TRANSFORMING AN URBAN CORRIDOR

Bus Rapid Transit Along Lake Street

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TRANSFORMING AN URBAN CORRIDOR
Bus Rapid Transit along Lake Street

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

By

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Primary Thesis Advisor

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STATEMENT OF INTENT

ABSTRACT

The Midtown Corridor is a culturally diverse, commercial district within the city of Minneapolis, Minnesota that is currently undergoing analysis for proposed transit alternatives. This site was selected because of its potential to provide access and connect to many important local and regional transit networks. The Midtown Corridor needs to improve mobility, increase ridership, and enhance transit connections, so that automobile traffic can subside and the urban street-life can be restored. Because this area has the potential to connect to other transit networks, it is important that it be frequent and reliable, as well as user-friendly. Transforming an Urban Corridor: Bus Rapid Transit Along Lake Street study suggests that Bus Rapid Transit would be a viable solution for this area. The study collected both qualitative data and quantitative data from city archives and involved organizations, as well as relevant case studies and literature. The information was used to evaluate if Bus Rapid Transit would be the best solution for revitalization of Lake Street.

PROBLEM STATEMENT

Minneapolis, specifically the Midtown Corridor, has a lack of efficient public transportation, therefore cars are heavily utilized. The Midtown Corridor is a unique area within the city of Minneapolis that has the opportunity to improve its street vitality and reconnect regional transit networks.

PROJECT TYPOLOGY:

URBAN STREETSCAPE & TRANSPORTATON PLANNING

THEORETICAL PREMISE:

Questions to seek Answers for:

How can an adapted transportation system aid in the revitalization of an urban corridor?

How can we create a more vibrate and vital street atmosphere, that gets users out of their cars and interacting amongst each other and surrounding businesses?

PROJECT JUSTIFICATION:

WHY TRANSPORTATION???

Transportation is more than just the means by which we get around, but is rather a way of life in urban areas. The modes and methods of transportation we use, not only impact the air we breathe, but the communities we live in and the relationships we have. Transportation is at the heart of many of the most pressing issues we face today, and we need to invest in sustainable, cost efficient, and viable transportation systems in order to ensure a high quality of life and health of our planet.

From 1998 through 2008, the most recent year for which complete data are available, showed that transit ridership grew at a faster rate than transit service (Wise, 2010). According to the Institute for Transportation and Development Policy (ITDP), "among core infrastructure in the US (electricity, education, medicare), the return on investment in transport is one of the highest. After education, it is the biggest factor in economic growth. Designing infrastructure with the protection of pedestrians and cyclists in mind, enhancing public transport, and improving automobile behavior on the roads reduces injuries and creates safer, more livable communities" (IDTP).

WHY BUS RAPID TRANSIT???

A Bus Rapid Transit (BRT) bus offers faster bus service, compared to that of a traditional bus, with a faster schedule, fewer stops, and a more direct route (Deng & Nelson, 2011). The BRT system has adopted many of the same elements from LRT and Metro to achieve high-capacity and high-reliability. This emerging form of mass transit has shown to be extremely efficient with the speed and reliability of rail service and the operating flexibility and lower cost of a conventional bus service (Deng & Nelson, 2011). There is adequate evidence to support that BRT can increase ridership and attract modal shift from private cars. For this reason, many cities in more recent years have implemented BRT systems into their cities' transportation networks including the TransMilenio in Bogota Colombia; Metrovia in Guayaquil, Ecuador; as well as the Orange Line of Los Angeles.

In an economic crisis where federal funding may be hard to come by, BRT systems may prove to be the answer to public transport issues in the United States. It is this system that this thesis examined more in depth.

Table 2. Main components of a BRT system

	Levinson, Zimmerman, Clinger, Rutherford, *et al*. (2003)	Canadian Urban Transit Association, (2004)
Components		
Running ways	BRT vehicles operate primarily in exclusive transit-ways or dedicated bus lanes. Vehicles may also operate in general traffic.	Three types of busways, including exclusive busways, dedicated lanes and mixed traffic.
Stations	BRT stations, ranging from enhanced shelters to large transit centres.	Sufficient shelter from inclement weather, seating, customer information, appropriate lighting and ample platform space for boarding, alighting and waiting are the minimum requirements.
Vehicles	Quiet, high-capacity vehicles use clean fuels to protect the environment.	The ideal BRT vehicle has a level of passenger comfort, is visually attractive, and is environmentally friendly.
Services	High-frequency service. The integration of local and express service can reduce long-distance travel times.	A variety of service alternatives, including all stops route(s), limited stop service, feeder services.
Route structure	BRT uses simple, often colour-coded routes.	—
Fare collection	Pre-boarding fare collection. They allow multiple door boarding, reducing time in stations.	Multi-door boarding for customers with pre-paid fare media.
ITS	Applications of ITS technologies include automatic vehicle locationing (AVL) systems, passenger information systems, and traffic signal preference at intersections.	A collection of computer and communication technologies that can enhance the convenience, safety and reliability of a BRT service.

BUS RAPID TRANSIT

HISTORY

Curitiba is the capital city of the State of Parana in Southern Brazil. The city is located about 250 kilometers [150 miles] southwest of Sao Paulo near the coastal mountain range. During the 1960s to early 1980s, Curitiba grew at a rapid rate, with a population growth rate of approximately 4% per year. (Robert Cervero, 1995) The rapid growth and development of the city, eventually led the city to yield a new transportation system, known as Bus Rapid Transit.

DEFINITION

According to the National Bus Rapid Transit Institute (NBRTI, 2012), Bus Rapid Transit (BRT), "is an innovative, high-capacity, lower-cost public transit solution that can achieve the performance and benefits of more expensive rail modes." According to the Canadian Urban Transit Association (CUTA, 2004), "BRT is a rubber-tyred rapid transit service that combines stations, vehicles, running ways, a flexible operating plan, and technology into a high quality , costumer focused service that is frequent, fast, reliable, comfortable and cost effective". The term 'BRT' originated in North American and is now a widespread term. Other terms used in substitution for BRT include: high-capacity bus systems, high quality bus systems, metro-bus, surface metro, express bus systems, busway systems, high level bus service (Deng & Nelson, 2011). Curitiba's Bus Rapid Transit system has shown so much success that it has become a model for other BRT systems in cities including the TransMilenio in Bogotá, Colombia; Metrovia in Guayaquil, Ecuador; as well as the Orange Line of Los Angeles. This emerging form of mass transit ties the speed and reliability of rail service, with the operating flexibility and lower cost of a conventional bus service (Deng & Nelson, 2011).

APPLICABILITY IN THE U.S

It is clear that in the years coming public transport will be a growing market, but many areas in the United States still lack adequate public transport. "75 percent of the people in Curitiba, get to work on a bus every morning." Says Kenneth Krunkemeyer, of the Center for Transportation and Logistics. "A city like Phoenix, has the exactly the same population as Curitiba, over the past 250 years. Yet in Phoenix, 1 percent of people get to work on a bus". (Press, E. (2009). Streetfilms) BRT has been shown to be very successful as an economically efficient mass transit mode in developing countries with large populations of low-income residents. (Pucher et al., 2005) In an economic crisis where federal funding may be hard to come by, BRT systems may prove to be the answer to public transport issues in the United States. Ridership figures from existing systems show that BRT is comparable with LRT in terms of capacity, but cost a fraction less. There is adequate evidence to support that BRT can increase ridership and attract modal shift from private cars. This transport type is worth further study in its applicability in the U.S.

BRT CONSIDERATIONS

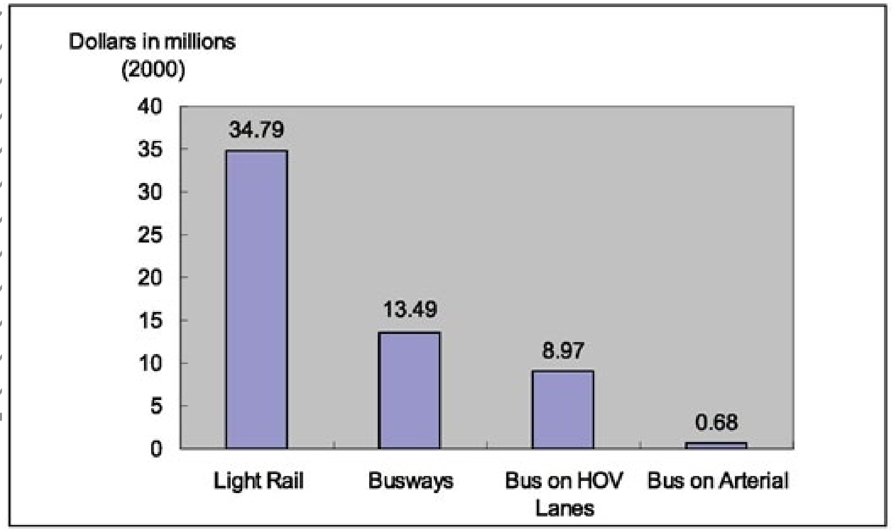

Figure 7. Capital cost per mile for LRT and BRT. *Note*: Cost adjusted to fiscal year 2000 dollars
Source: US Government Accountability Office, 2001, p. 17.

