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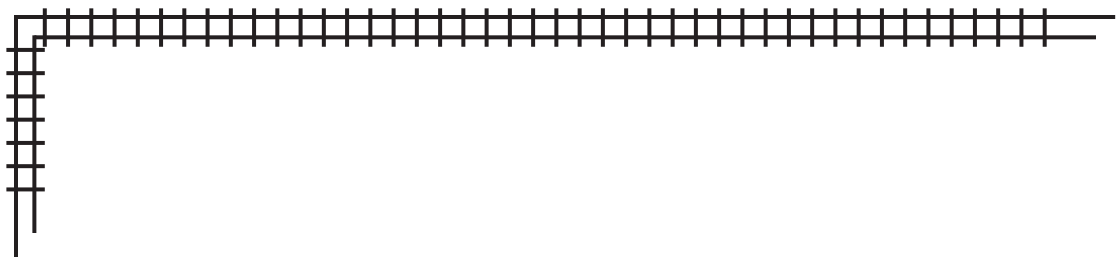
a suburban infill project



By: Jon Hegseth

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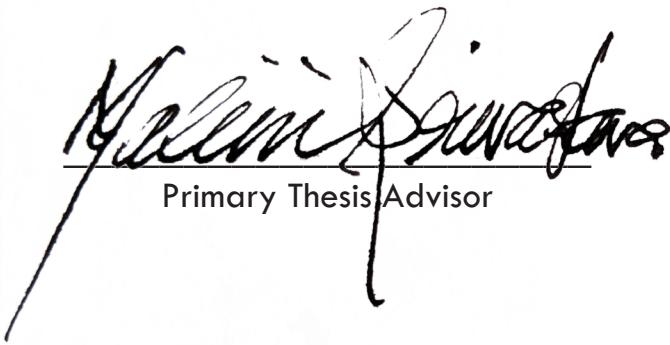
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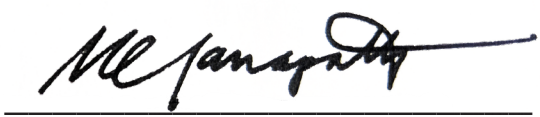


A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By
Jon Hegseth

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


Primary Thesis Advisor


Thesis Committee Chair

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ABSTRACT

The purpose of this thesis is to study a pocket of land along an existing train line in Anoka, MN. It is a pocket of land that was not developed due to its zoning for industrial use. The adjacent land has been developed into single-family homes, and the use of the train lines have changed from transporting goods to transporting people. My process will involve creating a Transit-Oriented Development with an emphasis on bringing density back into a suburban setting. The goal is to create a development near public transportation that can bring convenience, affordability and density of a city out to our suburbs.



figure 8.1



NARRATIVE

Did you know on average Americans’ spend an hour more commuting a week than the rest of the world? This may not sound like much, but over the course of a year that is nearly 50 hours. Let’s say you work from the age of 25 to 65, that is 2,000 hours spent commuting over just the average. Nearly 2 months of your life taken away from pursuing a new hobby, traveling, or spending time with your family. Not to mention the extra cost in wear and tear on your car and your body. Living inside the city center can be expensive and out of the budget, but what if there was another option? What if there were developments within the infrastructure of our suburbs that still had the perks of living in the city without the cost? The purpose of my thesis is to study how suburban-infill near public transportation can be used to bring the convenience and affordability from a city center out to our suburbs.

Most American’s are used to cars like fish are used to water. We have gotten so dependent on cars that people often don’t think of the negative effects it can have on our society and our daily lives. There are cities all over Europe that were developed around mass public transportation instead of around the automobile. These cities have a much higher density than here in the US. The street level is filled with small shops and restaurants bleeding out into the street and residential units above. The train station and transportation hubs are filled with small shops and necessity stores that reduce the distance of travel to complete daily tasks. This greatly cuts down on commuting times, and gives time back to the people.

America has had many attempts of trying to build density within a city, some more successful than others. One notorious failure was Cabrini Green in Chicago. The development was eventually torn down due to its declining condition, but there were certain characteristics of the architecture that caused those declines. The lack of public space, human scale and public transportation were all key factors that ultimately led to its failure. There was no connection within the city or the development itself.

For my thesis I am studying a pocket of land along an existing train line in Anoka, MN. It is a pocket of land that was not developed due to its zoning for industrial use. The adjacent land has been developed into mainly single-family homes and the use of the train lines have changed from transporting goods to transporting people. My process will involve creating a Transit-oriented Development with an emphasis on bringing density back into a suburban setting. The goal is to create a development near public transportation that can bring convenience, affordability and density of a city out into our suburbs.

T TYPOLOGY

Transit Oriented Development includes several smaller typologies grouped into one whole idea based around a public transportation. This sort of development is like that of a downtown setting where you would see multi-family housing and shopping centers. The difference is that it is based around a central transit center.



MAJOR PROJECT ELEMENTS

Multi-Family Housing

- o Multi-story low to mid income housing
- o Mostly 1 and 2 Bedroom units
- o Courtyard Space

Transit Center

- o Parking Structure
- o Indoor/Outdoor Waiting Area

Shared Outdoor Spaces

- o Shops
- o Plaza Space
- o Designated landscape areas
- o River front

USER-CLIENT DESCRIPTION

The City: While the City of Anoka may be the client of the development, it does not mean they are the main users. They are overseeing the project so that the design is best suited for the economic and social needs of their city.

Residents: Residents of the main users of the site. They will have the largest benefits of the metro line. Connecting with downtown will be a breeze without ever starting a car or sitting in traffic. The residents have very little need for a car at all between the metro line and the local shops, so long term parking is all they would need.

Site Visitors: From shoppers to daily transit users there will be a diverse number of people on the site. These users will fluctuate the most of any other users. Parking requirements vary greatly for this group. Commuters will leave their car there for the whole day, while a shopper might only stay for a few minutes.

Parking: The existing parking structure and parking lot will facilitate all the parking requirements for the shoppers and transit-users. The residents will park in more long-term parking underground.

THE SITE

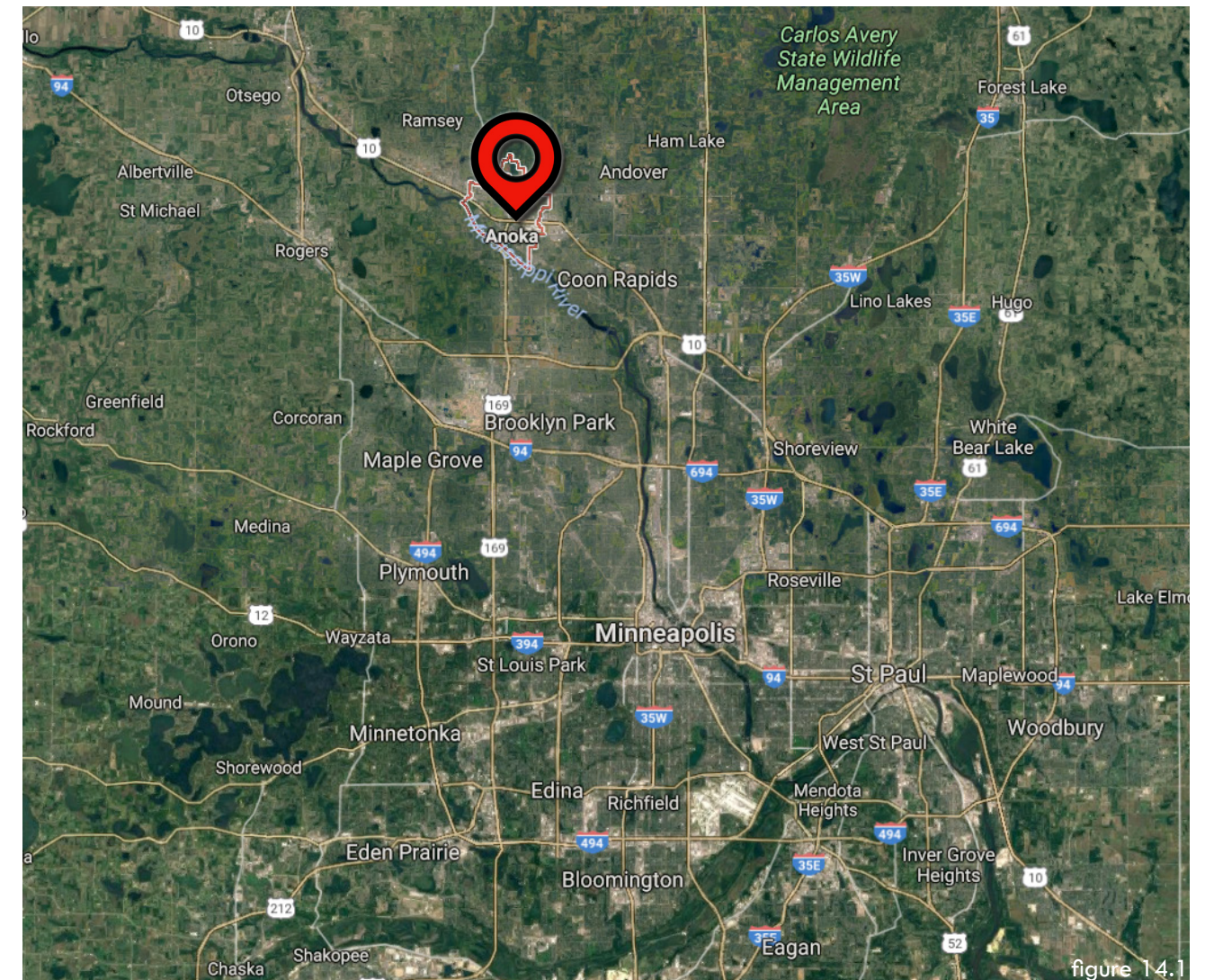
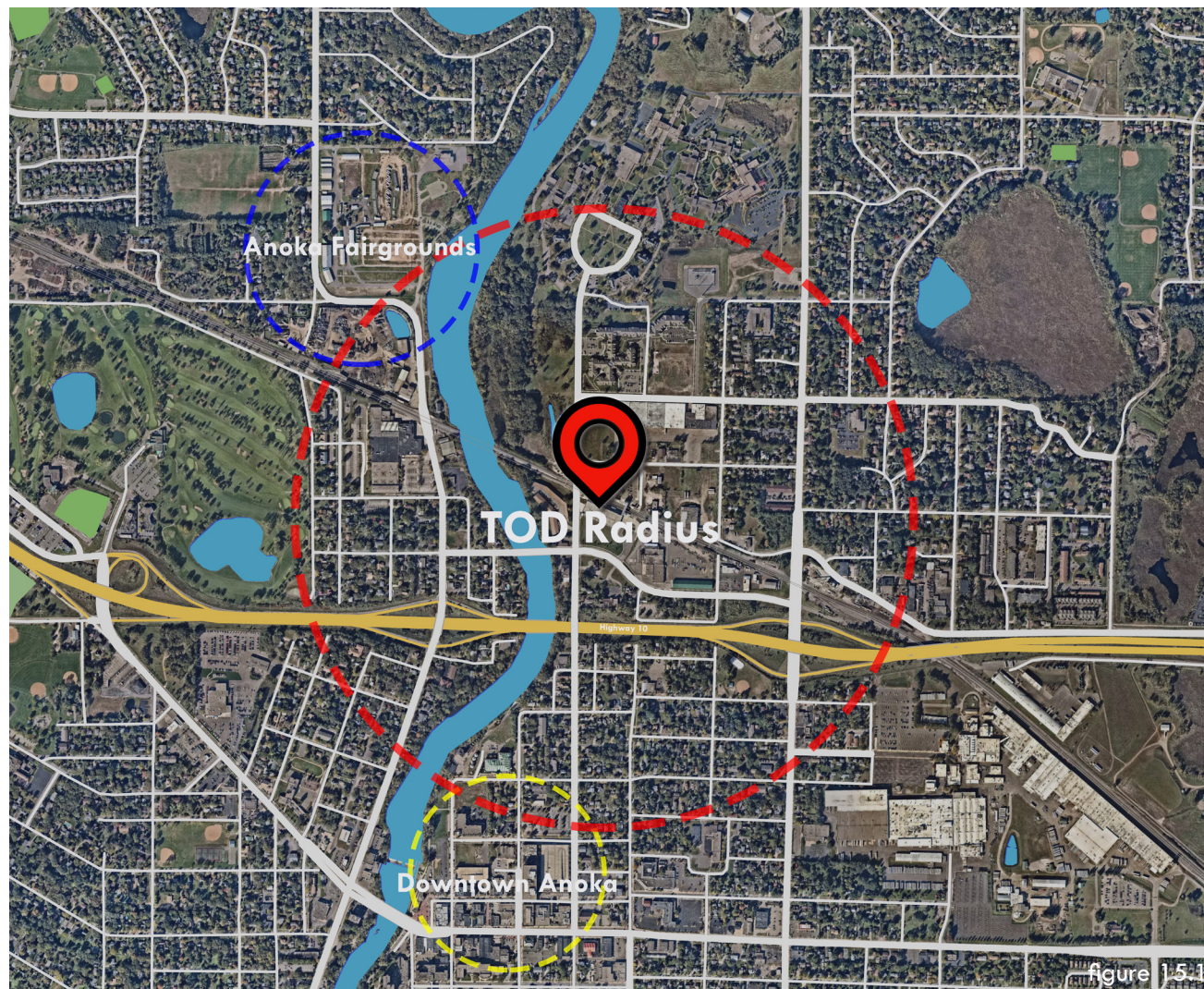


figure 14.1

Region: This thesis site is located 20 miles NNW of Minneapolis. One of the main reasons this site was chosen was its relation to the city of Minneapolis and St. Paul. Its location along the Northstar Metro line makes it a quick 30-minute traffic free commute to the heart of Minneapolis. This makes it a great study for creating alternative dense urban settings outside of the city center itself at a more economic price.

SITE:CITY OF ANOKA



City of Anoka: Anoka is a city located within Anoka County. It has a population just under 18,000 people. It is a well-established typical suburb of the Twin Cities that offers a more sprawled out and relaxed style of living than the upbeat busy nature of the downtown lifestyle. It is a platform that would serve as a great template for this thesis with its strong transportation connection to downtown with its lower cost of land.

SITE:THESIS SITE



Thesis Site: The site for the TOD weaves in and out around existing facilities. The design will be centralized by the existing park and ride transit stop. The location includes some riverfront property, some existing industrial buildings that will be reutilized, and open fields. The location just north of Anoka's existing downtown district is a vital part of the future development of the site. Trolley lines running between the already existing foundation would be a great way to jumpstart a new development. The site's location near Highway 10 makes it easily accessible for access the new development. Everything in highlighted in yellow above is the site for the initial installment. Everything highlighted in blue represents the expandability of the site.

PROJECT EMPHASIS

This thesis project will focus on a sustainable transportation approach to create an equal opportunity for all. It is important that the transit oriented development fulfills the needs of its occupants while still drawing in new clients and shoppers. The development should serve as a gateway between Anoka and Minneapolis. Developing a strong landscape environment is an important emphasis for the project. This is something that spread-out suburban’s have a big advantage over densely populated areas.

Project Emphases:

- 1. Create a community based around a reliable source of transportation as a more affordable solution
- 2. Supply the community with adequate amenities to reduce need for unnecessary travel
- 3. An alternate solution to the spread-out nature that our nation has grown accustom to

GOALS OF THE PROJECT

Academic Goals

My main academic goal for my thesis project is to display an accumulative knowledge from all my educational experiences. Most obviously from NDSU, but also from my year at Dunwoody and my drafting classes in High school. Whether it’s new technology or learning from mistakes in the past you never stop learning in the field of architecture. Each project is better and more complete than the last. For my capstone project I want to create the most comprehensive and profound project yet. It will forever be a snapshot from my educational experiences.

Professional Goals

One of my goals for this thesis project is to be able to use it as my centerpiece for future job portfolios. Transit oriented developments are not something I necessarily want to go into in the future, the comprehensiveness of the project should be shown in the work. My thesis project should show critical thinking applied to a problem at hand, which is something that every employer is looking for in an employee.

Personal Goals

Just like anything you put a lot of time into, you want to be able to show it off to those close to you. I plan on showing my thesis to family and friends who have been there for me even when I have disappeared for months at a time to live in studio. My thesis project will forever be an item I will take with me wherever I go. I want it to be something I am proud of and enjoy pulling out ever so often and reminiscing over.



