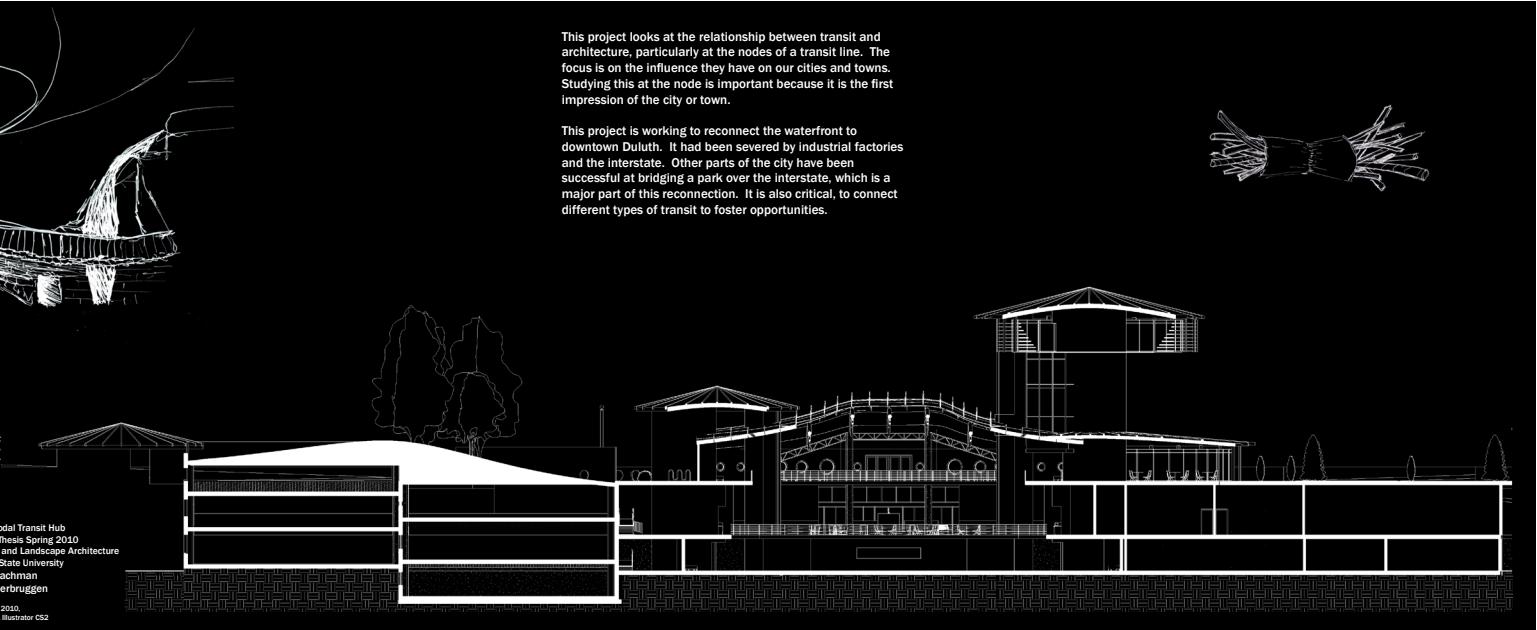
THE DESIGN

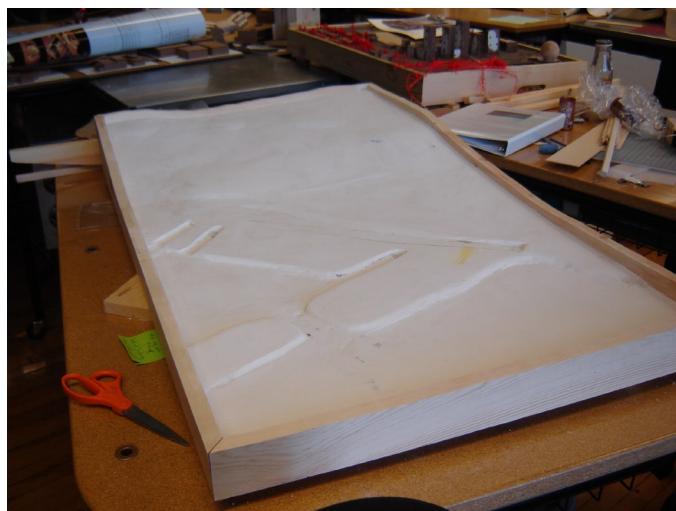


A central hall is important to multimodal transportation. It helps with way finding so that users do not get lost. Proper signage also helps in informing people where to go.

This project looks at the relationship between transit and architecture, particularly at the nodes of a transit line. The focus is on the influence they have on our cities and towns. Studying this at the node is important because it is the first impression of the city or town.

This project is working to reconnect the waterfront to downtown Duluth. It had been severed by industrial factories and the interstate. Other parts of the city have been successful at bridging a park over the interstate, which is a major part of this reconnection. It is also critical to connect different types of transit to foster opportunities.





THE DESIGN

DOCUMENTATION



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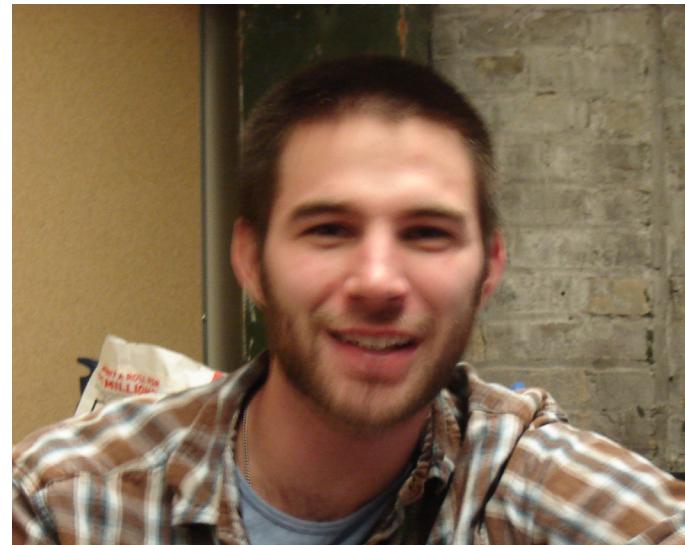


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To be human, at the most profound level,
is to encounter honestly the inescapable
circumstances that constrain us, yet muster
the courage to struggle compassionately for
our own unique individualities and for more
democratic and free societies.”

-Cornel West