SPEED, RELIABILITY & PASSENGER FLOW

BRT systems are measured by three key attributes – travel speed, reliability and passenger volume (Deng & Nelson, 2011). A critical issue in implementing BRT is how to provide right-of-ways for vehicles. This becomes an essential part of the design. Performance of a BRT system greatly depends on the quality of the busway. Speed and reliability are important factors in the success of a BRT system, the busway is the main contributor to this. BRT can be divided into four groups: running in mixed traffic (with signal priority), using shoulder lanes, using median busways and using exclusive busways (Cain,Flynn, McCourt & Reyes, 2009). BRT systems that operate on exclusive busways typically reduce travel time and ensure greater reliability. Utilizing fast boarding techniques such as off board electronic fare payment, multiple doors boarding and same-level boarding help accelerate passenger flow and minimize stop time.

COST

It was found through multiple sources that overall capital and operating costs of BRT systems are less than similar rail-based solutions. Wright and Hook found constructing a BRT system typically cost 4-20 times less than a LRT system and 10-100 times less than a Metro system (Wright & Hook, 2007). Because of the lower cost, BRT systems are able to be implement in budget-constrained cities. The lower cost also means that with the same budget, BRT can deliver greater network coverage than a rail (LRT) or metro system. A study from the US General Accounting Office (US GAO, 2001), suggested that BRT capital costs were generally lower than LRT capital cost on a per-mile basis (shown in figure 7), but ridership and operating costs were comparable between BRT and LRT (Deng & Nelson, 2011). Evidence is mixed regarding operating cost as Zhang (2009) measured four operating costs (cost per vehicle revenue mile, cost per vehicle revenue hour, cost per 1000 place miles and cost per 1000 passenger miles) among bus, BRT, LRT, and MRT in America. In all four categories BRT outperformed LRT (Zhang, 2009). Costs vary greatly depending on local circumstances, including existing infrastructure, busways, shelters, and vehicle conditions. Despite the variance, the BRT model has been shown to be cost-effective in most cases.

PERCEPTION

An important element in BRT is its users perception and how people identify with the system. With the improvement of service quality (high speed, reliability, safety, comfort and user-friendly design), BRT systems have a positive impact on customer satisfaction (Cain et al., 2009). The 2008 academic journal, Bus rapid transit identity meets universal design (Bitterman & Hess, 2008), explores how methods of universal design can applied to a growing transport sector. Based on seven principles of universal design, the article proposes a basic means for evaluating BRT identity systems and states that "Information design components and various graphic components and collateral products that together constitute the basis of a BRT identity system must not only be barrier free but accessible to all users regardless of age, physical ability or cognitive ability." (Bitterman & Hess, 2008). Universal design becomes particularly important to the design, as the space is public and should accessible for all user types.

URBAN LIFE

There is a growing concern with the effect BRT systems have on urban life. Because BRT systems run at ground level, some find this type of transport more intrusive than below ground Metro. Bogota's BRT system TransMilenio, which began in 2000, is considered one of the most successful models of BRT in the world. After several years of progress, TransMilenio has achieved impressive results in travel time saving, accident and emission reduction, operation without subsidy and is the highest capacity BRT system in the world (Cain, Darido, Baltes, Rodriguez, & Barrios, 2007). Transmilenio can carry up to 45,000 pphpd (people per hour per direction), but even with its success there are still complaints with the system. During peak times , extreme crowding problems often occur, which causes passengers dissatisfaction. This however, is not an issue that is only applicable to BRT. Rush hour crowding exists with other transit types such as LRT and Metro. Other complaints have been its disruption in traffic. According to the Patankar, Kumar, and Tiwari, (2007) comparison studies were done in India regarding traffic flow, speed, travel time, delay time, stop time, and fuel consumption. A micro-simulation traffic model was developed for BRT and mixed traffic systems and measured data concluded that "the average bus speed and flow rate in the BRT corridor was more than 100% against the present condition. Travel time, delay time, and stop time has also significantly decreased in the BRT system as well as increased car flow and speed."

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THESIS PROPOSAL

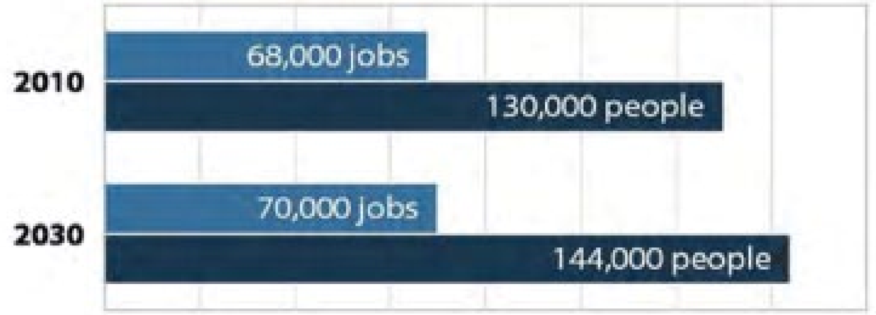
USER/CLIENT DESCRIPTION

CLIENT:

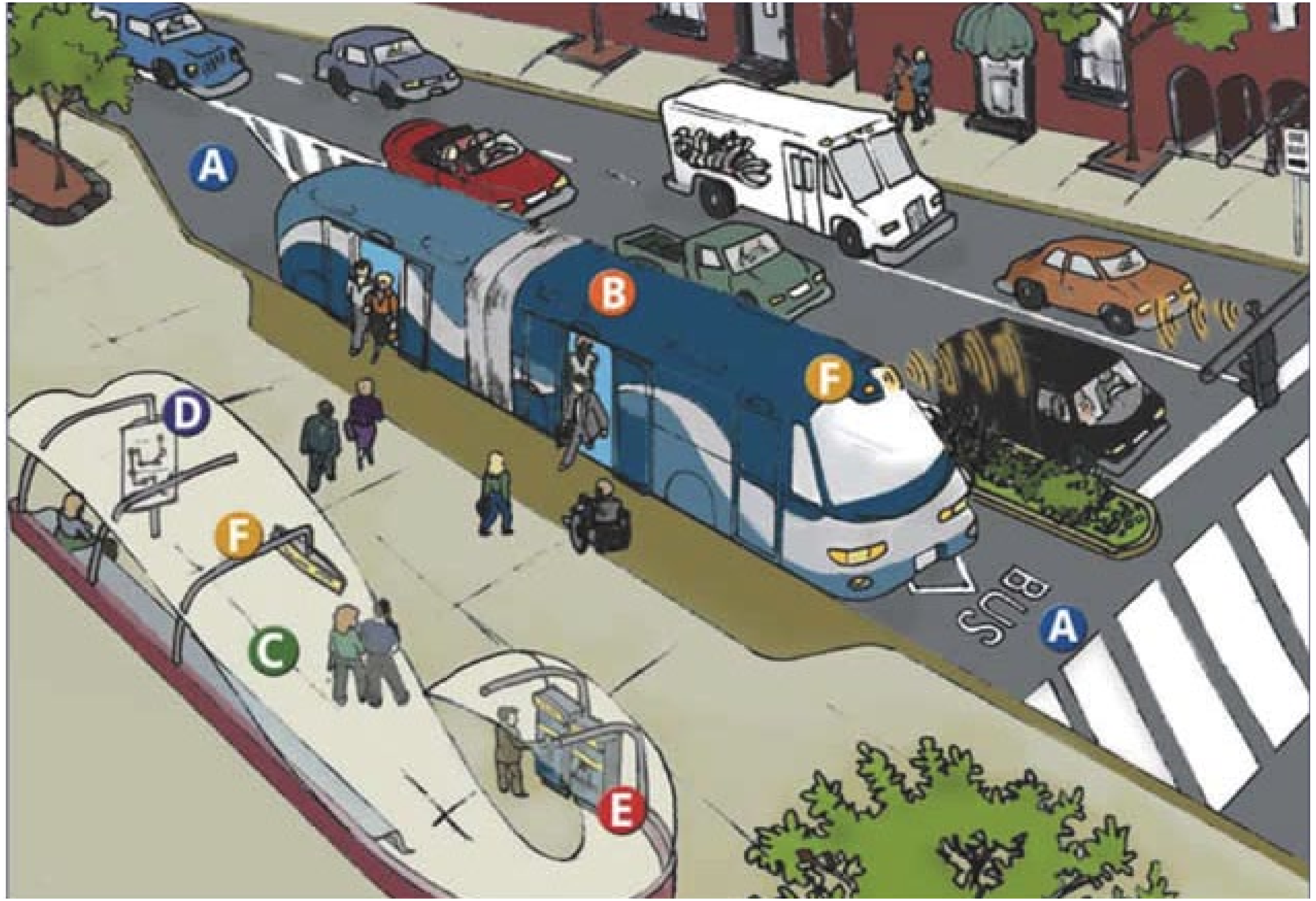
Minneapolis Metropolitan Council

USER GROUP:

Population and Employment with 1/2 mile of corridor



(2030 forecasts based on approved local plans)



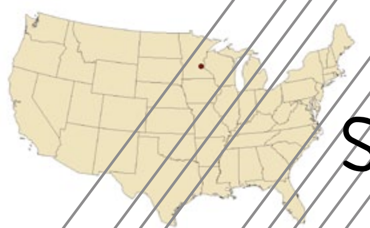
PROJECT ELEMENTS

BUS RAPID TRANSIT COMPONENTS

- Busways (A)
- Vehicles (B)
- Station/Shelter (C)
- Route & Schedule (D)
- Fare Collection (E)
- Advanced Technology (F)

STREET REVITALIZATION COMPONENTS

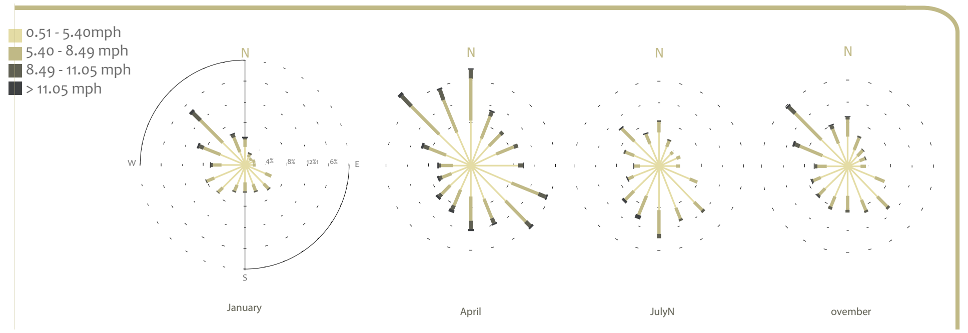
- Furniture
- Sidewalk
- Roadways



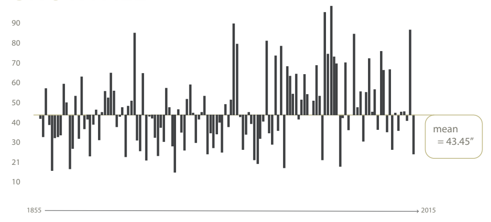
SITE INFORMATION

ZONING
4a
-30 to -25F

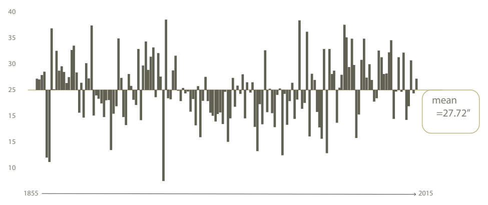
WIND
Speed & Direction



SNOWFALL

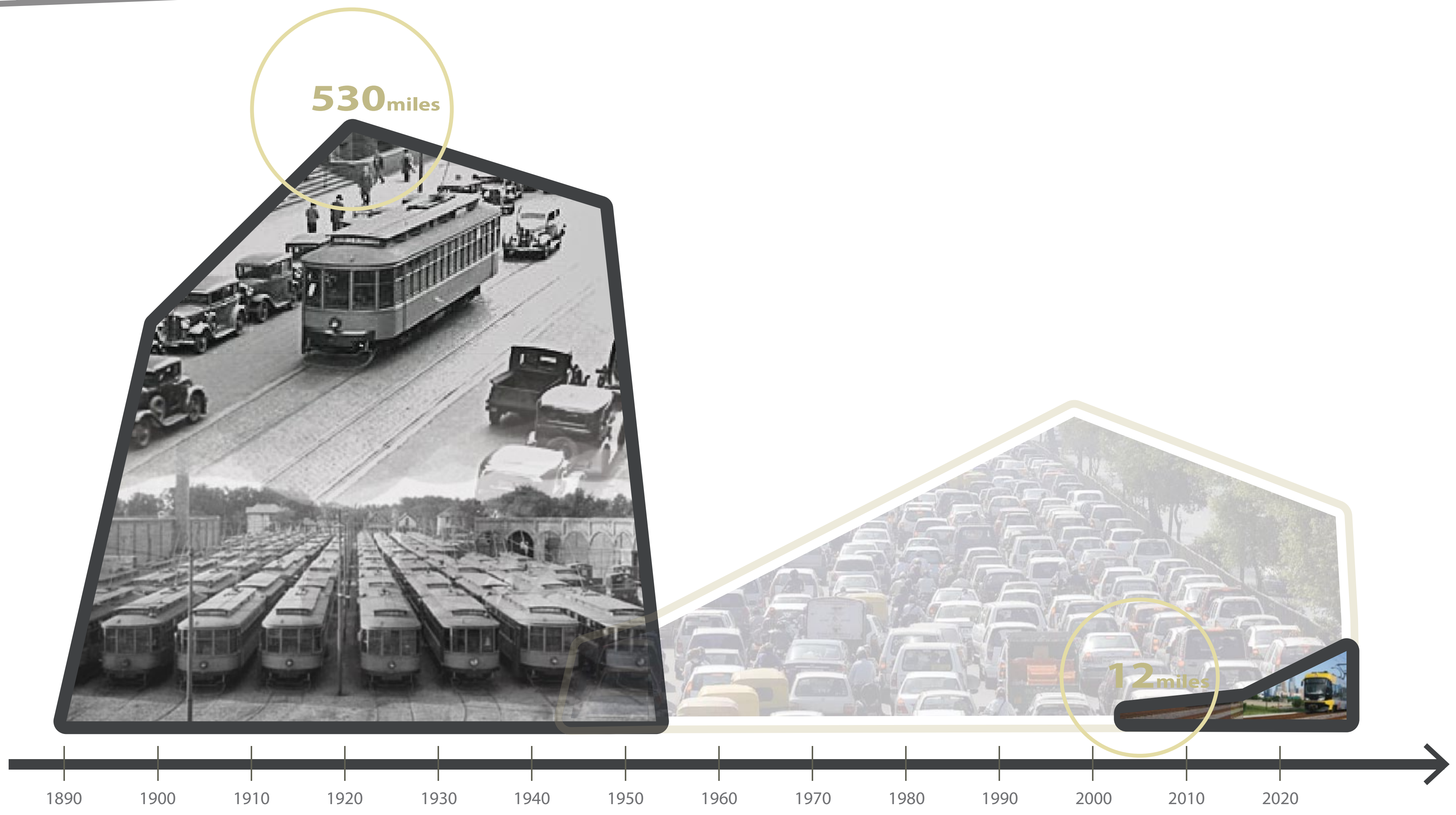


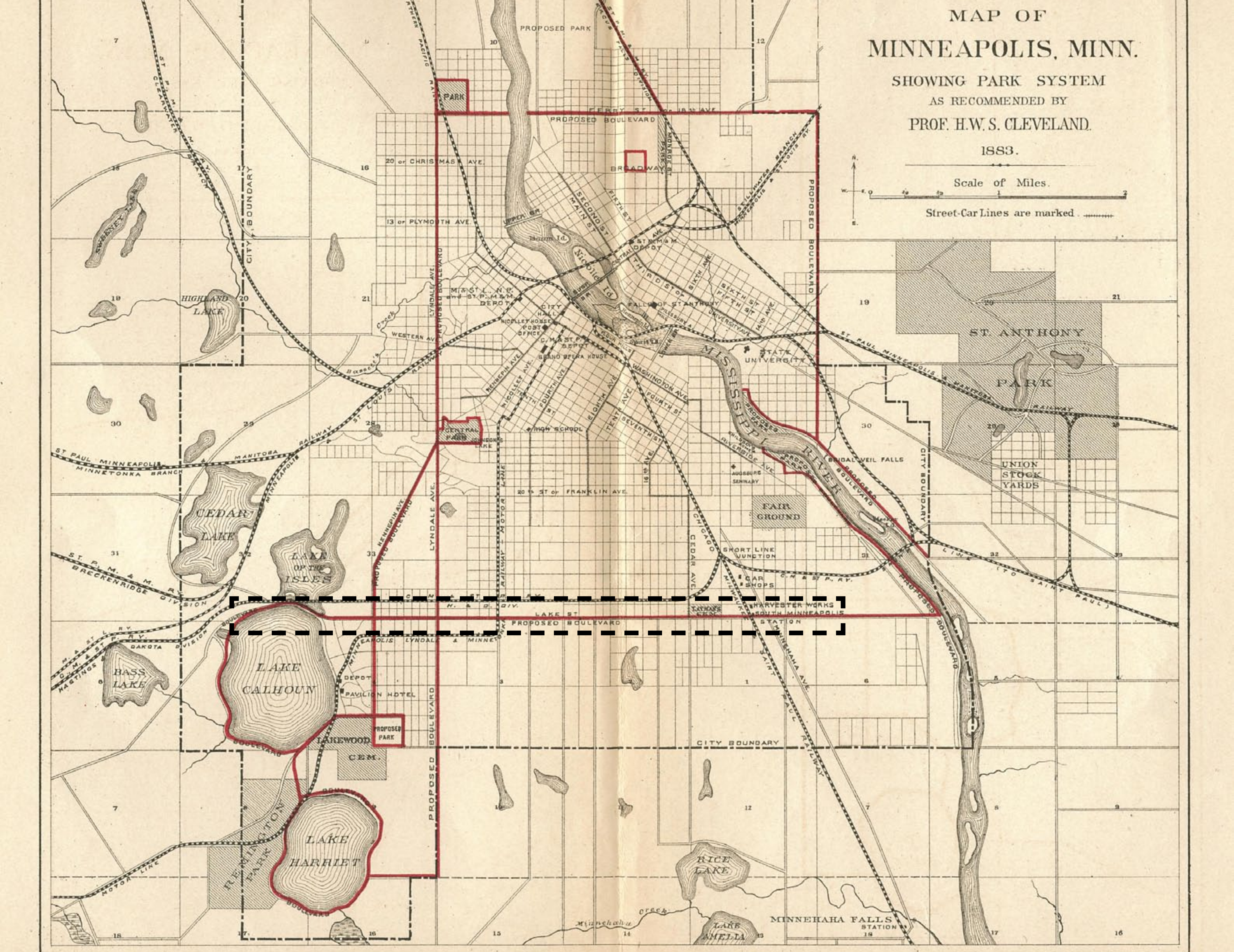
PRECIPITATION



INTRODUCTION

By the late 1990s, the Twin Cities ranked among the nation's fastest sprawling areas, as measured by the Brookings Institution. Between 1982 and 1997, the region added urbanized land at more than double the rate of its population growth. Miles of rail decreased drastically from 382 miles in 1900 to just 12 miles in 2007 (feet of rail per Capita dropped from 6.35 in 1900 to .10 in 2007) (By the numbers. (2009). In the more recent years, the city of Minneapolis had made initiatives to better the public transportation infrastructure. In 2004, Minneapolis reintroduced light rail transit with the 12 mile long Hiawatha LRT line, a $715 million project (Berg, 2009). Despite the popularity of the Hiawatha LRT, additional lines have been stymied by the lack of a funding stream. The city is now examining alternatives trying to determine the benefits, costs, and impacts of implementing other types of transit.

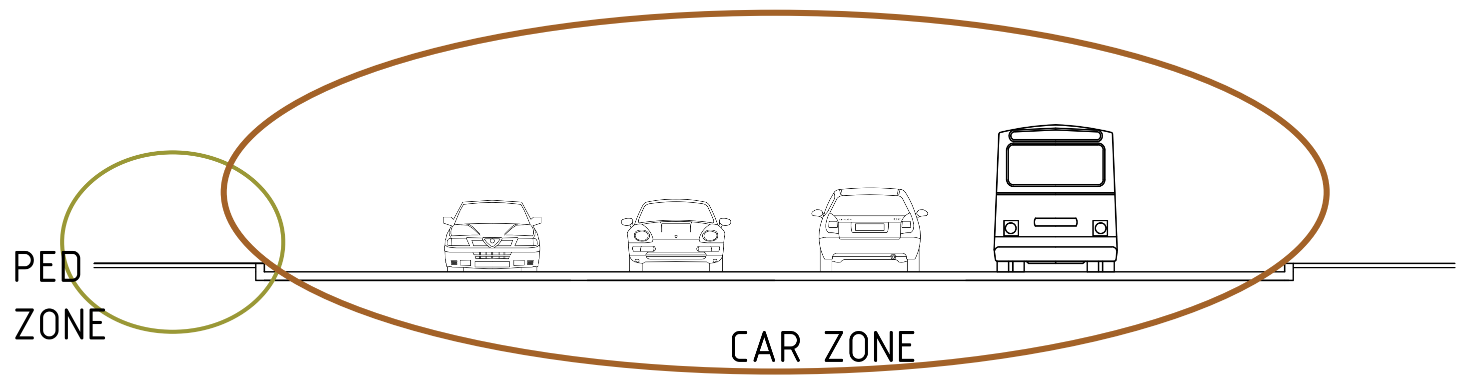




THE MIDTOWN CORRIDOR

The Midtown Corridor is a busy commercial district within Minneapolis, that is a crucial connecting point between many local and regional transit networks (including the Hiawatha Line). The Midtown Corridor is lacking an efficient east-west public transit connection, resulting in heavily utilization of automobiles and traffic congestion. According to the Lake Street Midtown Greenway Corridor Framework Plan, the corridor "is a key piece of a metropolitan-scaled puzzle, providing a highly desirable east-west link across the city". The Midtown Corridor is a unique area because it deals with not only the balancing of traffic flow, but with the broader goals of community revitalization (Dock, Zimmer,Becker, & Abadi, 2007). The site was also chosen because of its potential to provide access and connect to many important local and regional transit networks and improve the quality of corridor.

THE MIDTOWN CORRIDOR



EXISTING

80' Right of way

LAKE STREET

ORIENTATION