PLAN FOR PROCEEDING

Definitions of Research Direction

To properly understand how a development like a TOD could impact the Anoka Northstar Line stop, research must be done to better understand the context. Examination of similar case studies will give a better sense to the scale and program of a development such as this. A review of the historical background of the site and rail stop will lead into further understanding of where the city of Anoka came from, and where it looks to go. Once the research is complete, a proper site analysis and program can be completed based research done along with size limitations, parking/zoning requirements, and overall need for the city.

Design Methodology

Quantitative and qualitative research methods will be used simultaneously throughout project research and design. Examining case studies and analyzing existing projects will help facilitate a stronger understanding of a successful TOD. Being able to see multiple developed projects allows analysis into both the positive and negative from multiple projects simultaneously. Direct observation inside of mixed use developments and public metro lines will also be completed to help understand the scale as well as how the dimension of time is understood.

Documentation of the Design Process

The continual documentation of this project will be done through compiling photos, writings, 3d models, and any other files into a single place on a hard drive. The file will be copied to an external hard drive on a weekly basis to ensure no more than a weeks' worth of data is lost. All the files will be compiled into their appropriate files and uploaded to the NDSU repository upon completion.

Schedule

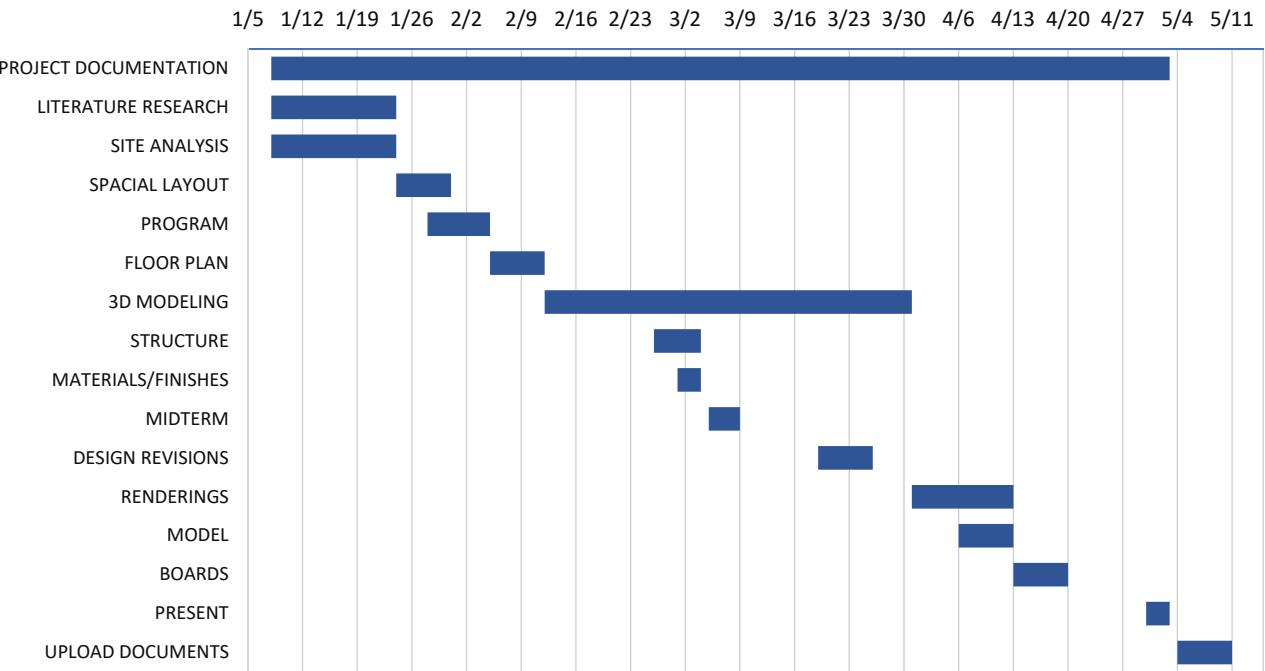


figure 20.1

CASE STUDIES

GABLES STATION

Transit-Oriented
Development

Location:
Coral Gables, Florida

Project Size:
\$160 million – 4.3-acre

Site Statistics:
16 stories tall
168 Hotel Rooms
526 Luxury apartments
75,294 sf of retail



GABLES STATION:CONTINUED

Similarly to Anoka, Coral Gables is a relatively small suburb to a much larger metropolitan district. It is 5 miles directly Southwest of Miami. It is located along the Miami Metroline, the main metro transit line that goes to from the outer edges to the center of Miami.

The scale of the project they have approved for the Gable Station is large and upscale. The 4.3 acre site is taking over an existing parking lot and small commercial business. The current proposal for a Transit Oriented Development came after a proposal for a big box retail in the same location, but plans were dropped when the traffic study came back and figured traffic to the site would increase by 250%.

The 16-story development is split up into three buildings, and is going to include: 504 multi-family apartments, 66 extended stay hotel units, 105,000 square feet of retail space, and 1,000 garage parking spaces. The development will be next to the Underline, a 10-mile park underneath the Miami Metrorail. Gable Station will fund a half mile of the park next to the development that will be integrated into the site.

The focus of the development is pedestrian oriented. The sites location is within a half-mile of the Miami Metrorail line, which gives you access to all of Miami and even the airport without having to use a car. The car parking on the site is located out-of-site and out-of-mind on elevated floors. Its direct connection to the adjacent park gives it direct access to miles of bike paths and sidewalks all through the park and rest of Coral Gables.

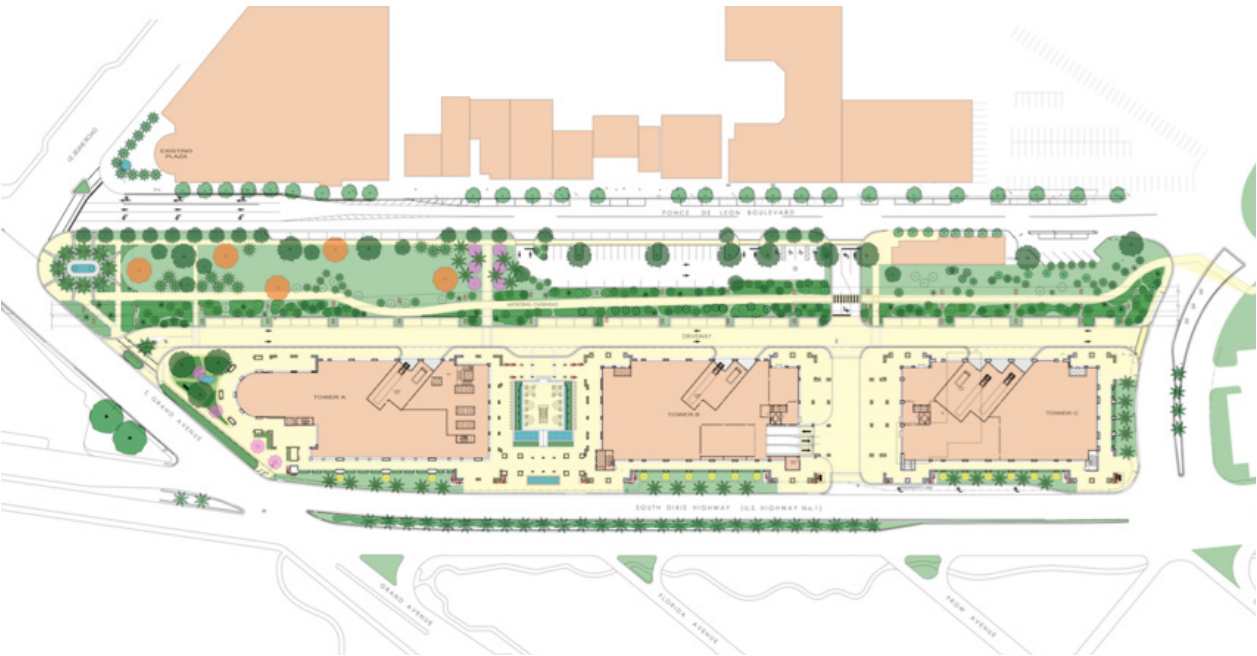


figure 23.1



Above: Open courtyard connecting two of the three structures at the pedestrian level.



Below: Correlation between the Gables Station development to the transit lines, as well as the 3-acre linear park.

Gable Station will obtain a perfect 3-star TOD Institute certified project. This is also a certification that the Anoka Station will look to obtain. They are looking to get a LEED Silver Certification as well. The entire development is trying to focus on a greener approach to common development ideas we have gotten used to.

At street level there is lots to see and do. There is ground floor retail space in all three of the buildings. The size of each unit varies greatly to allow for tenants both big and small. Sidewalks were widened to make room for sidewalk cafés throughout the development. There is a wide variety of developed public spaces on the site. In between two of the building is a large pedestrian only plaza with water features. There are covered walkways throughout the site with seating to create smaller pockets. Also, as mentioned previously it is located directly next to a 3-acre linear park on county land.



3 STARS OF EXCELLENCE
CERTIFIED PROJECTS

figure 24.3

EQUINOX

Transit-Oriented Development

Location:
Equinox, Toronto (Scarborough)

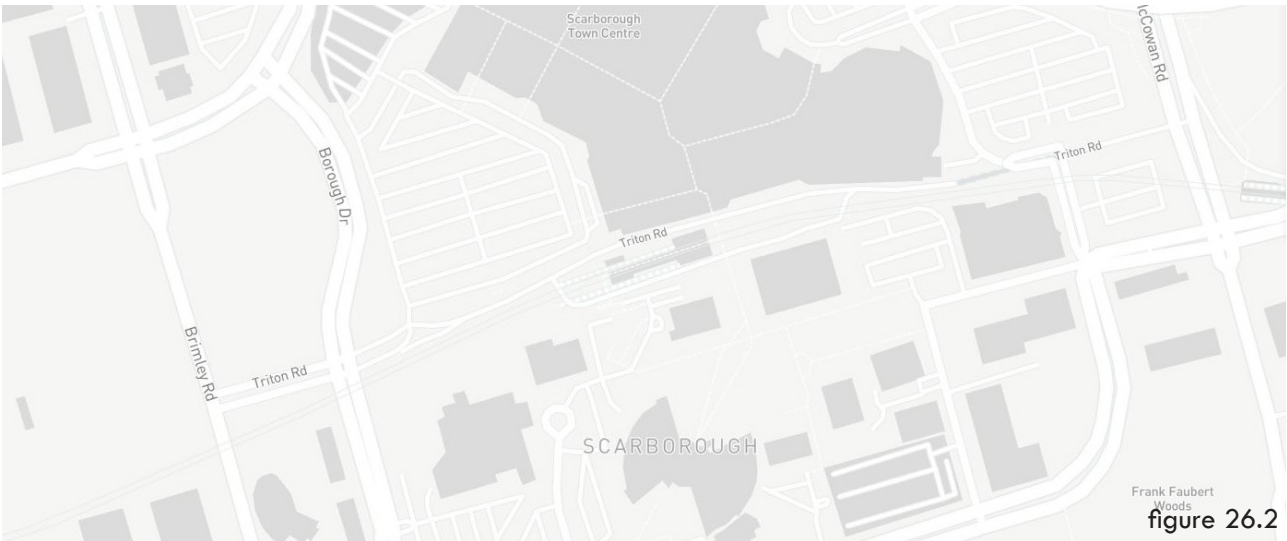
Project Size:
3.14-acre

Site Statistics:
2 buildings 37 stories tall
689 units (Between 550 & 970 sf)
8,600 sf of retail in 9 suites



The Equinox development in Scarborough, Ontario is in an already developed area of Toronto. The developed site is directly adjacent to office buildings, Scarborough Centre Rapid Transit Station, a civic center, and a Mall with nearly 1.3 million square feet of retail space. The city of Scarborough saw the existing infrastructure and land development as optimal conditions for a residential development.

Parking for the two structures are underground. There are 771 parking stalls due to a strict city code there needed to be 1.1 parking stalls per unit. Since the two buildings have been created the developer has started working with city codes to reduce parking standards and decrease the number of parking stalls required. For a project like this based around public transportation, there is a much smaller need for car transportation at all.



EQUINOX:CONTINUED

The nearly 700 condo units sold very quickly. The price when the units opened in 2005 was between 130k and 230k dollars. The average price for condos in Toronto at the time was 231k dollars, making the Equinox a cheap and competitive option for local home buyers. With the added incentives of the public transportation and local entertainment and shops the development was a no brainer for a lower income option for housing.

The layout of the site is split into two tall towers connected by an outdoor square park. The site was already surrounded by places to go and things to do, so the focus was not on keeping people on the site. The sites use was to be as a residential node. There are several shops located at the base of one of the towers, but nothing extensive. There are strong pedestrian paths in every major location around the site, including an direct bridge to the transit stop.



MILE HIGH VISTA

Transit-Oriented Development

Location:
Denver, Colorado

Project Size:
2-acre site

Site Statistics:
80-unit affordable apartments
Public Library
Small commercial development



MILE HIGH VISTA:CONTINUED

The city of Denver has taken a very proactive approach to their future city’s development. One of the key ways they have tried to manage this is through community land trusts. They buy land along future transit stops and lease land to developers to ensure affordable housing along transit-oriented development over an extended period. In Denver, the Urban Land Conservancy (ULC) was established in 2003 and works like a traditional CLT with the added benefit of financial support from a private land bank. They have been buying land throughout Denver and leasing the land to developers looking to create affordable housing, school facilities, community centers, and affordable office space.

The Mile High Vista is one of ULC’s envisions. They purchased a 2-acre lot back in 2011 within walking distance of two future metro line transit stations. The lot has since been developed with an 80-unit affordable rental housing called Avondale Apartments and a new public library. There is plans to finish an open part of the lot with future commercial space.



figure 29.1



figure 29.2

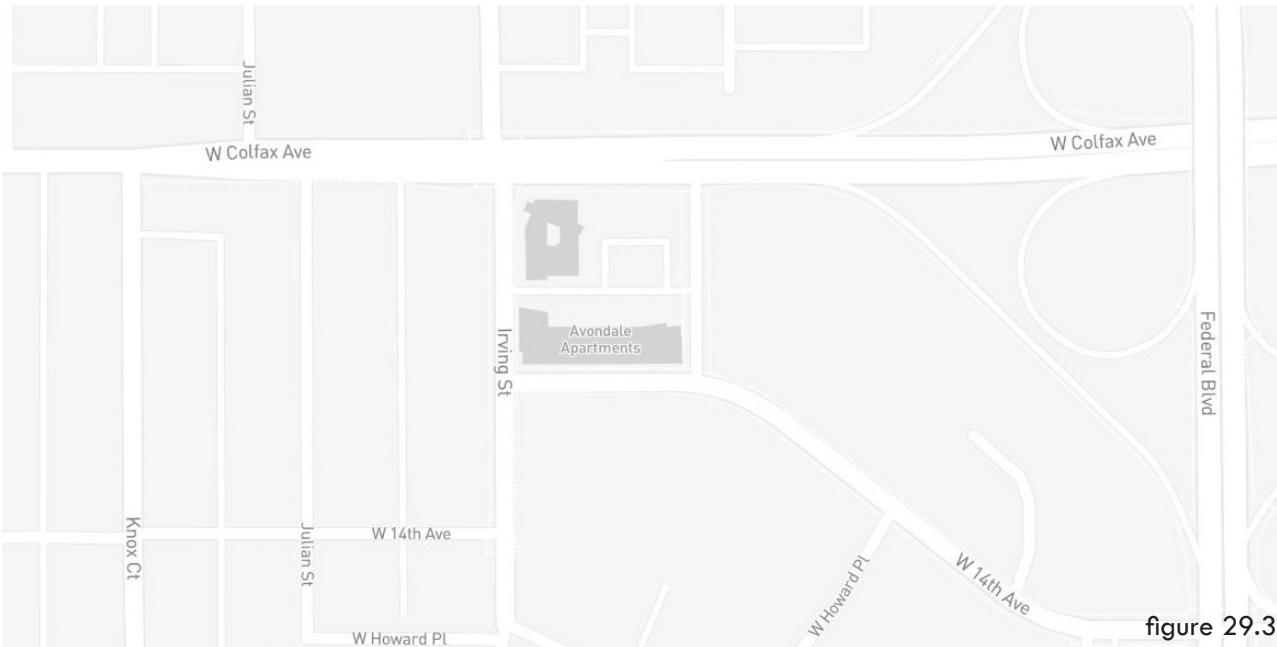


figure 29.3



figure 30.1



figure 30.2



figure 30.3

The Mile High Vista project was developed as a social need for the city of Denver. They were trying to find a way to close the affordable housing gap that they have by creating a transit-oriented development. They are trying to give back to the city and respond to their needs. The public library was created to bring a sense of community to the area. Denver’s proactive approach to jumpstarting their low-income housing create organizations like ULC and use lower income loans from a TOD fund to create these low-income housing options. The Mile High Vista project was only one example of a site along the transit line, but there are several that have already been created with a similar idea in mind.

The Avondale Apartments are a 7-story tall apartment complex with 80 units. The apartments are affordable apartments to households earning up to 60% of the Area Median Income. The apartments range in size from one to three bedrooms, and are between 730-1300 sf. The building was built to a LEED Gold achievement. The public library directly adjacent to the apartments was built to a LEED Silver standard. Both buildings were built as a way to give back to the community as well as educate the public on green design.



figure 30.4

CASE STUDIES:CONCLUSION

All three case studies are all very different in location, budget, and size of development. Each project approached their transit-oriented development with different intentions and goals. Nevertheless, they share several characteristics between them. Most importantly, each one of them individually responded to the need of the people. In doing so each one of them were occupied with tenants quickly, showing an obvious agreeance for this type of new development.

In the case of parking it was a universal idea across all three case studies; out of site out of mind. The Equinox and Mile High Vista located the parking was underground. The Gables station had it hidden behind a façade that appeared to mimic the rest of the building. The purpose of the development is to take advantage of the public transportation, not use a car. The Equinox in Canada has parking dedicated only to tenants strictly based on building code. The Gables Station shares the parking between tenants and shoppers.

When trying to figure out the size of the project, you must think of it in vertical growth. The size of the project must be within ½ mile radius of the public transportation to be called a TOD, so to achieve this it must be developed vertically instead of horizontally. In the case of all three case studies they were built in an already developed area, so the site was laid out for them. The limitations of density are strongly based off 2 city codes, parking and height restrictions. In the case study of Equinox in Toronto, they could make an amendment to the zoning code restriction on height to go from 10 stories to 16 stories. Doing this helped them create a higher density near the public transit system.

All three case studies have 2 or more buildings that make a transit-oriented development. They are not a single entity, but a collaboration of multiple buildings with multiple uses. The buildings are connected by strong walking paths and corridors that connect them to other buildings on the site or surrounding sites. It is most important for the buildings to have a strong use of pedestrian oriented spaces. These developments are being approached by foot or bike in most cases, so opening the main level of the site for people to roam and shop is key to developing a TOD. Parks are a great way to bring color and life to a site, and give the people a place to relax and enjoy nature between the city and home.

Some achievements that are commonly sought after in TOD’s are LEED and TOD Institute certification. The Mile High Vista contains LEED Gold apartments and a silver library. Many of the LEED points are items that transit-oriented developments are already based around like walkability and pedestrian orientation. The Transit Oriented Development Institute has a 3-star TOD Certification that are given out to projects that comply with their 10 elements. Many of the elements that TOD Institute follows are the same elements that come with the successful TOD case studies. It covers things from parking, to accessibility and affordability. For the thesis project in Anoka, a perfect 3-star TOD Certification will be sought after.





THEORY PREMISE RESEARCH

In the literature review section, two journal articles closely related to suburban infill will be introduced, discussed and analyzed. The first article comes from *Urban, Planning and Transport Research*. The name of the article is “Evaluation of public transport: regional policies and planning practices in Sweden.” The journal article discusses some of the process already in place around public transportation. Sweden is a great example to study this topic due to its scale of existing public transit infrastructure in towns both large and small.

The second journal article comes from *Economics of Transport*, Volume V. The article titled “Vehicle fuel-efficiency choices, emission externalities, and urban sprawl” talks about the relationship between vehicle less fuel-efficient vehicles and low-density cities. The article talks about many studies done here in the US, giving lots of insight into destructive tendencies we need to look at as a nation.

THESIS RESEARCH





figure 35.1

Evaluation of public transport: regional policies and planning practices in Sweden

By: Erik Johansson

Introduction:

There is a substantial interest in developing new ways to become more sustainable. One topic that is becoming increasingly popular is the subject of public transportation. The transport sector faces challenges including fuel dependency, global warming, poverty and social exclusion (Johansson, 2017, p. 59). Cities are increasingly planning for more bike trails, walking paths and public transportation. There is evidence supporting the positive effects public transport has on society, including: accessibility, safety, health, environmental, shorter travel times, livability and economic growth (Johansson, 2017, p. 59-60).

With the declining state of our planets environmental health combined with the recent studies to support this, the role public transport plays in our society could be used to serve societal and political needs. The need for strategic planning in this field has already been identified by Sweden, who has new legislation to change the task of the regional public transport authority, otherwise known as RPTA (Johansson, 2017, p. 60). Since public transport is majorly supported by public funding, it is important for the public to be well-informed on the subject. It is ultimately the peoples' decision who gets put into office to mitigate tax funding.

The purpose of the case studies within the journal are to shed light on the current planning practices and strategies. By interviewing planners and practitioners at RPTA in Sweden, the hope is to spread the knowledge of those that are already tackling the subject and share it with the rest of the world. The interviews are based on 3 themes:

1. How local and regional strategic public transport objectives in Sweden are translated into actual measures taken
2. How local and regional Swedish public transport services can be evaluated in terms of the overarching strategies of public transport
3. Are there potential areas of conflict?

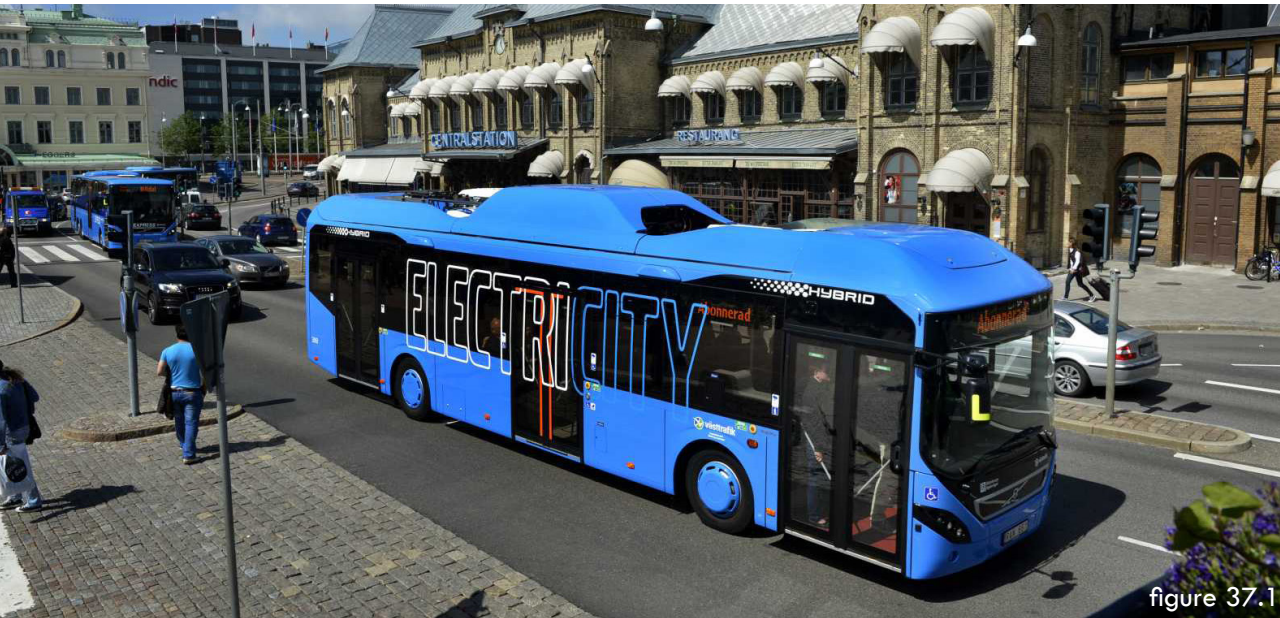
The purpose of the study was to inspire an analyses of other countries system, and to evaluate any gaps in the methods and objectives of planning for public transport.

LITERATURE:SWEDEN (cont)

Background:

Existing literature in public transportation appraisal is primarily focused on cost-benefit analysis. There is a need for factual evidence on public spending so the goals of the public are most efficiently achieved. Decisions shouldn't be made from persuasive arguments and personal objectives. These assessments may need more research to fully understand the quantitative and qualitative benefits from a long-term transportation plan. Some of the benefits that have not been fully analyzed due to the length of study are: reduced emissions from reduced car use, decreased traffic injuries, health benefits, impacts on land-use and land values, diminishing social exclusions, and improved accessibility for the disadvantaged (Johansson, 2017, p. 61-62). Public transport planning combined with land-use coordination are important from a sustainability standpoint, and not just a housing and business supports.

Sweden has been very progressive on their search for sustainable cities. Their primary national transport policy goal is economic efficiency and sustainability. Cities in Sweden have a common long-term goal of creating sustainable cities with a sustainable transport system. Subsidies on public transportation at the local and regional level are on average 52%, according to a transport analysis conducted in 2016 (Johansson, 2017). Due to such a high percentage of government funding there is an increasing interest in analyzing the cost benefit to building these transportation systems. Most of the authorities in Sweden currently do not conduct a cost benefit analysis. This is not due to a lack of financing, but more a lack of knowledge about the subject. Basically, the municipalities know that a strong public transportation system a good thing, but they do not know how to analyze its effectiveness at an economical level.



The Study:

The purpose of the study was to obtain insight into the qualitative process of evaluating public transport planning in Sweden. The goal was to understand certain processes rather than gathering generalized knowledge. The study focused on five Swedish regions, ranging in size from the dense city center of Stockholm to a more rural neighborhood of Blekinge. This way they can see differing markets from urban to rural and their differing labor markets. Questions were posed to informants on the transport planning committee and the operators of the services to get a full range of views.

As stated previously, the three questions that were posed were this:

1. How local and regional strategic public transport objectives in Sweden are translated into actual measures taken
2. How local and regional Swedish public transport services can be evaluated in terms of the overarching strategies of public transport
3. Are there potential areas of conflict?

These questions were written to try and understand the main aim of the study, which was to understand appraisal practices among planners. They wanted to keep the questions as open ended as they could with a limited amount of vernacular to test the cohesiveness between the different municipalities.

The Results:

It is up to the regional public transport, or PTA, to present the needs and objectives for the regional public transport system. From there, the goals are broken down into measurable targets that can then be achieved. The two objectives that were stated most often were increasing the market share of public transport as a sustainable measure and providing a social service (Johansson, 2017, p. 67). The interviews with the members of the PTA traced the way we view public transportation which is by stressing the outcome over output. It is more important to address environmental issues, land use, and labor market effects that simply increasing frequency. It is most important to stop and ask yourself what public transport is creating.

LITERATURE:SWEDEN (cont)

Collaboration is key to public transportation. It is about combining different jurisdictions and modes of transportation to create an effective system for society. Planning walking/biking paths near transportation terminals can help connect the space between stops, and making it that much more convenient to use the system. It is not about the number of stops, but how well each one is integrated to be able to use them reliably as a main source of traveling. Creating links between cities and neighborhoods helps emphasize the social values that public transportation is used for.

To maintain an effective long-term structuring effect of public transportation a collaboration with city land use planners is key. A transportation center can bring the people to a location, but it is up to land use to dictate what will be there. Creating a structuring effect where one transport hub connects to the next as a city grows and changes is the best way to secure a stable passenger base. Recognizing these changes early can stop any unexpected changes that could come. An effective way this could be done is by building a new development around an already existing public transport system. The transport system can be used as a marketing factor for the development as well to build new travel habits within its users.

Regarding the use of cost benefit analyses most informants said they are rarely done by choice, only if it is required. Consultants are only used to compute net costs of services. Never are they reviewed to appraise the qualitative items that public transport brings. There are many variables in the iceberg of public transportation, we only see part of the big picture. There is a limited amount of research out there on the social impact of a system like this. We need to focus on hitting goals within the societal level to shape public transportation, because accurately appraising all the cost benefits is impossible.

Some of the informants had very passionate reasons for appraising the benefits of the public transport system, but for the most part they shared the same ideas. One informant stated that we should focus solely on the people that would use the transportation the most, workers and students. He says we shouldn't design around people because we feel bad for a person or society. This shows reason why there needs to be more studies on the actual uses of these systems so that we can take a more analytical view how a public transport system can positively affect society.

Conclusion:

There stands to be reasoning around the benefits of public transportation systems in our society. The full economic and social analyses of them are not clear, but it is clear the aim of them is to increase ridership and not economic efficiency. Public transport objectives seem to be less about the quantitative targets and more about what it creates for our goals as a society. It is important that we continue to develop and collaborate with all areas surrounding public transportation, because it is something that is not going away anytime soon.



figure 40.1

LITERATURE:FUEL-EFFICIENCY

Vehicle fuel-efficiency choices, emission externalities, and urban sprawl

By: Jinwon Kim

Urban sprawl is a phenomenon that we have seen patterns of in the US since 1950. While city growth is expected to maintain a healthy up-in-coming population growth, it appears the US have taken that to an extreme. No one has stopped along the way to analyze any negative consequences of low-density growth. One of the most notarized downfalls of suburban sprawl is the traffic congestion associated with it. When a city has no way of monitoring or penalizing development farther away from the city people will continue to move where it is cheaper.

Traffic congestion is only one negative effect of suburban sprawl. Other major downfalls are air pollution, our country's oil dependence and traffic accidents. Longer commute times mean people are using their cars more and more as the radius of our cities' growth gets farther away. We are forced to use personal transportation due to the fact there is no other reasonable options to get around. Due to this reason studies have shown that lower population density increases vehicle mileage and energy consumption (Kim, 2016). Even more importantly, studies have shown that increased vehicle travel distances are responsible for a large percentage of the greenhouse gas emissions (Kim, 2016). According to these studies we have spread our cities out to unsustainable levels. That is, we cannot maintain this type of growth without expecting permanent damage to the Earth.

One of the key variables we use in studying fuel-efficiency is the recent adaptation by law makers to put limits in place for new vehicle production. Companies are set to a standard to achieve a certain level of average miles per gallon across all their production vehicles. Additionally, there are fuel taxes and financial subsidies and penalties for the purchase of high and low efficiency vehicles. Financial incentives and technology advancements are both valid ways to combat the effects suburban sprawl has on greenhouse gases, but they are both slow moving and do not attack the root of the problem.

There is another series of studies that show an average correlation with consumers' vehicle fuel-efficiency choices and their housing choice (Kim, 2016). The study shows specifically that consumers living in less dense suburban areas tend to choose lower fuel-efficient vehicles than those in denser populated areas. The study therefore proves there is an exponential increase in the emittance of air pollution in lower dense regions since they spend on average the most amount of time on the roads.

The negative effects suburban sprawl has on our society in terms of vehicular traffic is very present socially and environmentally. Increased travel times and higher greenhouse gas emissions make it a substantial issue in our current day. Increasing fuel tax and creating congestion tolls are two of the quickest ways to reverse these effects. Compared to international standards the US is low in both categories (Kim, 2016). It is not a permanent fix, but it is a quick way to slow the rapid pace land growth we have gotten used to as a nation. Land-use restrictions and urban growth boundaries are two additional anti-sprawl policies. While these options are appealing, they have a much slower turn around as increasing fuel taxes, making them less efficient in the grand scheme of things.



LITERATURE:CONCLUSION

While neither of the journal articles discusses suburban infill directly, but they show the how and the why they need to be addressed. The first article “Evaluation of public transport: regional policies and planning practices in Sweden” discusses how together as a country they have been making changes to adapt and grow their public transportation. The second article, “Vehicle fuel-efficiency choices, emission externalities, and urban sprawl,” shows the reason why we need to address our low-density development we have grown accustom to here in the states. Together they give a solid reasoning and approach to the thesis topic in this book surrounding suburban infill. The question this thesis is looking to answer is how can we look at ways to combat suburban sprawl. The question that should be focused on is ‘how can public transportation play a role in infilling suburbia?’