Lake Street is a major east-west thoroughfare in Minneapolis, Minnesota which is located between 29th and 31st Streets in south Minneapolis. Lake Street runs parallel to the Midtown Greenway, just two blocks south, which together makes up the Midtown Corridor. Lake Street is, and has been historically known for its cultural diversity and is the official boundary of several Minneapolis neighborhoods. From west to east these include: East Isles, East Calhoun, Lowry Hill East, CARAG, Whittier, Lyndale, Central, Phillips West, Midtown Phillips, Powderhorn Park, East Phillips, Corcoran and Longfellow.

HISTORY & SIGNIFICANCE

Once home to major industrial sites, Lake Street fell into a long period of disinvestment and economic decline following the 1950s and 1960s, when the new interstate highways and other freeways shifted road traffic and commercial development away from the corridor. Planning by the county to reconstruct Lake Street corridor began in 1999 (Dock, et al., 2007). Dock, Zimmer,Becker, & Abadi, (2007), indicate the challenges for planners and engineers in the reconstruction of declining Lake Steet, dealing with issues such as the balancing of traffic flow with the broader goals of community revitalization.

CURRENT CONDITIONS

Lake Street is currently a 4 lane two-way street with parking along most of the corridor. Signalized stops are approximately 2-3 blocks apart, and the public transit (bus) opperates with car traffic. Sidewalks are as little as 6' in some areas and shelters and street furniture take up most of the sidewalk. It is clear that Lake Street is car-dominated, leaving public transit and pedestrian space lacking. Creating an exclusive busway, increasing sidewalks, and reducing traffic, Lake Street will be transformed into a pedestrian friendly area where public transit blossoms.

TRANSIT CONNECTIONS

MIDTOWN GREENWAY

Midtown Greenway. The Midtown Greenway is a former freight rail trench located between 28th street south and Lake Street. The old railroad right-of-way was purchased by the Hennepin County Regional Railroad Authority in 1993 for use as a future transit corridor ("Busway feasibility study," BUS RAPID TRANSIT: TRANSFORMING AN URBAN CORRIDOR 2000). This 20-foot deep, grade-separated route could provide fast and reliable transit, but poses distinct challenges to create physical and mental connections. The trench is just one block north ofLake Street, which is filled with small businesses. The Midtown greenway received its name after its transformation into a public space with bicycling and walking trails. Today the Midtown Greenway is the busiest commuter bikeway in Minnesota .