The topic of mass public transportation is relatively new for many cities in the US. Subway systems and commuter train lines are typically reserved for major cities like New York and Chicago. However, in Sweden they use public transportation to connect many of their cities both big and small. When looking for a case study it seemed appropriate to look over seas where public transit is abundant, and has been for much longer than here in the US. The way Sweden looks at creating and maintaining a healthy public transit system is not by focusing on the numbers, but focusing on societal cause. Public transportation can have positive effects on many different issues in society, including accessibility, safety, health, environmental, shorter travel times, livability and economic growth (Johansson, 2017). We can only hope that every development of a city has this in mind when being created.



figure 43.1

One of the issues a public transportation can look to help resolve is reducing greenhouse gas emissions and our dependency on foreign oil. The farther away from city center we build the more reliant we become on personal vehicles as our way to get around. The second journal article discusses a direct relationship between low-density and increased mileage and energy consumption (Kim, 2016). Increasingly so, there is correlation with less fuel-efficient vehicles being more common in low-density areas (Kim, 2016). Therefore, an exponential amount of fuel consumption is coming from less populated areas, furthering the justification of infilling population in suburban neighborhoods.

Both journal articles provide adequate justification to the focus of this thesis. They look at the downsides of the low-density developmental habits we as a nation have gotten used to. They also look at the many benefits that can come from a higher density area with an effective public transit system by looking at an existing system in Sweden. Unfortunately, the full effects of suburban sprawl are not anything that can be fixed overnight. However, by taking the right steps today and relooking at the ways we have gotten into this mess we can always hope for a brighter future.



figure 44.1

PROJECT JUSTIFICATION

Often as cities are developed they look to grow outward. New land is found and build upon with new infrastructure farther away from the city center. This leads to further suburbanization of cities and lowers the density count. This thesis proposal looks at ways of changing the current mindset of new construction from looking outwards to looking within. There are many different areas of a city that either change use or are simply overlooked in the first pass of development. These locations can be used to infill our cities densities and offer a more sustainable type of growth.

The main benefit of a project of this nature is post occupancy for cities and their inhabitants. The proposed Transit Oriented Developments provide a greener approach to living within a city with benefits of accessible transportation and lower building costs. The lower cost is not from government funding, but instead from cheaper land fees in areas away from a city center. It provides an easier opportunity for starting professionals to be able and work within the city without having the cost associated with living in the city. The extended distance is not an issue due to the fast train lines into the city.

I believe that a project like this can grow my knowledge base and provide as a challenging academic exercise. The project partially imposes the ideas of a city planner, a site designer, a landscape and building architect all in one project. It focuses on a controversial issue in our society that should be further developed. Developers need to start building within or existing infrastructure instead of always considering new land. I plan on employing all the design and software knowledge that I have learned in my years at school and work into one project.

CONTEXT OF THE SITE

The task of trying to meet the needs of a growing city is something that has been happening since settlements were first formed. The initial reaction is to build out, and take over undeveloped land. With the increased population growth of today our cities are expanding at a rapid pace. In developing outward, we have not stopped to look inward for growth. Large areas of land, such as abandoned industrial parks, are sitting vacant in the middle of cities. What if there was a way to discover and develop these pockets of land and restore density within our cities?

The goal of this thesis is to develop land within a city that has been overlooked. Specifically, the focus is areas along railways that may have been shied away from due to noise and possible pollution. These pockets of land could be used for creating transportation hubs within an already sprawling suburb. The purpose of these hubs is to provide necessities for residents as well as provide an alternative access into the city. A transit-oriented development is the template used to create these hubs that can be used to infill suburbs, restoring density within our city once again.



figure 46.1

SITE ANALYSIS

Water near the Site

There are two bodies of water with immediate connection to the site. The main body of water is the Rum River that runs along the west edge of the site. It is a tributary river that feeds into the Mississippi south of the site. There is a thick row of trees on each side of the river that close it off from any views other than the bridge leading to the site. The second smaller body of water is a holding pond located on the Northwest corner of the site. It contains very little standing water and is filled with tall grasses and cattails.



figure 47.1

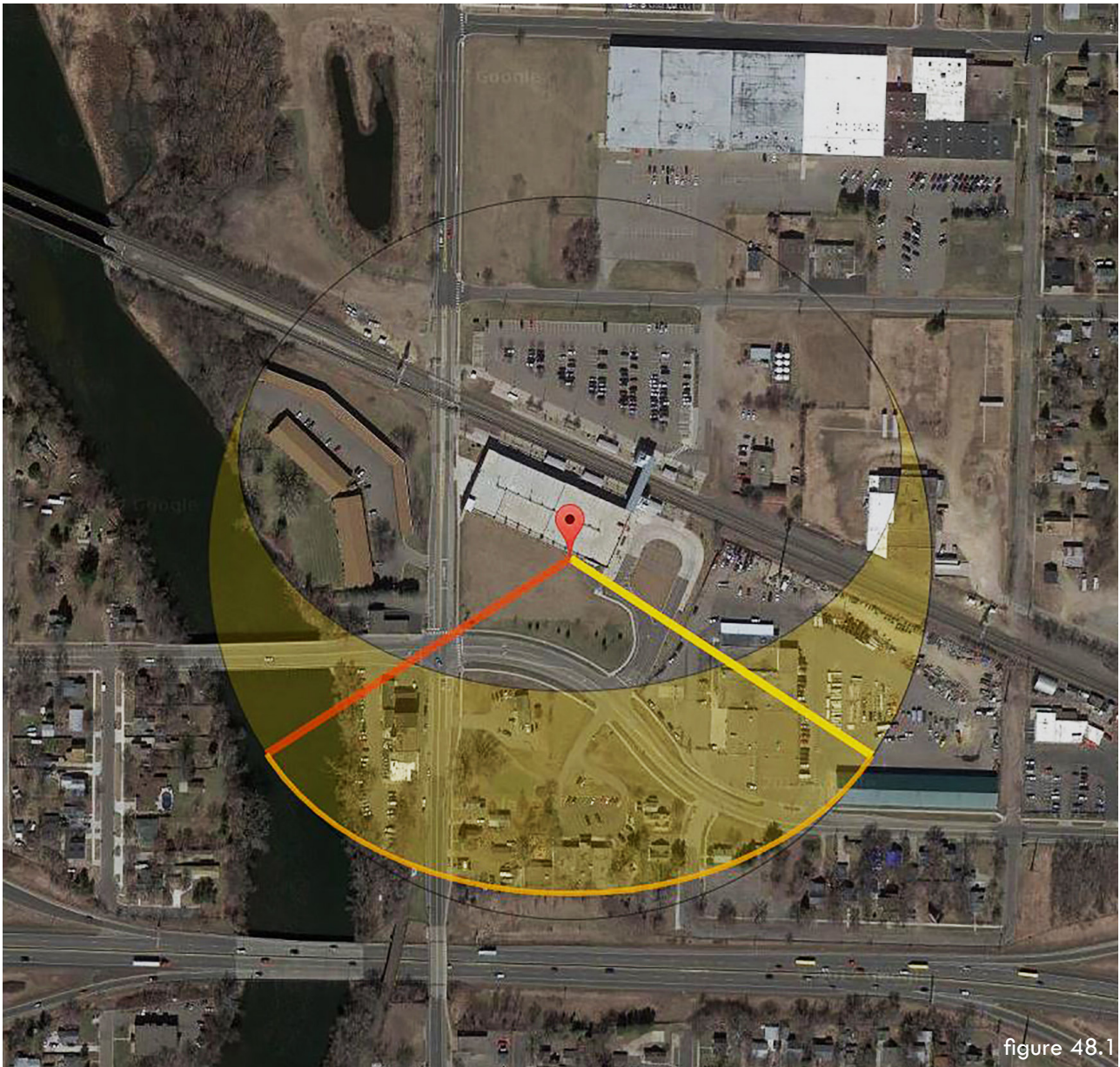


figure 48.1

Sun Intrusion:

The sun reaches into the site with very little intrusion from buildings or tree coverage. The most coverage from the sun comes from the 4-story parking ramp located at the center of the site. All the surrounding buildings are 1 to 2-story buildings that do not cast any shadows onto the site. There are several trees located throughout the site, but none significant enough to cast a large shadow.

SITE ANALYSIS

Wind Roses

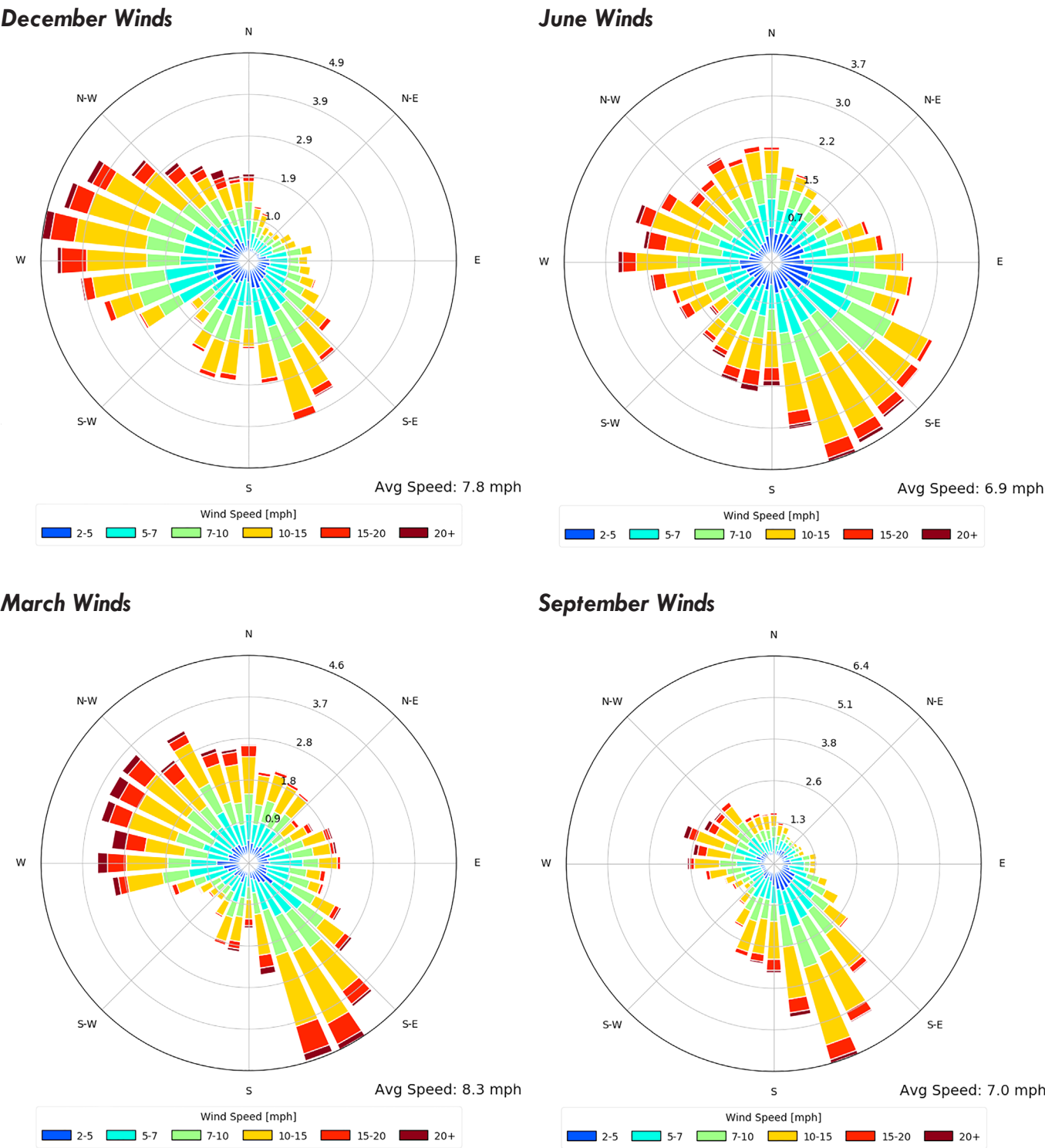


figure 49.1-4

Vehicular Traffic:

The heaviest traffic flow on the site is in the southwest corner at the intersection of Pleasant Street and 4th Ave. Pleasant Street feeds people into the site primarily from the west, where there is an exit off Highway 10. People travel up 4th Street from Downtown Anoka which is located less than a mile south of the site. To the north there is a retirement facility as well as several of Anoka’s community buildings that lead traffic through the site mostly during the daytime. To the east is single family residential neighborhoods.

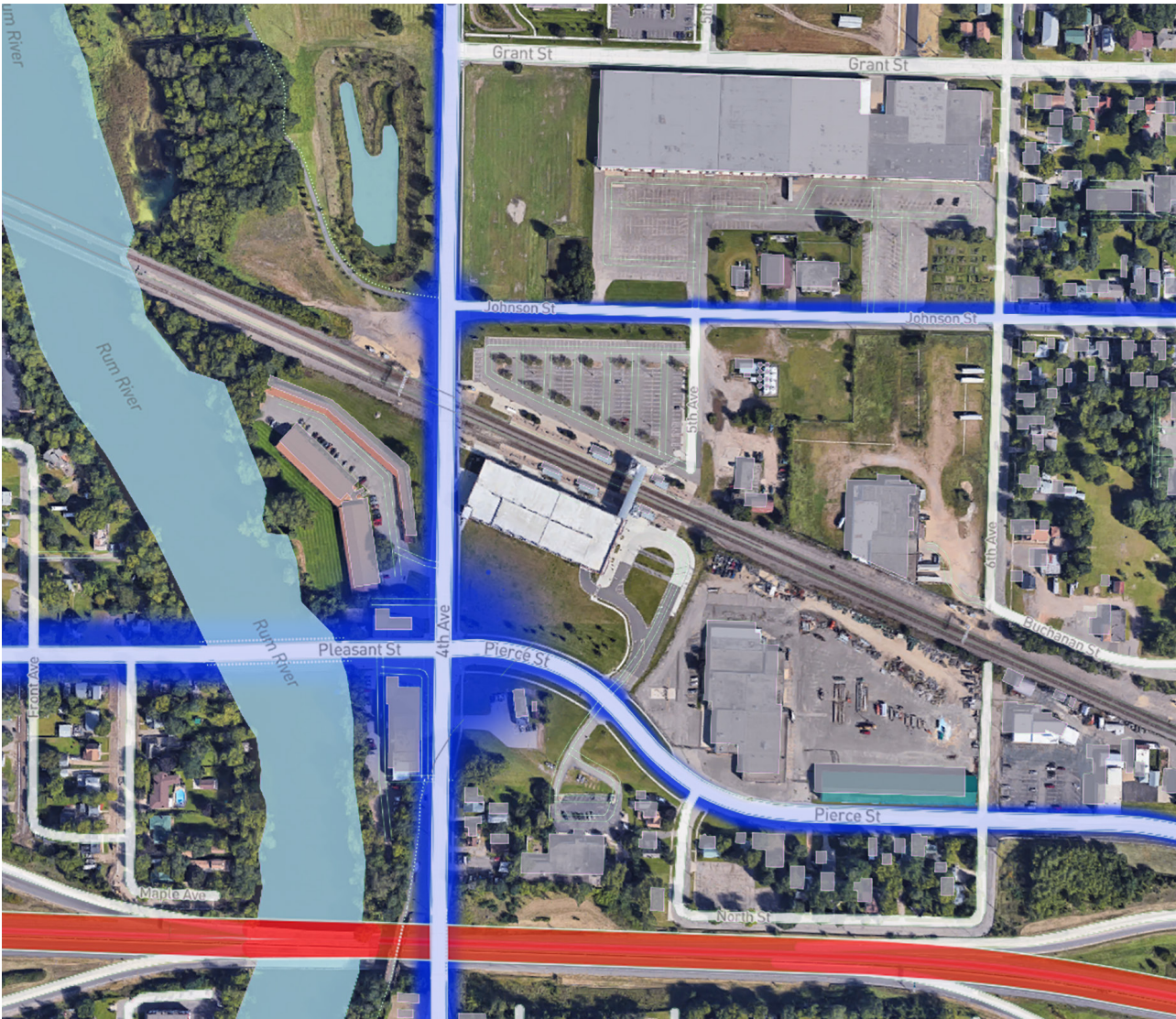


figure 50.1

SITE PHOTOS

Site Photos



PERFORMANCE CRITERIA

Site Relationships

The Anoka park and ride station has a proximity to other elements located near the site that serve to play a critical role in the overall performance of the site. These elements are not located on the project itself, but are close enough to affect it. The first nearby element is:

Downtown Anoka: What the downtown Anoka lacks in size it makes up for it in character. The historic area is home to many local shops and restaurant. It is home to many of the towns yearly festivals and markets that are held right in the streets. Being that it is such a focal point of the town already, it would be necessary to tie it in with the future TOD development at the Anoka station stop. Downtown is less than a mile directly south of the station. The two sites need to be connected by public bus lines as well as a bikeshare system with trails between the two sites, possible along the Rum River. Together the sites could collaborate to serve a larger community, bringing business to local shops while serving those right in the community.

Highway 10: While the focus of the site is not to rely on a nearby highway for its inhabitanace, it is a great way to bring others to the site. One of the main purposes of a TOD is to also server residents of the surrounding areas. Many of the same amenities that the TOD residents would use can be just as effective for nearby residents. The site can be utilized to take the transit into work every day, and then be used again coming home to get groceries and other necessities needed for that night. Instead of being able to walk your goods home you have a short drive ahead of you, but it is still reducing traffic on the roads and therefore emissions.

Hours of Operation

- Peak Usage:
- Apartments – 5pm to 7am
 - Transit Station – 6am to 9am & 4pm to 7pm
 - Shops – 12pm to 10pm

Project Design Standard

The Anoka station will be designed to achieve a TOD 3-star certified project. That is the highest rating of a TOD seal project achievable. The site must meet 10 out of 10 TOD elements. The judging criteria are as followed:

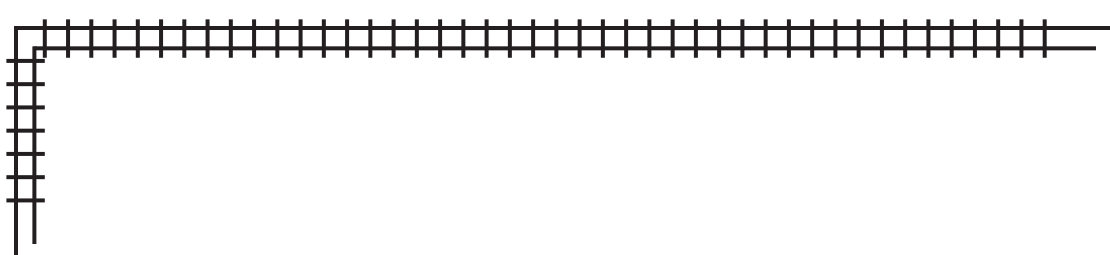
1. **Well defined public spaces** - Arranging the buildings to create ‘outdoor rooms’ with a sense of enclosure around the public spaces.
2. **Mix of uses** - A diversity of uses within each building, and within the buildings on the block.
3. **Quality pedestrian experience** - Safe and comfortable pedestrian access to the site with active storefronts to engage.
4. **Human-scale architecture** - Breaking up large surfaces to avoid the appearance of a mega-block. Reducing architectural elements to a smaller scale.
5. **Active ground-floor retail** - Variety of stores to choose from on the main level.
6. **Tree lined streets** - Trees lining streets and pathways throughout the entire project.
7. **Easily Accessible by bicycle** - Ample bicycle infrastructure, including locks, storage facilities and a bikeshare system in place.
8. **Reduced and hidden parking** - Shared parking between various buildings. A visible barrier between public spaces and parking.
9. **Affordability** - A diversity of units for sale or rent.
10. **Expandability** - A project designed to fit in with surrounding urbanism with possible room for expansion in the future.

This is just an abbreviated list of the requirements for the certification. A further analysis will be done in the project design phase.



3 STARS OF EXCELLENCE
CERTIFIED PROJECTS

figure 54.1



DESIGN SOLUTION



HISTORICAL CONTEXT

INDUSTRIAL ZONING

One of the major influences in choosing this site was because of the large pocket of land that was available in an already well established city of Anoka. The large area of land within the existing infrastructure is due to the existing land-use Industrial Zoning. The area of land was located right off the train line so material goods could be easily accessed on and off the train. The train line has since changed from transferring goods to transferring people. Looking back at existing site photos can help show the gap in development. This kind of zoning change has happened along the entire Northstar Line, and can be used as a template in any one of the other pockets of land originally zoned as industrial.

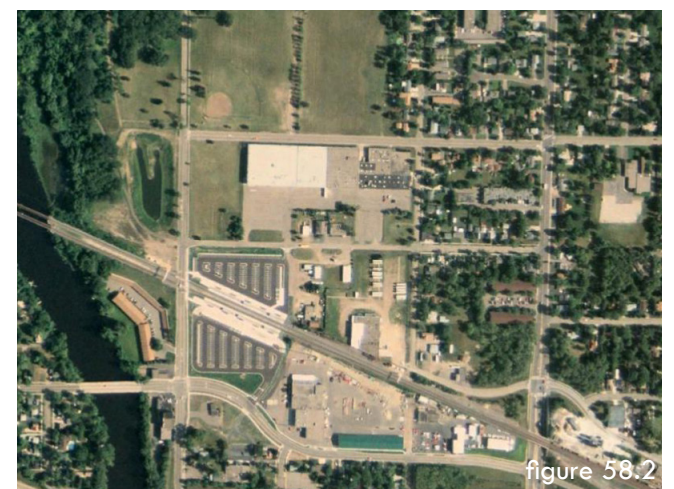
The first site image (top) was taken back in 1991. Development was stopped West of 6th Avenue. These large land was intended for large industrial usage. The land blocks off most interaction between the suburbs and the riverfront.

The second image (middle), taken 18 years later, shows the two parking ramps completed for the Northstar Park & Ride station.

The final image (bottom) from 2014 shows the most current image of the site. The southern parking lot of the Park & Ride station was upgraded to a 3-story parking ramp. Industrial buildings are being abandoned and demolished, leaving even larger fields open. Also, the northern most edge of the site shows the addition of an assisted living retirement taking advantage of the zoning usage change to TOD from industrial.



1991



2009



2014

INFLUENCES

PUBLIC HOUSING: CABRINI-GREEN

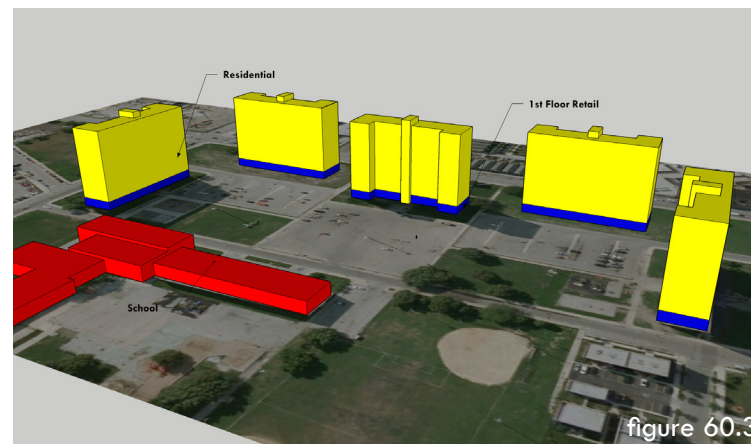
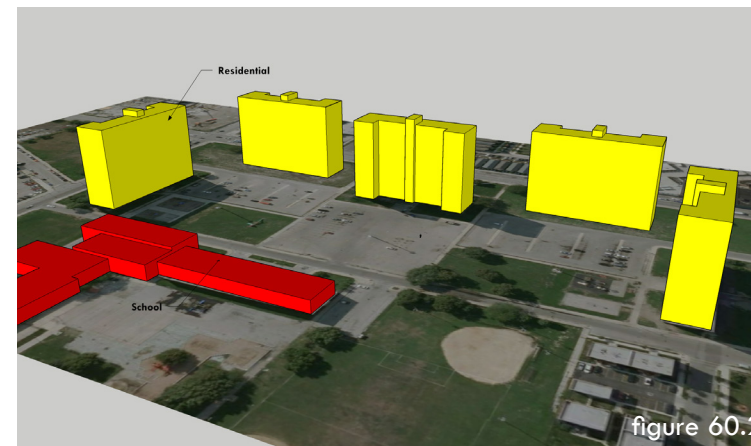


Density Hubs

While Cabrini-Greens is not a Transit-Oriented development, it is an instance where high density living were established in a relatively short time-frame. There are many things that do not apply, but there are many things that can be studied about the failures and ultimately demolition of Cabrini-Greens from a designers standpoint.

Applying TOD Principles

The final high-rise for Cabrini-Green was torn down in 2011. The condition of the buildings were in horrid shape from years of neglect and abuse. Considering it was one of the first major public housing projects in America there was much to be discovered in terms of how they were to be designed and how they would function. Ultimately it was the years of deterioration that let to the destruction of the buildings, but what if the design could have shaped how the buildings were used? In one study for this thesis I took the existing Cabrini-Green buildings and applied some of the 3-star TOD principles to the structures to see how they could've been shaped differently.



The top image shows the existing structures and their program (figure 60.2). There is no connection between the residential housing above and the ground plane. The first principle applied was an active ground floor retail (figure 60.3). This better connects people by giving a place for people to be drawn greeted by a variety of shops and stores. Programatically it softens the intersection of the residential above with the ground car plane.

PUBLIC HOUSING:CABRINI-GREEN

The next TOD principle applied to the site was creating a quality pedestrian experience and giving sufficient bicycle access into the site. These principles were enforced by removing two of the high-rise towers on the corners of the site (figure 61.1). The removal of these two massive structures allowed for both light and visual access into the site by opening it up. The more eyes you can get on a space, the safer it can be.

The final principles applied to the site were:

- Creating human scale architecture
- Well defined green spaces
- Mix of uses

Each of these 3 principles are shown on the site on figure 61.2. Shopping centers were added in lieu of the demolished structures to bring a greater mixture of programmatic space to the site. Green spaces were updated as well as a community center added all to help bring people in the community closer together by giving them a place to do so.

By no means do I believe these changes would have made the Cabrini-Green public housing a success. There are many political and sociological factors at play in a large scale project such as this. What the principles applied to this project does is create a higher quality of life for the inhabitants and nearby people affected by the space. A higher quality of life can help people take more pride in calling this their home, hopefully reducing the destruction of the site over time.

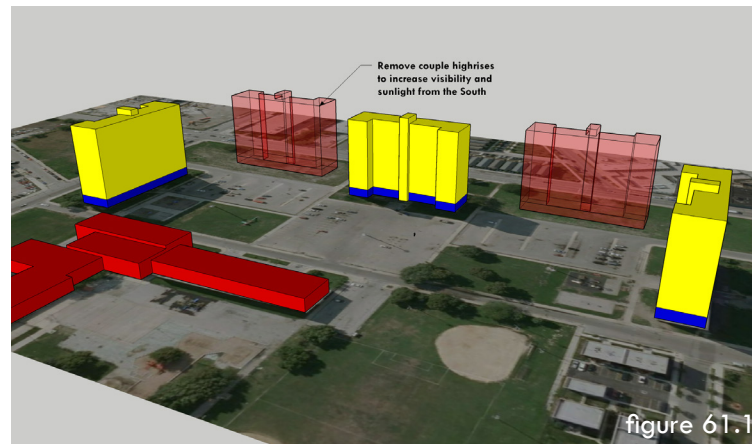


figure 61.1

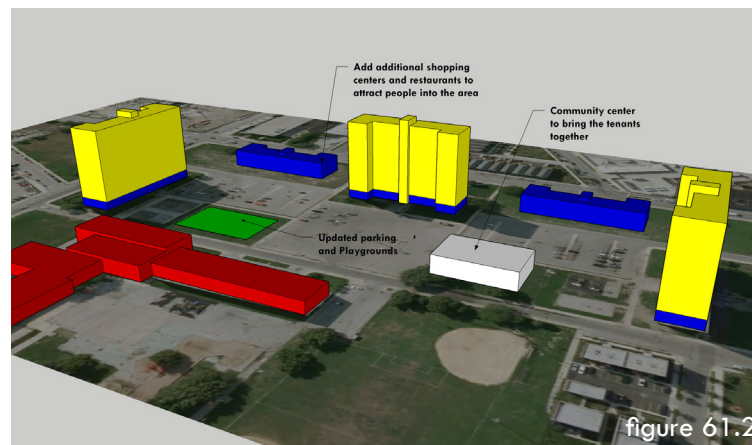


figure 61.2

PUBLIC HOUSING:RIVERSIDE

Understanding Proximity

The scale of people affected by a Transit-Oriented development ranges from a city scale all the way down to the personal space of somebodys balcony. This means that every scale in between also needs to be designed for. This is no small task to complete within one semester of thesis. A case study like Riverside Plaza in Minneapolis, MN can be a great case study to help better understand the varying scale of a large scale development.

Riverside Plaza is a public housing project that was designed by Ralph Rapson and completed 1973. While this these project is a TOD and not a public housing project, there are a lot of similarities in both developments. I had the chance to take a site visit to Riverside while working on my thesis project, and there were many design ideas I was able to transfer to my own project. The variance in scale of design was the biggest.

As I approached the Riverside Plaza, I could start to see how the scale of proximity to the development changed. At each level there was a new design layer that could be seen. When first approaching (figure 62.1) the large scale of the building could be seen against the Minneapolis skyline.

Once you enter into the facilities you start to see the layers break down into a more personal scale. The pathways throughout the facility vary in direction and levels. Pathways can be seen connecting buildings to one another via skyway (figure 62.2). Personal patio spaces are distinguished by various colored panels scattered over the buildings facade. This helps distinguish one persons space from another. Even on the ground level, personal spaces are distinguished by a seres of wall planes that set it off from the walking paths (figure 62.3).

Every level of proximity was designed for at Riverside Plaza. Everything from building form down to ground plane material selection. As seen in figure 62.4, the concrete material that is used all over the site uses a smaller wood planking form-work to give a smaller, more human size scale to the material selection.



figure 62.1

CITY



figure 62.2

COMMUNITY



figure 62.3

PERSONAL



figure 62.4

DETAIL

ANOKA TOD

Program

The city of Anoka has released a proposed master plan for a TOD located on the same site as A New Anoka. Limited parts of the plan have been implemented since it was proposed in 2012, the only recognizable one being the parking ramp on the south side of the Northstar Line. Upon further study into the program of the master plan, there is a major design flaw.

The purpose of a TOD at this location in Anoka to be to serve as a gateway for the suburbs into the heart of the Twin Cities. That would mean that people would be living near or around this TOD that want direct access into the city. This would mean that the development program should include mostly residential with enough shops and services to support them. The proposed master plan does not take full advantage of the space provided.

As seen in figure 63.2, there is over 200,000 square feet of office and industrial space planned for the transit-oriented development. To make matters even worse, they are the facilities located nearest the transit stop. The purpose of the development as stated earlier is to serve as a gateway for workers from the suburbs into the Twin City business district where space for housing is limited and expensive. By adding 200,000 square feet of office space to Anoka's new TOD, you are pushing people the business district of Minneapolis out of city center and therefore allowing people to develop farther out of the city. You are supporting suburban sprawl instead of increasing density to fight back against it.