HIAWATHA LRT

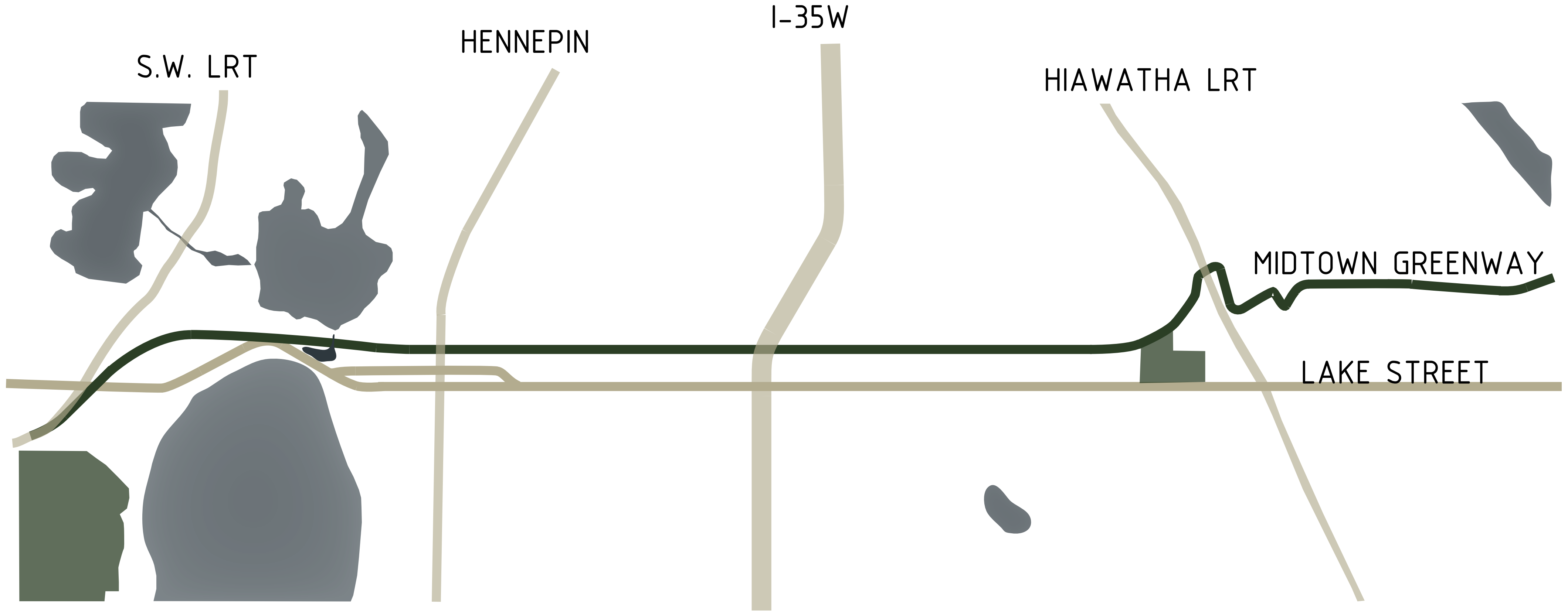
In 2004, Minneapolis reintroduced light rail transit with the 12 mile long Hiawatha LRT (lightrail transit) line, a $715 million project (Berg, 2009). The Line has 19 stations ("Hiawatha line (route 55)," 2012) linking downtown Minneapolis, the Minneapolis/St. Paul International Airport and the Mall of America. The Metropolitan Council ("Hiawatha light rail," 2011), indicated the success of the Hiawatha line stating that "Ridership on the line already exceeded the per-construction estimates for the year 2020". In 2008, the Hiawatha provided 10 million rides, an average of 30,500 per weekday. The Metropolitan Council also found the Hiawatha line to be "a powerful catalyst for development in a corridor that once had large tracts of vacant and underutilized land". Since 2000, nearly 7,700 new housing units have been built along the line, with additional 6,750 more units planned. Despite the popularity of the Hiawatha LRT, additional lines have been stymied by the lack of a funding stream. Unlike Denver, Dallas, and other cities, Minneapolis-St. Paul was trying to build a system one line at a time, causing issues for Federal funding (Berg, 2009).

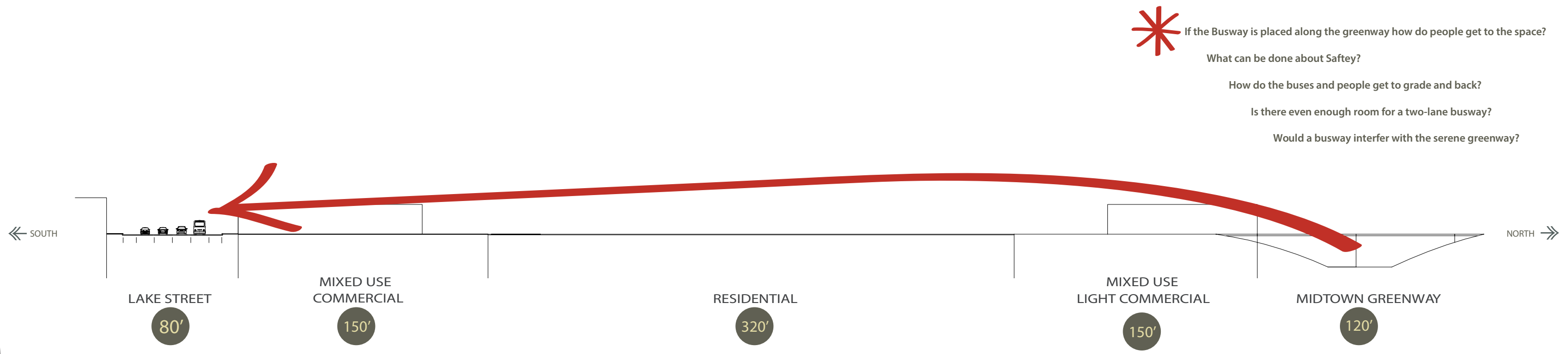
I-35W

I-35W is one of two through routes for Interstate 35 through the Twin Cities of Minneapolis and St. Paul. The other is Interstate 35E which runs through downtown Saint Paul. I 35-W runs over the Midtown Corridor. A newly implemented BRT system runs along this interstate and an existing transit stop is located at the intersection of I-35W and Lake Street. Metro Transit commissioned a study to evaluate and recommend options relative to ADA compliance and associated improvements to the existing transit stops. According to the Midtown Community Works "The primary functional goal of this project is to successfully link the two levels of the Lake Street and I 35W intersection with an ADA compliant vertical circulation system integrated into the transit facility which affords maximum user convenience and safety, ease of maintenance, durability of materials and reasonable cost."

OTHER

In addition to the grid system of streets that provide multiple routes for cars, a number of other transit options are being proposed including an additional LRT line running southwest connecting the rapidly growing southwest metropolitan area ("Southwest transitway," 2008).


S.W. LRT
HENNEPIN
I-35W
HIAWATHA LRT
MIDTOWN GREENWAY
LAKE STREET



OBSERVATIONS

Lake Street and the Midtown Greenway run parallel to each other a block apart. Together the two corridors work interdependently, creating a east-west connection. The Greenway is below grade and major north-south connections are bridged over this corridor. These major nodes are Lyndale, Nicollet, 4th, Chicago, Bloomington, and Hiawatha.

The Lake Street/Hiawatha Avenue intersection is a complex confluence of multimodal transit including light rail, bus, roadways and also foot traffic. The light rail Lake Street/Midtown station is one of two above grade stations on the Hiawatha line and presents both visual and physical challenges.

PROJECT EMPHASIS

Continuation of the thesis, based upon BRT implementation on Lake Street, will show a proper route for the transit to serve, right-of-way reconfigurations, shelter and station design, as well as corridor detailing.

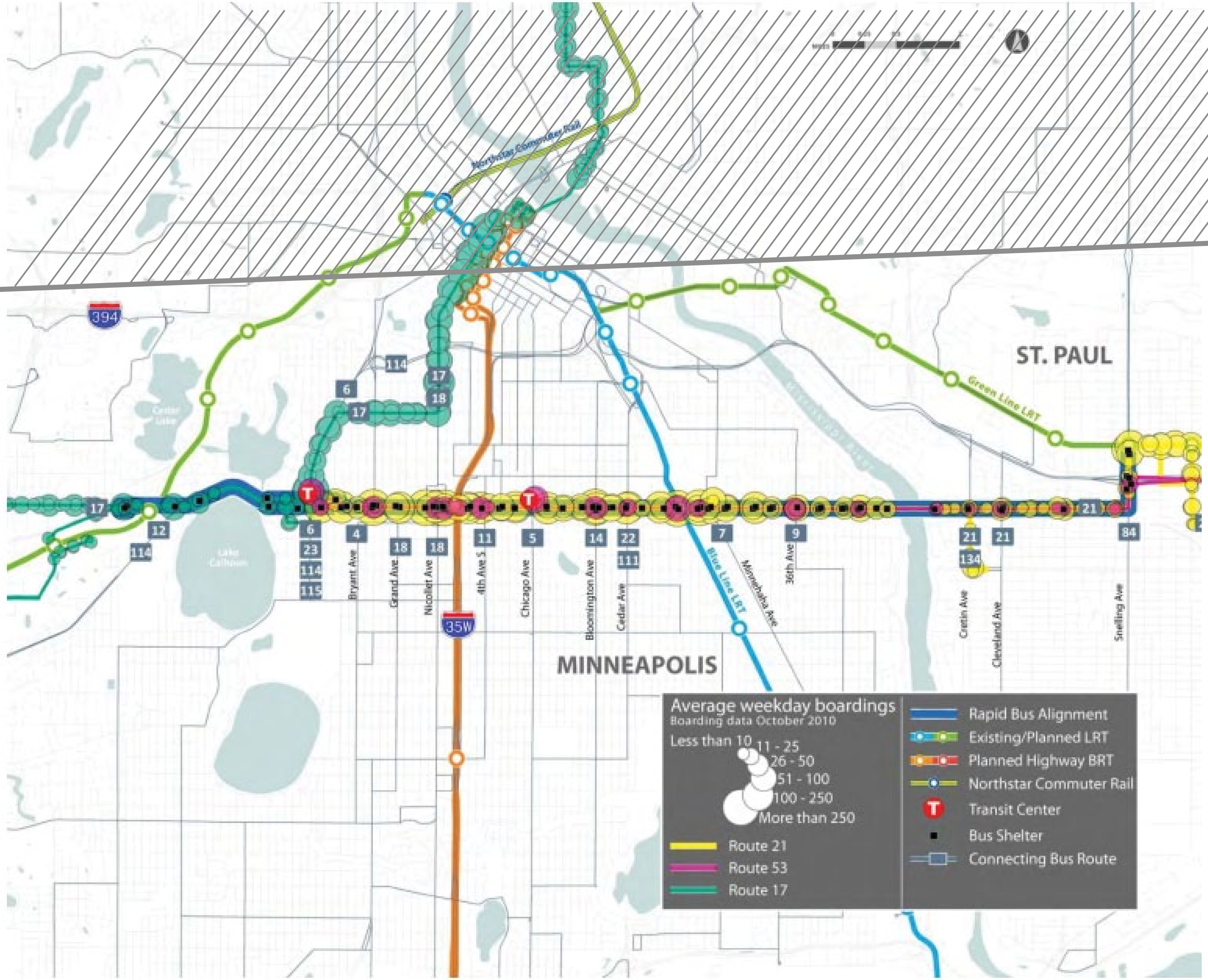
FUNCTION

The system needs to follow certain space requirements so configuring the right-of-way is an essential first step. The functionality of the design is most important and BRT components will be a priority of design.

FORM

The unifying concept will be an important part of the thesis as it influences the reasoning for the form and overall design. The form transforms the identity or character of the corridor. However important, form will follow function.

RESEARCH



EXISITNG TRANSIT SERVICE

*as shown in the Arterial Transitway Corridors Study Final Report (2012)

ROUTE 21

Route 21 is the primary route serving the Lake Street corridor. The route begins at the Uptown Transit Station at Lake and Hennepin and follows Lake Street/Marshall Avenue to Snelling Avenue. The route turns north to the Midway Shopping Center at Snelling and University, and then follows Selby Avenue into downtown St. Paul. Two primary route patterns operate on weekdays—one traveling the full alignment to downtown St. Paul, and one shortline ending at the University of St. Thomas.

Combined weekday frequencies are generally 6 to 10 minutes; frequencies east of Summit and Finn are generally 15 to 20 minutes. Route 21 is part of Metro Transit's Hi-Frequency Network between the Uptown Transit Station and Cretin Avenue. Saturday frequencies along the trunk portion of Route 21 are generally 6 to 10 minutes. Sunday frequencies are 6 to 15 minutes.

ROUTE 53

In addition to Route 21, peak-only Route 53 provides limited stop service between the Lake Street corridor and downtown St. Paul via I-94 east of Snelling Avenue. Route 17 operates on Lake Street west of Hennepin Avenue, along with Routes 12 and 114.

PERFORMANCE INDICATORS (2010)

Average Speed	10mph
Average Riders	10,000
On-Time Performance	86.1%

THE NEED

*as shown in the Arterial Transitway Corridor Study Final Rerport (2012)

Corridor forms important connection to regional fixed guideway transit system

High existing corridor transit demand offers opportunity for service improvement

High demand challenges existing transit capacity

Corridor serves large proportion of people who depend on transit

Existing passenger waiting facilities offer opportunities for improvement

Slow transit travel speeds lead to high operating cost/lower service attractiveness

Customer boarding time and fare collection cause delay

Roadway configuration and intersection controls challenge speed and reliability

Roadway configuration presents opportunities for travel time savings

Planned roadway improvements offer potential for construction coordination

MIDTOWN PLANNING INITIATIVES

***The Midtown Corridor is actively seeking ways to improve the area. The Midtown Community Works published these studies relating to the feasibility of both a Busway and a Retro Rail transit.

TABLE A
2020 Transit Ridership Forecasts

Alignment	Busway	Vintage Rail Trolley	LRT
29th Street Corridor (West Lake – Hiawatha)	7,300	6,100	7,700
Southwest Corridor to Minneapolis CBD (Hopkins – Minneapolis CBD)	16,000	14,500	16,500

TABLE B
Capital Costs (2005 Dollars)

Alignment	Busway	Vintage Rail Trolley	LRT
29th Street Corridor (West Lake – Hiawatha)	$59M	$84M	$122M
Southwest Corridor to Minneapolis CBD (Hopkins – Minneapolis CBD)	$84-95M	$144M - $194M	$244- $289M

TABLE C
Annual Operating and Maintenance Costs (2005 Dollars)

Alignment	Busway	Vintage Rail Trolley	LRT
29th Street Corridor (West Lake – Hiawatha)	$2.0M	$2.2M	$2.3M
Southwest Corridor to Minneapolis CBD (Hopkins – Minneapolis CBD)	$9.1M	$11.2M	$8.4M

BUSWAY FEASIBILITY STUDY

A busway feasibility study ("Busway feasibility study," 2000), was initiated in May 1999 as a joint effort of Hennepin County and Metro Transit to determine the feasibility, defined in terms of ridership forecasts and cost assumptions, of constructing and operating a limited-stop, rapid transit busway within the Midtown Corridor. The area studied was along the Midtown Greenway (29th street) between West Lake Street to Hiawatha Avenue. This study was intended to determine if BRT was a practical first step toward light-rail transit (LRT). Assumptions in the Busway Feasibility Study were as followed:

> Key study assumptions were that busway infrastructure elements such as transit stations, parkand- ride lots, fare collection systems and communications would be compatible with LRT and capable of re-use with conversion to LRT. Another assumption was that the bicycle/pedestrian trails constructed within the corridor would remain with conversion to a busway. For purposes of this study, a busway was defined as a two-lane roadway, separated from other traffic, operating with hybrid, diesel-electric, low-floor buses and a proof-of-payment fare collection system. (p. i)

The study found that despite there being a modest preference for LRT, a busway was viewed as "a positive precursor to LRT given LRT's long-term implementation prospects in this corridor". Current transit riders in the corridor are highly transit-dependent with 51 percent not owning an automobile and 36 percent riding the bus 10 or more times per week.

RAIL FEASIBILITY STUDY

A vintage rail trolley study ("Vintage rail trolley," 2000) was initiated by Hennepin County and the Metropolitan Council in April 2000 at the request of the Midtown Greenway Coalition, to determine the feasibility, defined in terms of ridership forecasts and costs, of constructing and operating a vintage rail trolley. This study is intended to determine whether a vintage rail trolley is a practical step toward future LRT. This study was done preceding the 1999 Busway Feasibility Study. According to the study, "vintage rail trolley systems currently operate in a number of U.S. cities including Portland, Dallas, New Orleans, Seattle, and Memphis. Vintage rail trolley systems are generally two to four miles in length, use either refurbished PCC type cars or newly-constructed replica trolley cars, and operate on rails with an overhead power system similar to that used to operate light rail vehicles." The study seeks to find the feasibility of this transportation type for the strict purpose of transportation, not tourism. Ridership estimates for 2020 were expected to carry 6,100 passengers per day along the 29th Street Corridor. Although these numbers make the trolly a feasible option, busway ridership estimates are higher at 7,300 passengers per day. This study suggests that a busway would be more effective in moving people. Table A from the study, shows the comparison between these two modes, as well as predictions for LRT. Cost estimates were done regarding both capital costs and operating cost, comparing all three modes. The study suggests that the Busway would be the most economic solution because of lower capital and operating costs. Table B and Table C, relay the study findings.

RESEARCH RESULTS

- Bus rapid transit (BRT) can help increase mass transit mobility in the Mid-town Corridor, and provide more immediate support than light-rail transit.

- Planning and designing within an existing built environment, will help lower cost, while revitalizing an urban corridor.

THESIS GOALS

- Design amentities that enable Bus Rapid Transit to run properly along Lake Street, including major Bus Rapid Transit components.

- Make the system identifiable with the area, giving the corridor a strong identity. Use a similar material pallette and design aesthetic to create unity.