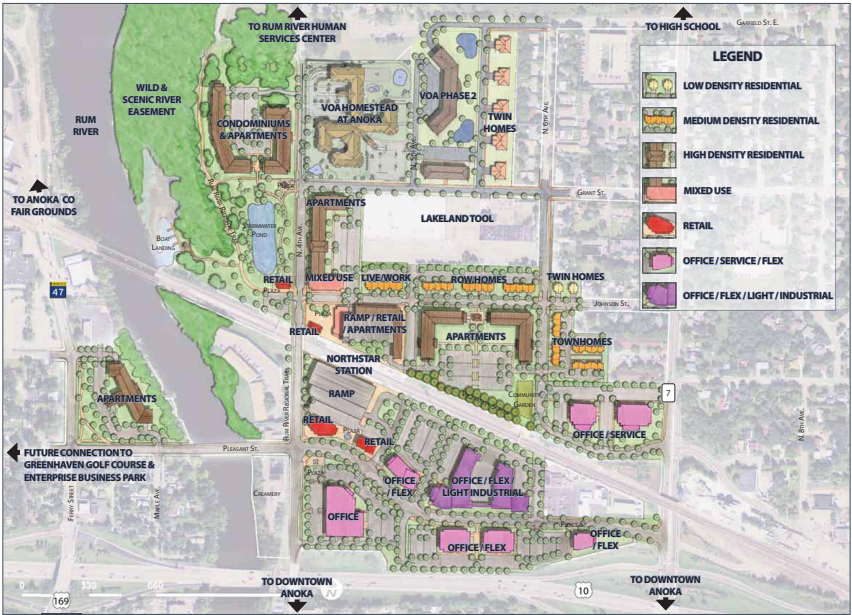


figure 63.1

Development Summary Table:

Residential	Units
Twin Homes	14
Townhomes / Rowhouses	33
Apartments	246
Condominiums	170
Senior Housing Units	348
Live Work Units	20
TOTAL:	831
Commercial	Sq. Ft.
Stand Alone Retail	18,000
Ground Level Retail	18,000
Office	105,000
Office / Flex	150,000
Light Industrial	68,000
TOTAL:	359,000

ANOKA HOISINGTON KOEGLER GROUP INC.

figure 63.2

KEVIN LYNCH'S IDEAS

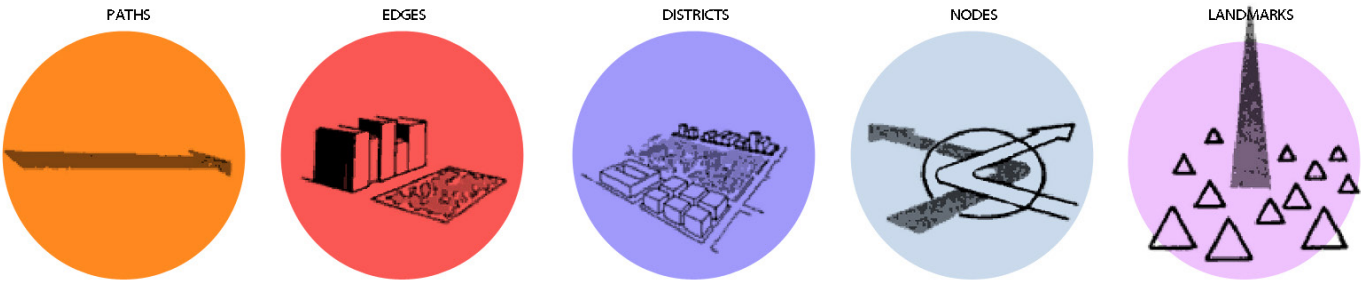


figure 64.1

Wayfinding

Kevin Lynch is an urban planner an author that spent his life researching effective wayfinding for large scale development. From his years of research he broke it down into 7 principles for creating effective wayfinding. These seven ideas create a more purpose driven design that allow for a higher quality of living through design elements of an urban scale. His principles were very effective in master planning a development such as A New Anoka.

Kevin Lynch's Principles for Effective Wayfinding:

1. Identity at each location
2. Landmarks for orientation
3. Structured path
4. Regions of different character
5. Don't give too many choices in navigation
6. Provide signage
7. Use sight lines to show what's ahead

All of Kevin Lynch's principles listed above are simple and straight forward. This is so the ideas can be applied to any project that deals with proximity and scale. Figure 64.1 shows a series of 5 principles straight from Lynch's book titled *The Image of the City*.



Performance & Process

The next couple pages bring you step by step through the design process. Many of the principles and analyses for the design were taken from previous case studies and typological research. The first major element implemented on the site was a simple 30' x 30' grid system. The grid system helped with two things: scale down the project into a workable framework & help orient buildings and site-lines.

DESIGN THINKING



PERFORMANCE & PROCESS

Grid: Perpendicular & Radial

The first 30'x30' grid orientation was one perpendicular to the sites existing prominent features; the parking ramp and the Northstar Line. The size for the grid was broken down from the 210'x60' parking lots overall dimension. An additional radial grid was added from the main arrival point on site, immediately off the train station. This helped first develop important site-lines to help wayfinding throughout the development.

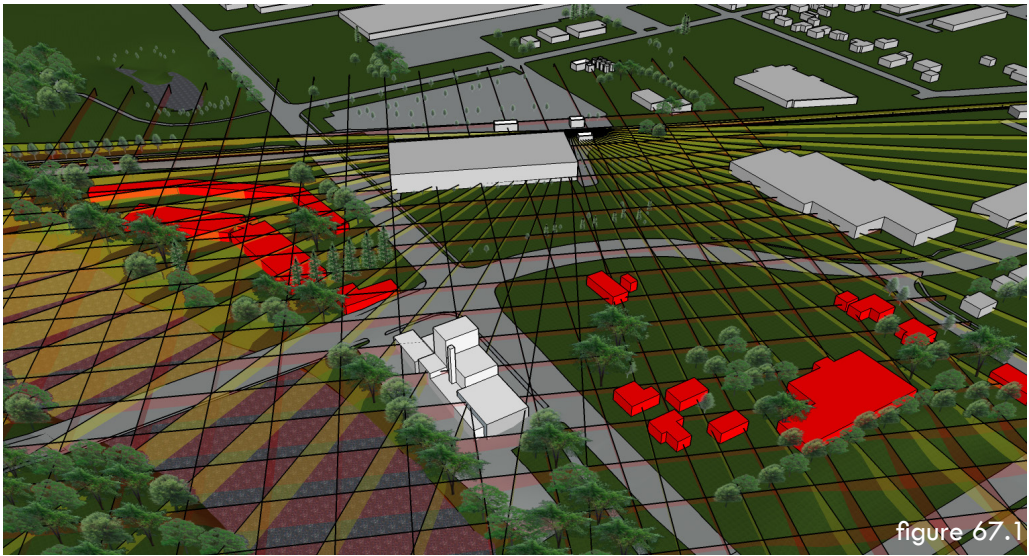
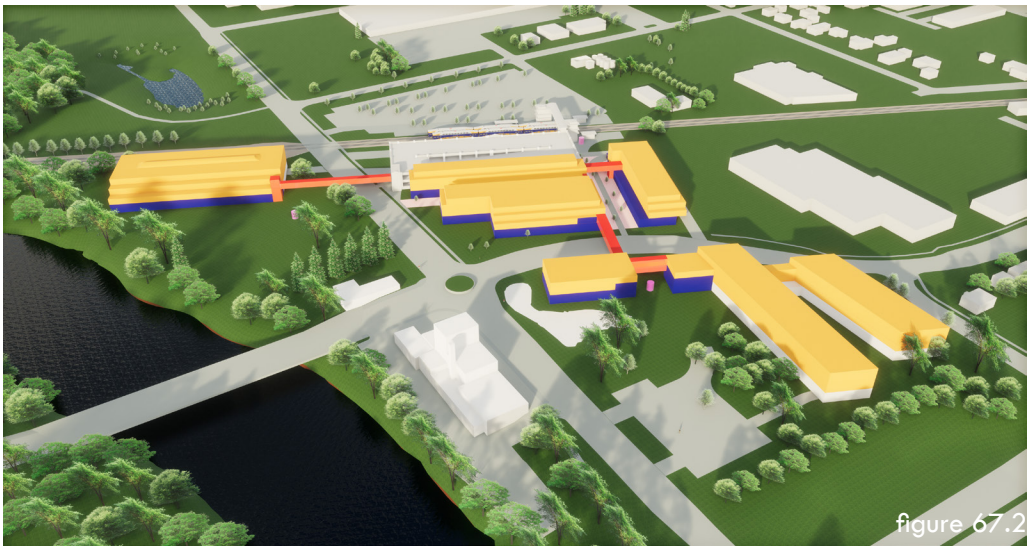


Figure 67.1 shows the initial grid system overlayed onto the existing site. Figure 67.2 below shows a potential site layout based from the initial grid system. Program and site lines were the two main factors in the planning of the entire site.



Performance Analysis

Figures 68.1-68.4 to the right show the points at each end of the sites visual corridors. The purpose of these points are to show major access points for visual wayfinding and walking corridors. The color key for the images are as followed:

- Yellow: Residential
- Blue: Commercial Mixed-use
- Red: 2nd-story Skyway

Wayfinding: The main corridors of the site are oriented based off the existing site elements. The buildings are entirely oriented along corridors. A second floor skyway (as seen in red) moves along both corridors, connecting the site together. It not only gives a strong path system for those walking through it, but also a visual cue to the people walking below.

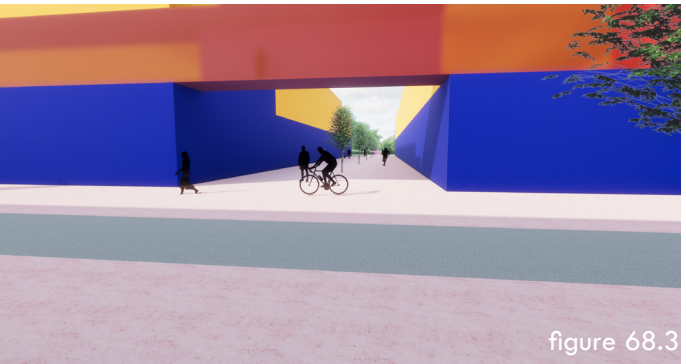
Program: The purpose of the site as stated previously is to act as a transportation gateway to and from Anoka. It is important that it does not take away from either Downtown Anoka or Downtown Minneapolis, but rather work to connect the two. For that reason, you can see the focus on residential housing, something that is hard to come by in a dense environment. The blue on the main level is commercial mixed-use space that is to provide the essential necessities for the people living on site or simply using the site for transportation.



North Point



South Point



East Point



West Point

PERFORMANCE & PROCESS

Grid: Cardinal

The second 30'x30' grid orientation was one based on the cardinal directions; North, South, East and West. Site-lines and programming were similar to previous renditions of the site, but an awareness of solar gain became prevalent. Reacting to the sun and existing site conditions are the two main things that Architects are responsible for in their design. These two grid orientations take both of those issues into account for A New Anoka.

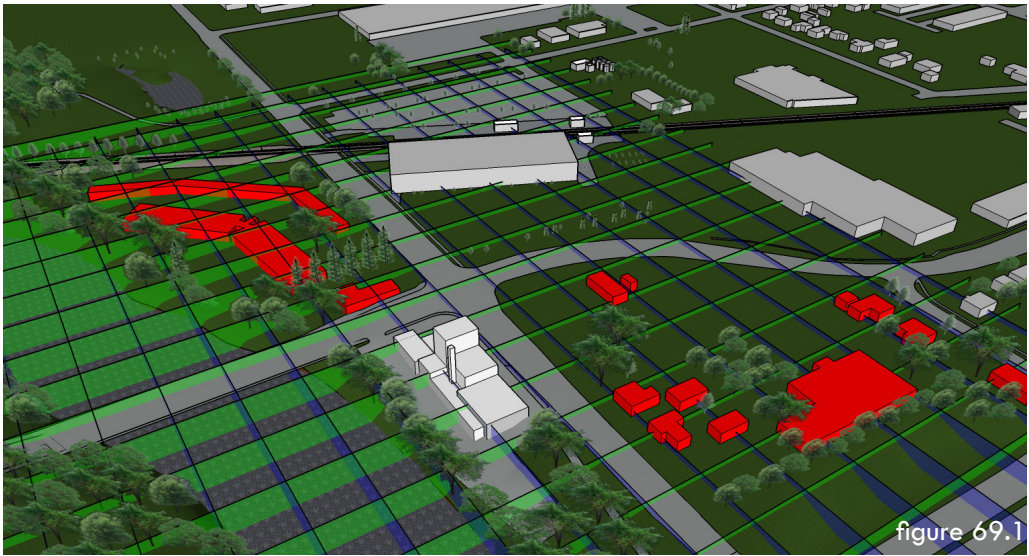
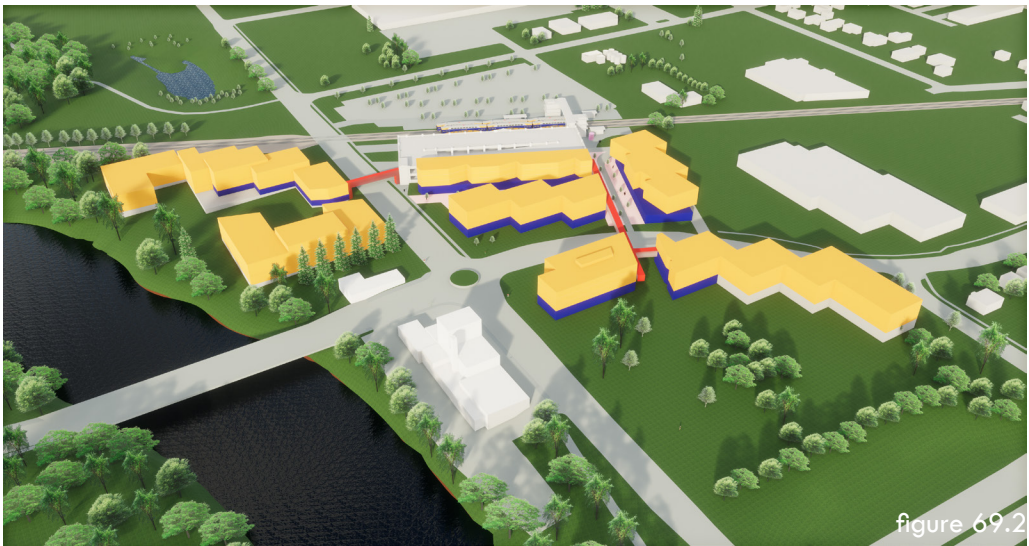


Figure 69.1 shows the initial grid system overlaid onto the existing site. Figure 62.2 below shows a potential site layout based from the initial grid system. Design points from the initial grid were kept intact, but an overall awareness of solar orientation was kept in mind.



Performance Analysis

Figures 70.1-70.4 to the right show the same 4 points at each end of the sites visual corridors. The main pathway has stayed the same as the previous grid, with a slight variance on solar orientation. The color key for the images are as followed:

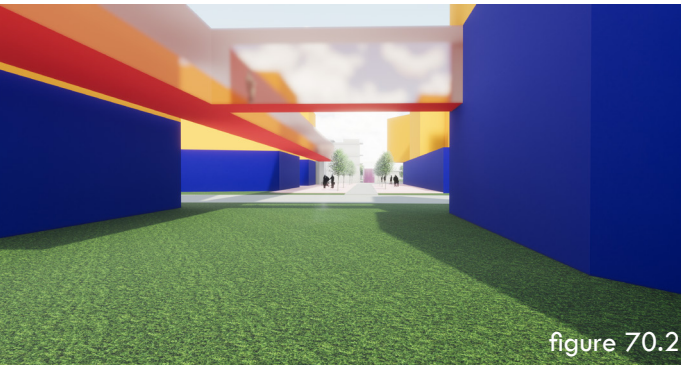
- Yellow: Residential
- Blue: Commercial Mixed-use
- Red: 2nd-story Skyway

The program and wayfinding elements stayed the same with the addition of the cardinal grid. The biggest change between the two is the orientation of the residential housing above.

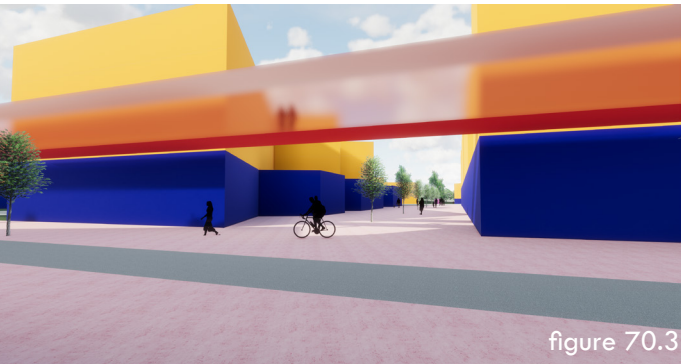
Solar Gain: The choice to rotate the upper residential housing was made to maximize on solar gain. The main corridors were kept mostly true to the previous iteration with some slight indents to create breaks in the facade. Best seen in figure 70.3 and 70.4, the facade began to undulate and retract in certain places along the form to better control natural lighting into the places below. The residential units not only react to how the sun enters their space, but also begin to inform the public spaces below. The entire building form is being used as a passive heating and shading system through the undulation of form.



North Point



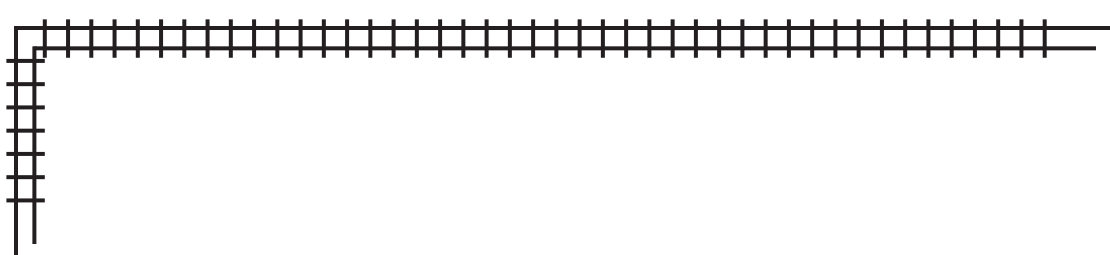
South Point



East Point



West Point



FINAL DESIGN



SITE PLAN

Welcome

The site for the first installment of A New Anoka is nearly 600'x1200' and houses over 200 apartment units. This transit-oriented development serves as a *Gateway to Anoka*. The purpose of this development is to provide suburban-infill near public transportation that can be used to bring the convenience and affordability from the city center out to our suburbs.

Wayfinding

As you can see on the map below, every form of transportation is separated to allow for better flow of traffic and allow each one to respond to their own needs. The pathway that connects all the different modes is the 2nd-Story Pedestrian skyway. This path connects any two points on the site while keeping them out of the elements.

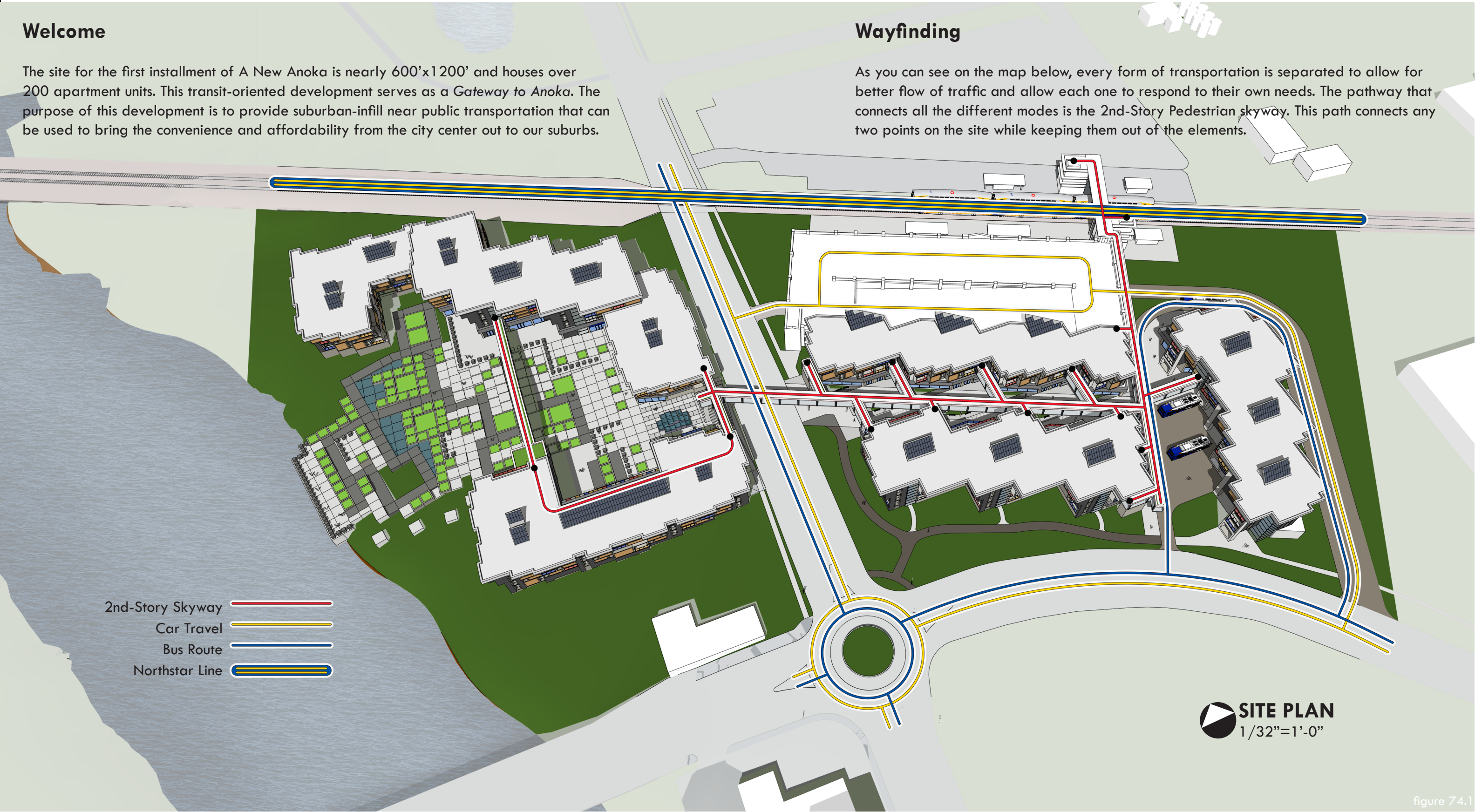


figure 74.1

TRAIN-SIDE

Commuting

The train-side site connects all of the transportation modes on the site. The Northstar line is easily accessible to both cars and bus, allowing anyone surrounding the site to take advantage of everything a resident living on the site can. By creating a central transportation hub the entire city of Anoka can become better connected with the any other stop along the entire metro system. As the system grows, it only gets stronger and reduces our dependency on cars.

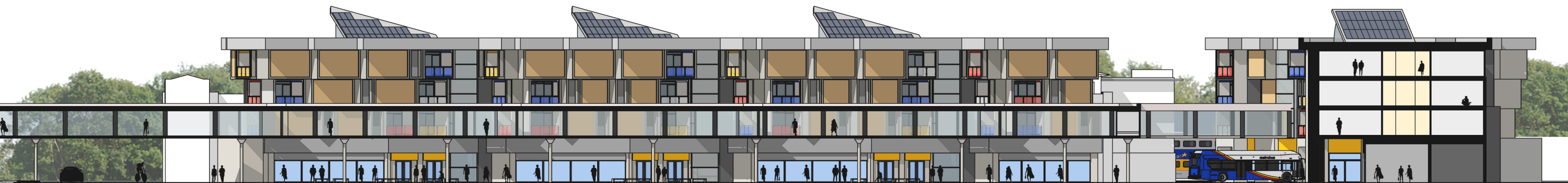
Time

Time is a non-renewable resource. It is important that we take advantage of all the time we have. A New Anoka reduces daily commuting times by connecting all the public transit systems and houses all the errands in one location, reducing travel times greatly.



EAST SECTION
1/16"=1'-0"

figure 76.1



NORTH SECTION
1/16"=1'-0"

figure 76.2

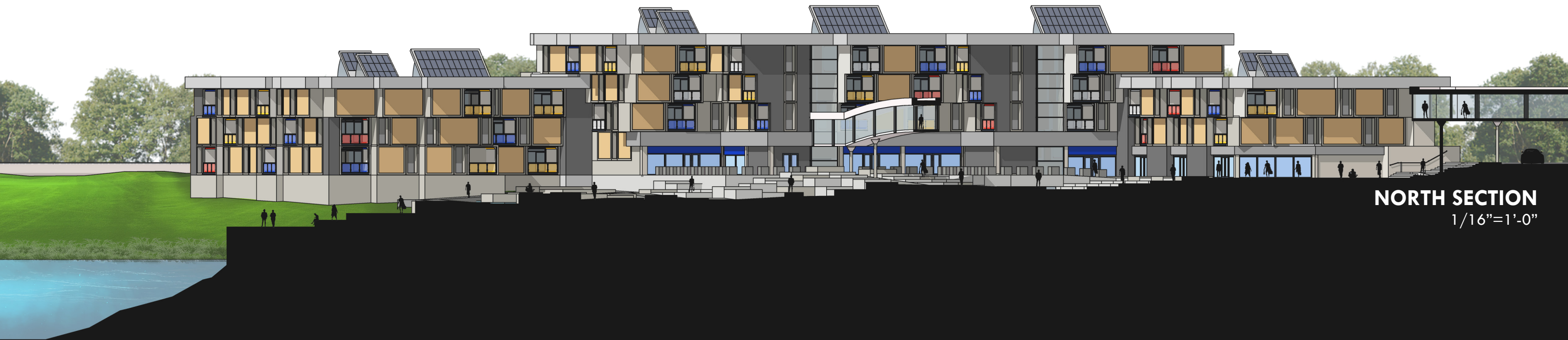
RIVER-SIDE

Community

While the train-side of A New Anoka focuses on connecting transportation types, the river-side focuses on connecting the people. It is important that the inhabitants of Anoka feel they have place to meet together. Creating a space where people could meet and take pride in there home helps bring the city together and create a better, safer place for everyone to live.

Relax

After a long day at work it is nice to have a connection with nature. The river-side of A new Anoka alows people to travel down a path right to the rivers edge and get away from the busy world. Here people can relax by journeying throught the paths, sitting at a reflection pond, laying in the grass, or just sitting and watching the river flow by.



NORTH SECTION
1/16"=1'-0"



figure 80.1

Arrival Point

Figure 80.1 is the first stop you see when you get off the Northstar Line. You get a first glimpse at the buildings undulating form. As you follow the skyway into the site you are greeted by busy ground floor retail level.



TRAIN-SIDE



figure 81.1

Bus Station

The bus station is located near the arrival point off the Norhtstar Line and at the main intersection of the site. The purpose of the A New Anoka is to be a gateway to Anoka, so what better way to explore it than with the Metro Bus line.



figure 82.1

Center Corridor

The center corridor on the train-side is the main destination for pedestrians. Located all along the main level and partially on the second floor is a mixture of retail and small restaurants. Here, people can grab anything they might need such as groceries, breakfast, or drop off a package. The location along a main travel hub allows users to get in, get out, and get on with their lives.



RIVER-SIDE



figure 83.1

Fountain

The fountain is the first landmark on the river-side. It provides a visual cue for the path of travel when coming from the train-side. It also provides an ambient white-noise to filter out the traffic and cars, and allows the pedestrians a place to come relax and cool down on a warm summer day.

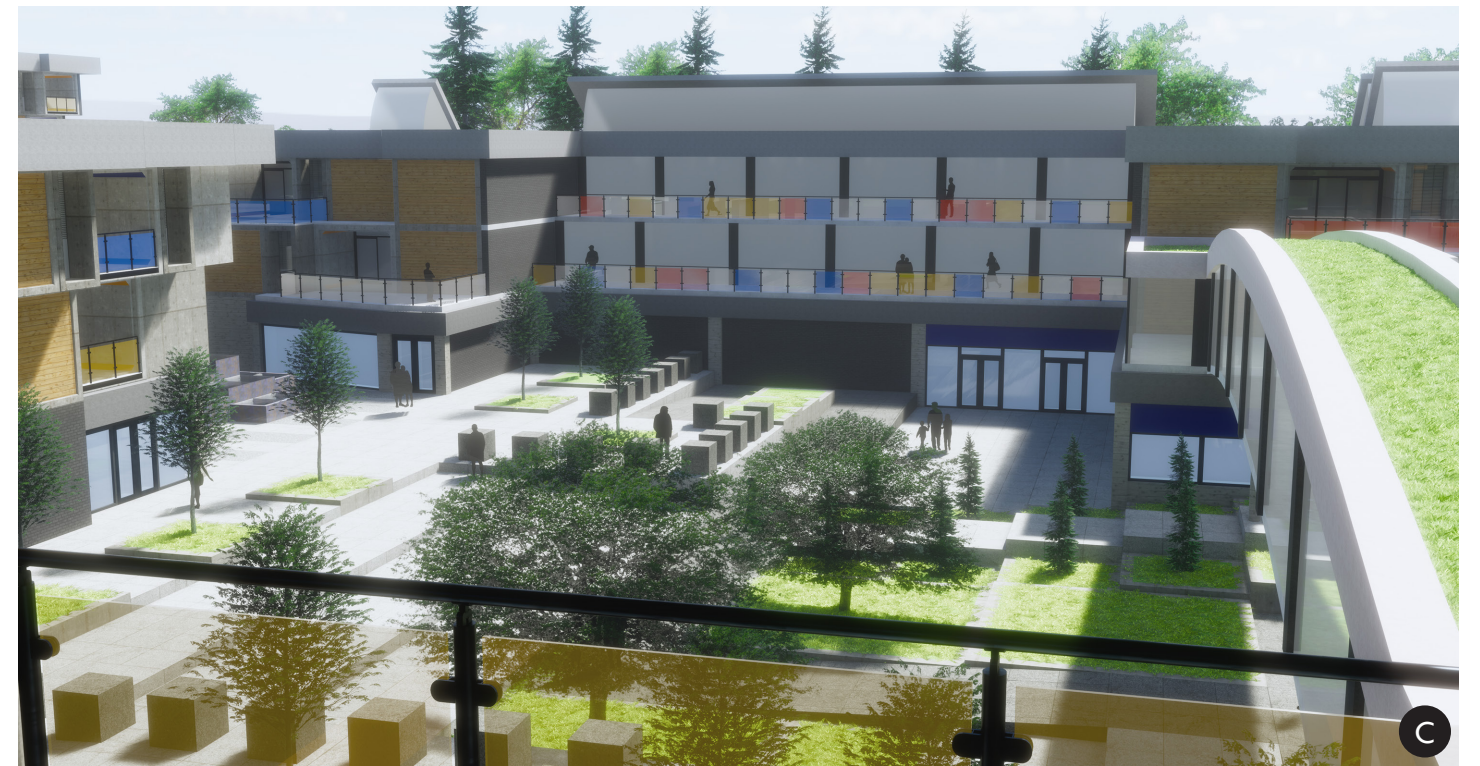


figure 84.1

Plaza River-side

The plaza on the river-side allows for a quieter, more personal space from the train-side. The space is still open to the public, but has much less foot traffic and more greenspace to relax. The space also provides a great place for the residents to connect with one another.



RIVER-SIDE



figure 85.1

Rivers Edge

The rivers edge gives the site a connection to Rum River. The access to nature allows residents and visitors a peaceful connection to nature where they can sit and contemplate, or simply wind down after a long day at work.

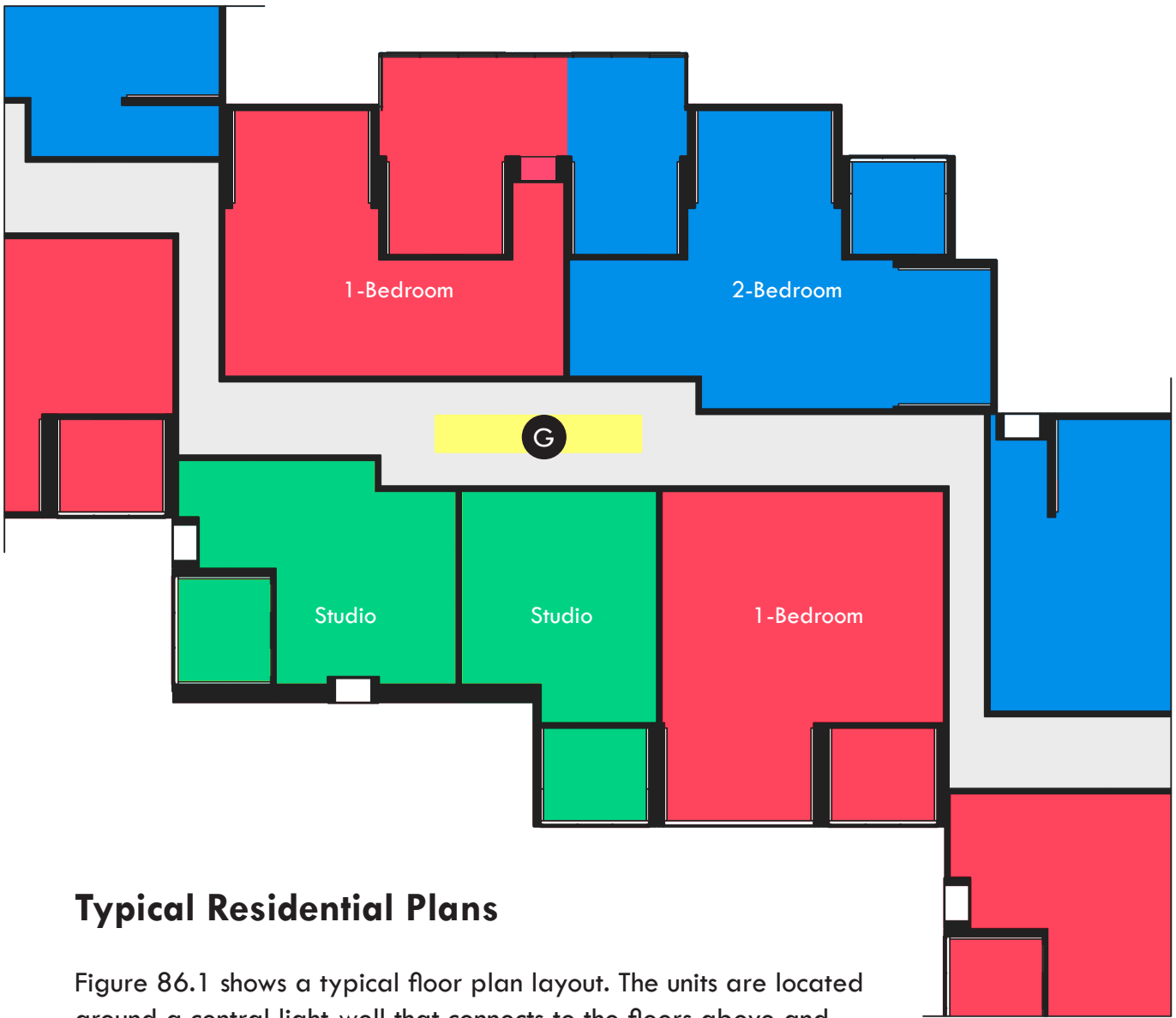


figure 86.1

Typical Residential Plans

Figure 86.1 shows a typical floor plan layout. The units are located around a central light-well that connects to the floors above and below. These light-wells help represent a small scale community with the residents that surround it. Also, having a centralized layout allows for multiple eyes on each unit, making for a safer community.