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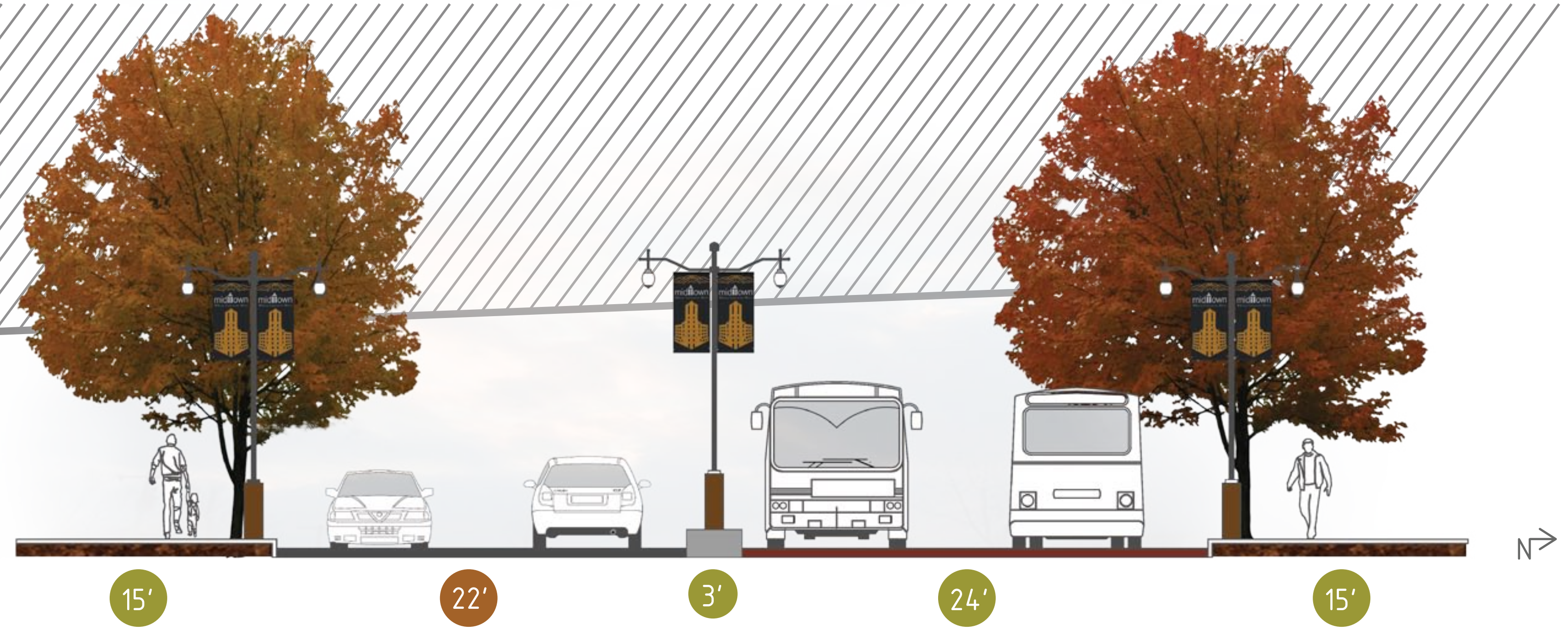
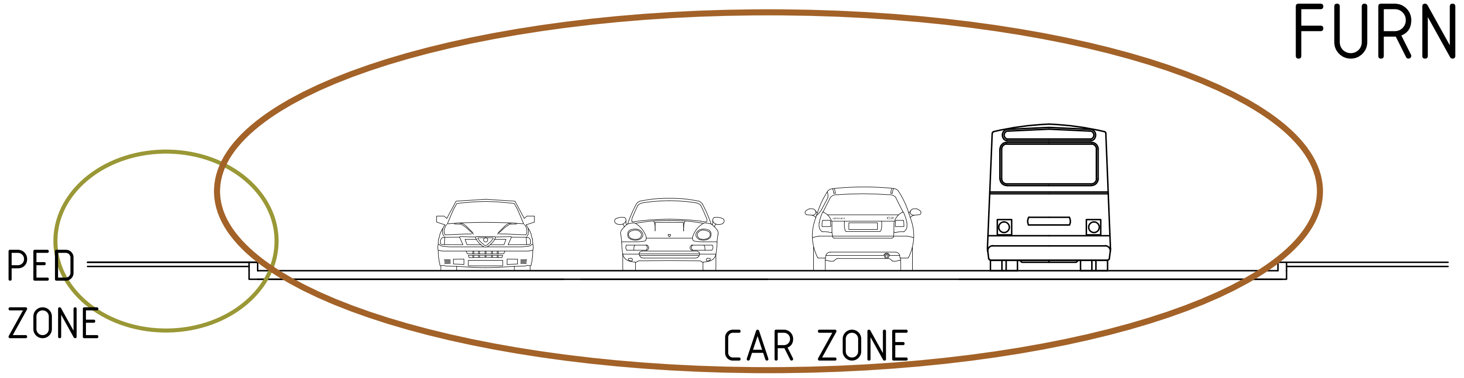
DESIGN DEVELOPMENT

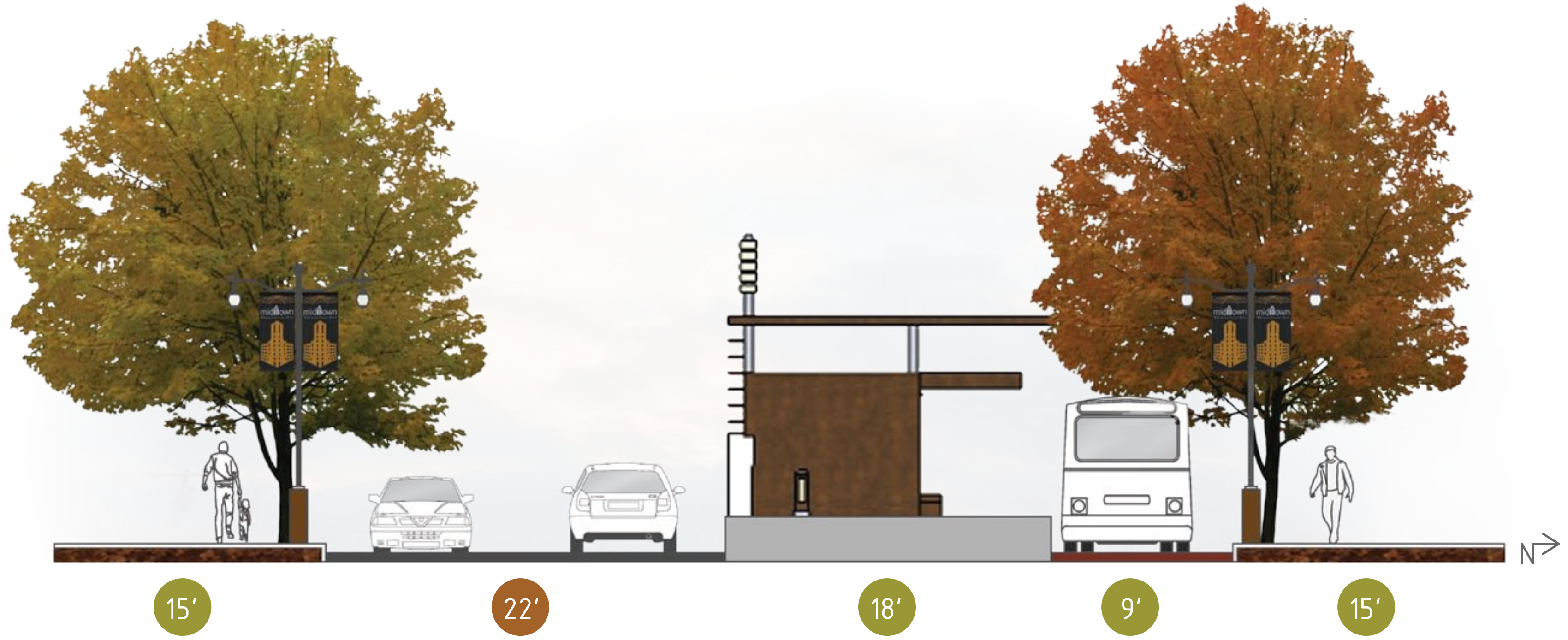
One of the first steps in the design process was evaluating and making critical changes to Lake Street. Lake Street is currently a 4 lane two-way street with parking along most of the corridor. Signalized stops are approximately 2-3 blocks apart, and the public transit (bus) opperates with car traffic. Sidewalks are as little as 6' in some areas and shelters and street furniture take up most of the sidewalk. It is clear that Lake Street is car-dominated, leaving public transit and pedestrian space lacking. Creating an exclusive busway, increasing sidewalks, and reducing traffic, Lake Street will be transformed into a pedestrian friendly area where public transit blossoms.