There are over 200 units in A New Anoka.



MODULAR EXTERIOR SHELL



figure 87.1

Passive Shading

The entire facade of the residential units is composed of a Concrete Thermal Modular Shell. This form of shell undulates in and out to react to the solar condition of that side. The precast modular shell is produced off site to ensure quality and speed up the build process. Once placed on site, the concrete units can be fitted with walls on for bedrooms or a sliding glass door for balconies. These unique forms provides an private and intimate space for the inhabitants of the residential units to live.

Solar Performance

Figures 88.1 & 88.2 show the buildings South facades interaction with solar gain. Figure 88.1 is on the Summer Solstice when the sun is most intense. The balcony spaces stay out of the red and keep the living spaces in out of direct sunlight. The same time of day during Winter Solstice can be seen in figure 88.2, where light is allowed to filter into the living spaces during the cold winter months.

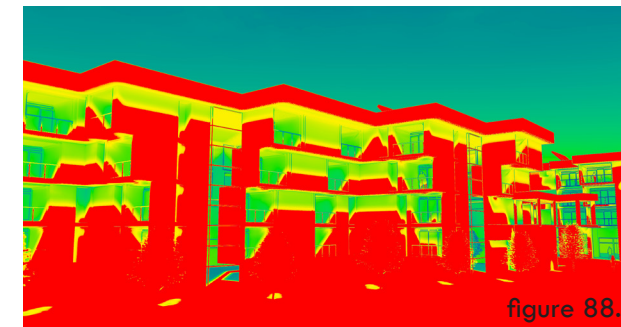


figure 88.1

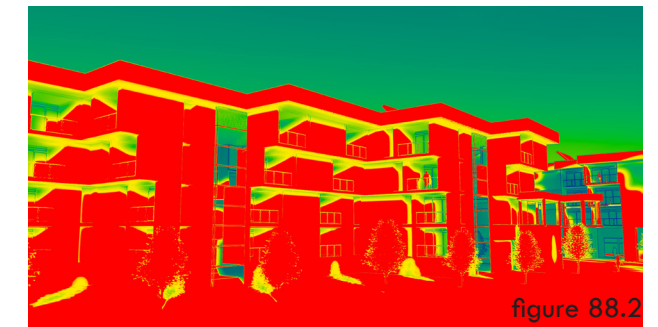


figure 88.2

Constructibility

One of the obvious challenges when you start undulating building form is to keep it continuously insulated. The details in figure 88.3 and 88.4 not only show how the continuous insulation is achieved, but also how these forms might stack together.

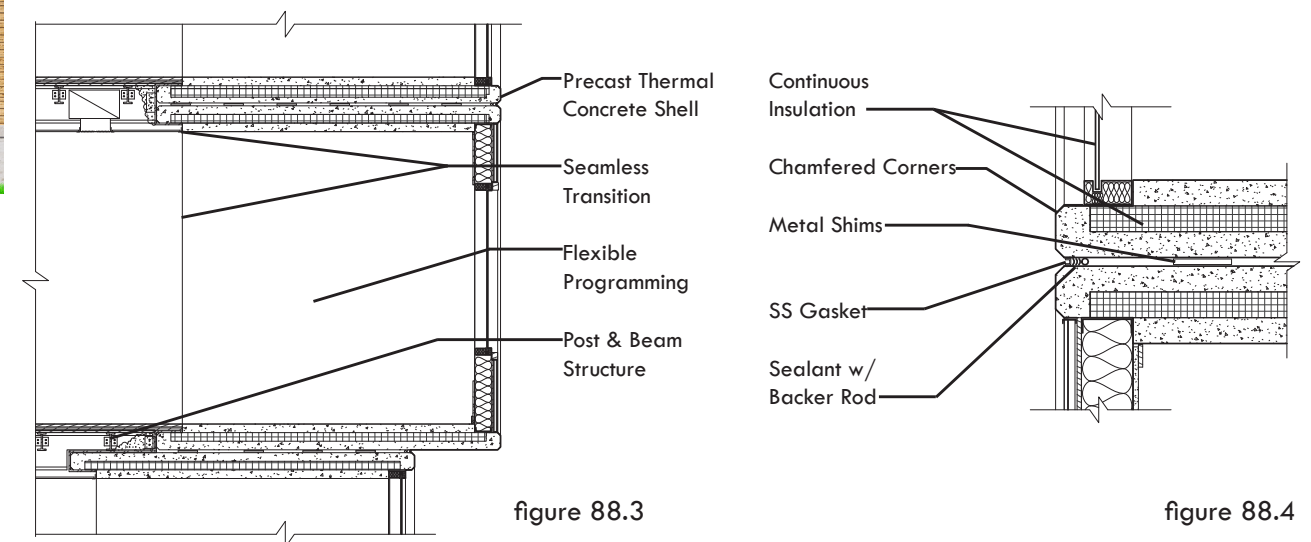


figure 88.3

figure 88.4

PROJECT INSTALLATION

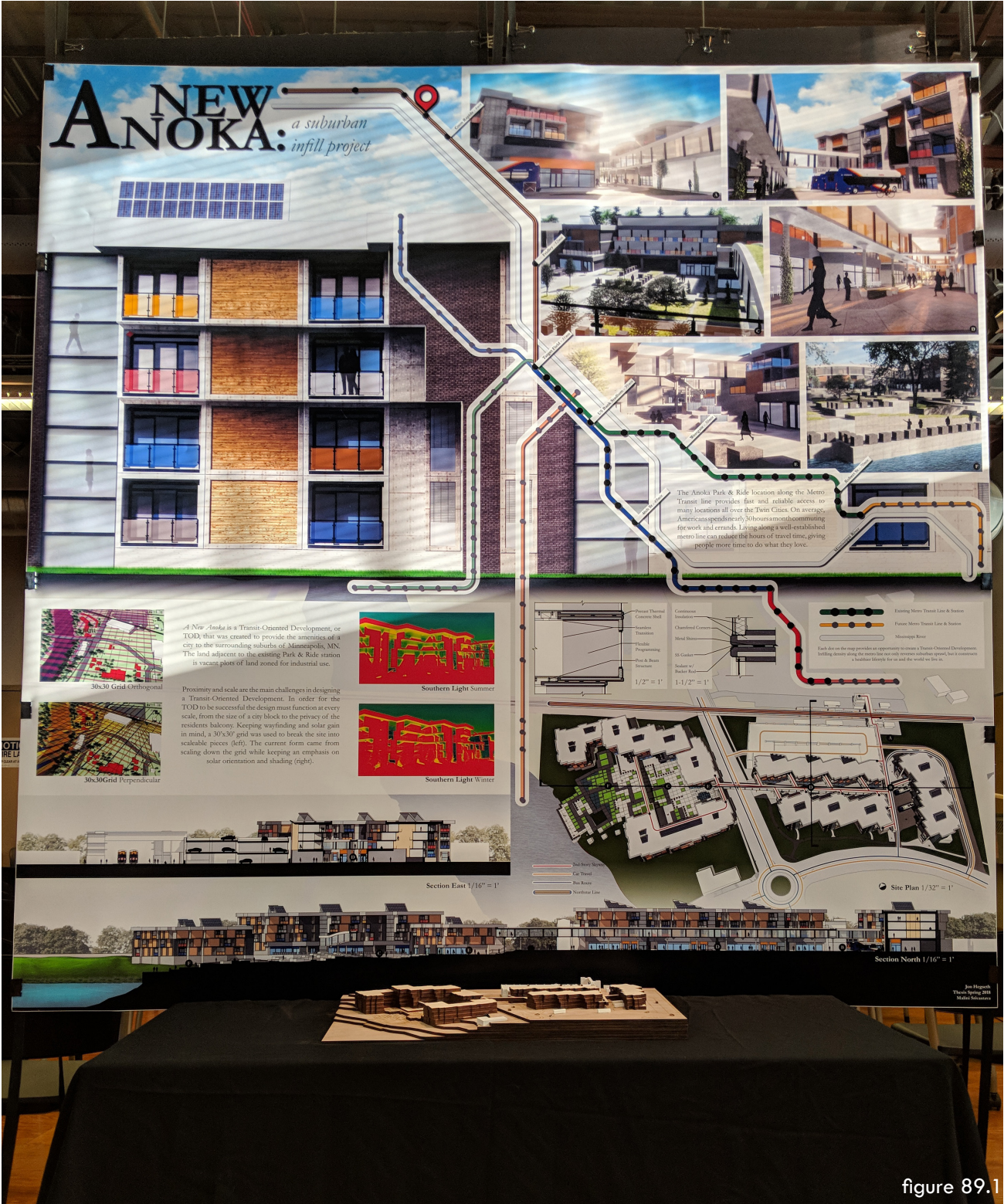


figure 89.1

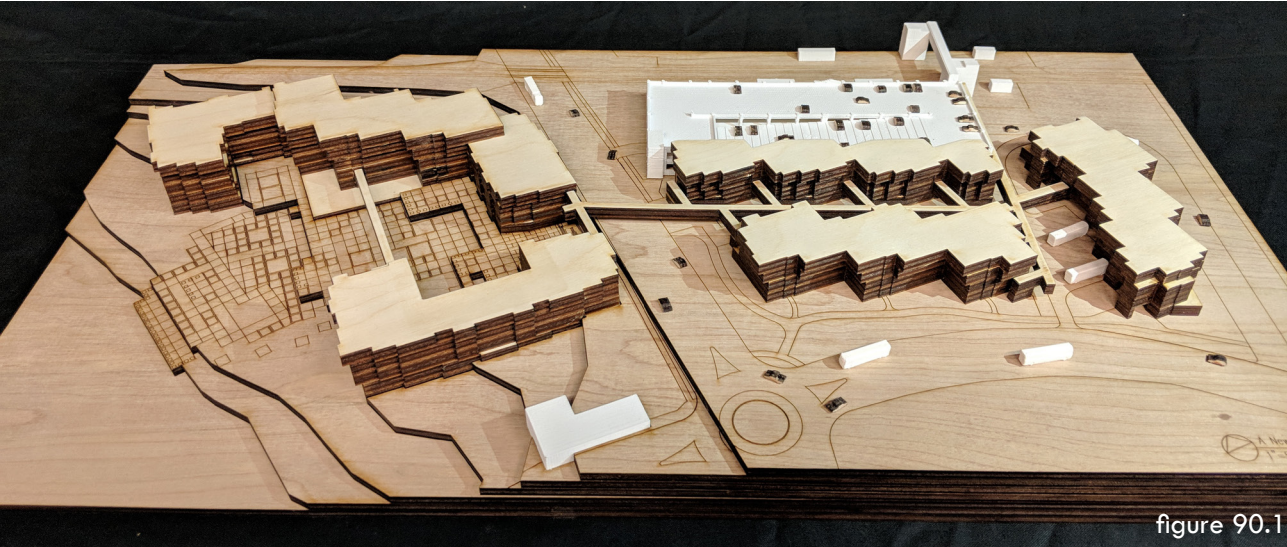


figure 90.1

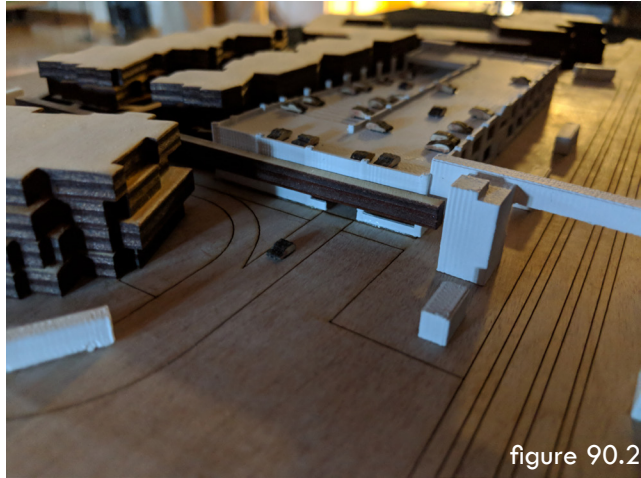


figure 90.2

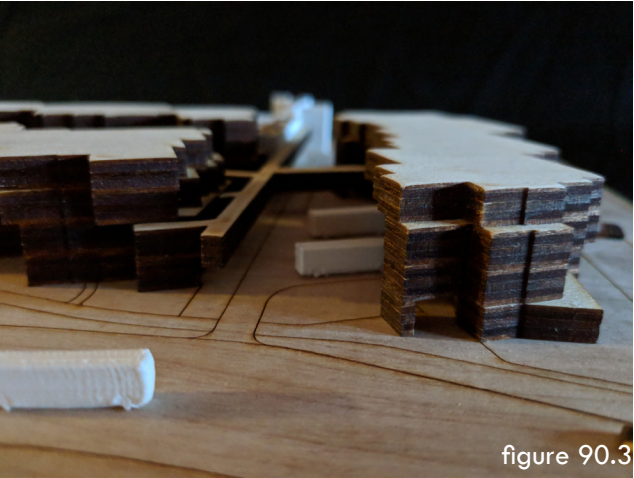


figure 90.3

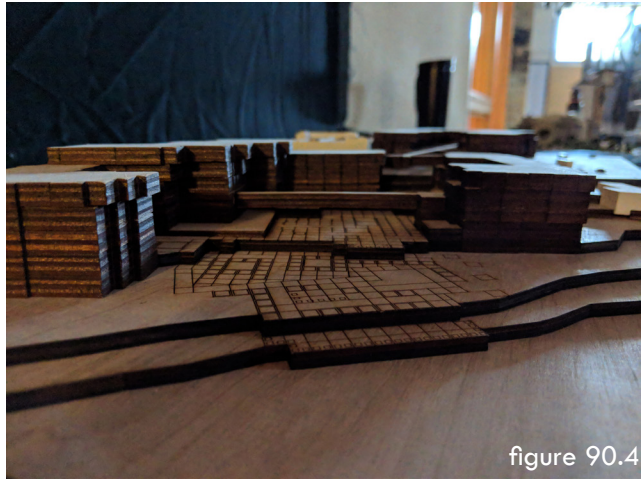


figure 90.4

Final Instalment

These were the final boards and model installed on the 5th floor of Renaissance hall in Spring of 2018



APPENDIX

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PREVIOUS STUDIO EXPERIENCE

Arch Design Studio I	Cindy Urness	Fall 2014	Tea House Boat House
Arch Design Studio II	Daryl Booker	Spring 2015	Montessori School Birdhouse Small Dwelling
Arch Design Studio III	Steve Martin	Fall 2015	Firehouse Station Duluth School
Arch Design Studio IV	Bakr Aly Ahmed	Spring 2016	Culinary Arts Center Gym
Arch Design Studio V	Don Faulkner	Fall 2016	High Rise
Arch Design Studio VI	Paul Gleye	Spring 2017	Urban Redesign
Arch Design Studio VII	Mark Barnhouse	Fall 2017	Wetlands Research Laboratory
Arch Design Studio VIII	Malini Srivastava	Spring 2018	Thesis Design

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Inspirational Quote:
“Do or do not, there is no try.”
– Jedi Master Yoda



figure 94.1