FURNITURE DESIGN

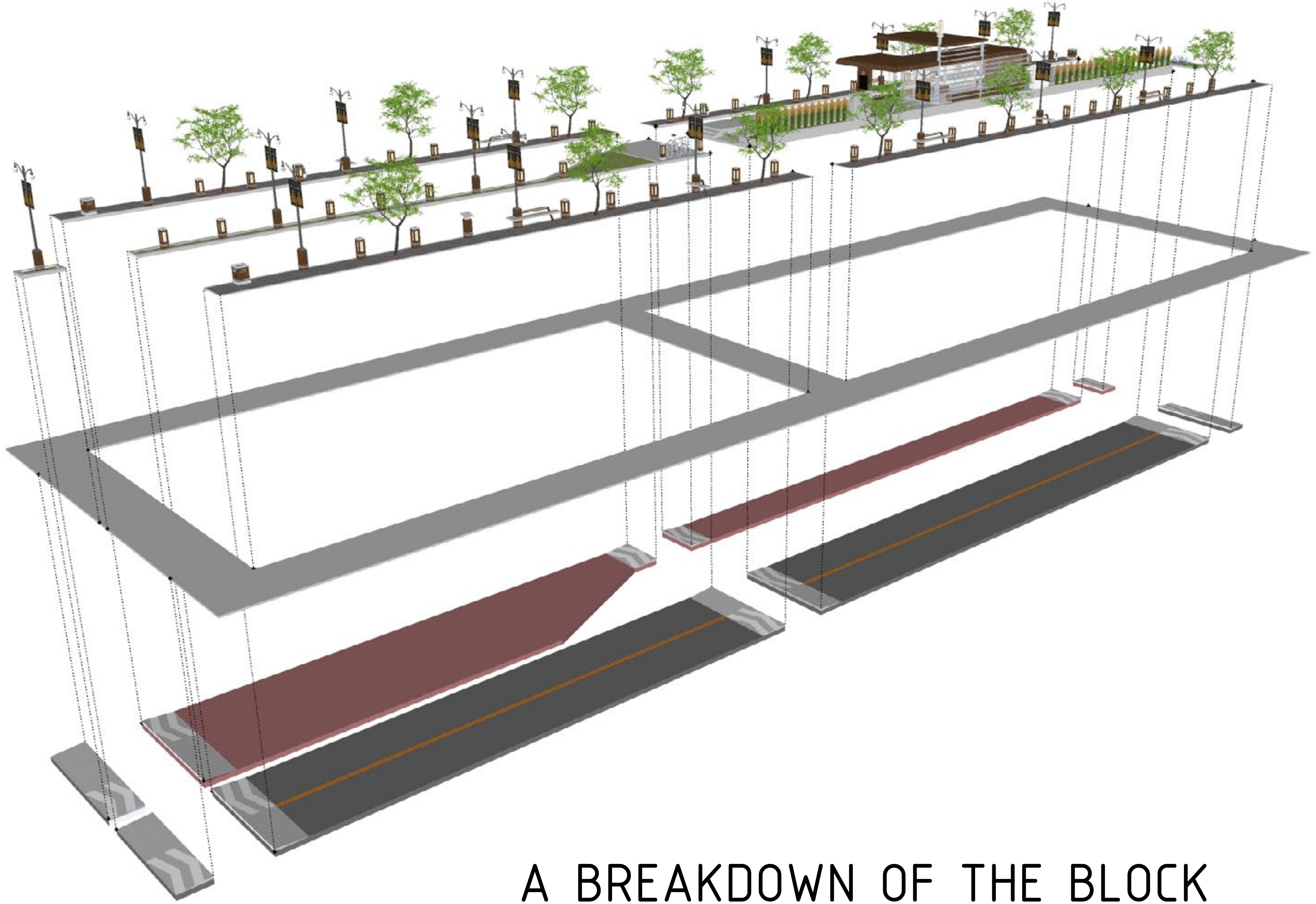


EXISTING
79' Right of way



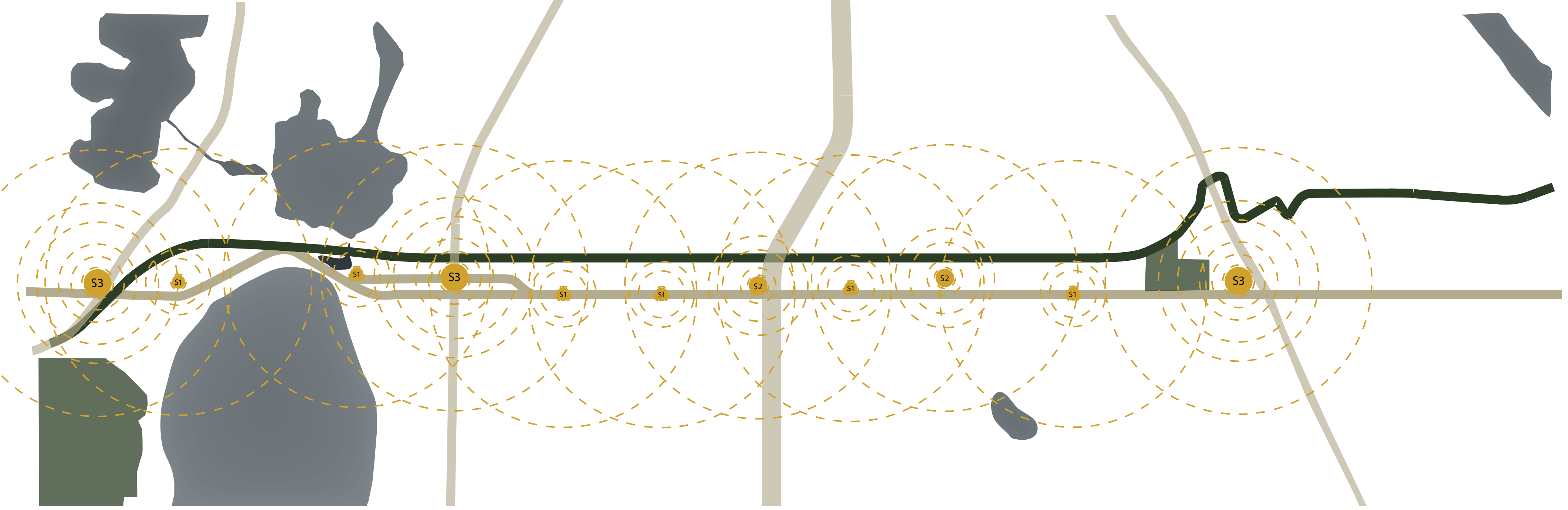
FINAL DESIGN WORK

STREET PLAN
STATION TY.2



A BREAKDOWN OF THE BLOCK

ROUTE PLANNING & STATION TYPOLOGIES



The next step was planning a route with different station typologies. The route was planned with three different station typologies to adequaetly accomodate BRT service.

*The 5 min walk is shown by the outermost circle
*Stations are an average .37 miles apart (appropiate for most BRT routes)

Ty.3

The first stations placed were type three (Ty. 3) stations. These stations are the largest of the three, and are considered major transfer stations. These stations are placed at such areas as; The Hiawatha LRT, The Uptown Transfer Station, and The future Southwest LRT intersections. These stations would be on an off-street location and would entail a site-specific design.

Ty.2

The second stations placed were type two (Ty.2) stations. These stations are the second largest and are placed at major destinations and small transfer stations. These stations were placed at such areas as; The Midtown Global Market and 1-35w. These stations would be on-street (like the previous streetscape details show), and have been programmed further (shown on the next page).

Ty.1

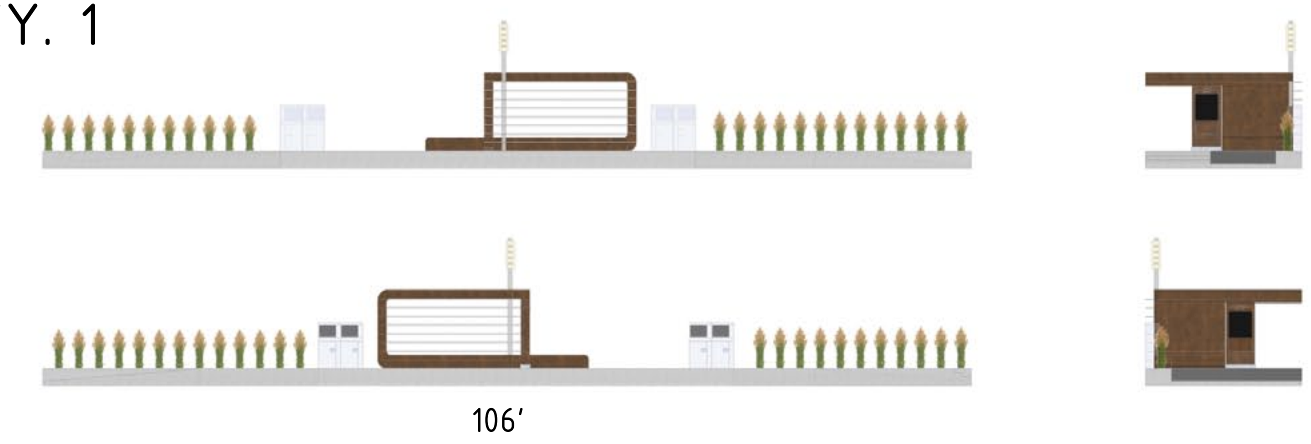
The third stations placed were type one (Ty.1) stations. These stations are the smallest of the three and are placed at minor destinations as well as other intersections along the corridor. These stations were placed in between large gaps in the Ty.3 and Ty.2 plan, and fulfill the route so that it is fully accessible. These stations would be on-street (like the previous streetscape details show), and have been programmed further (shown on the next page).

STATION PLATFORMS
2 TYPES

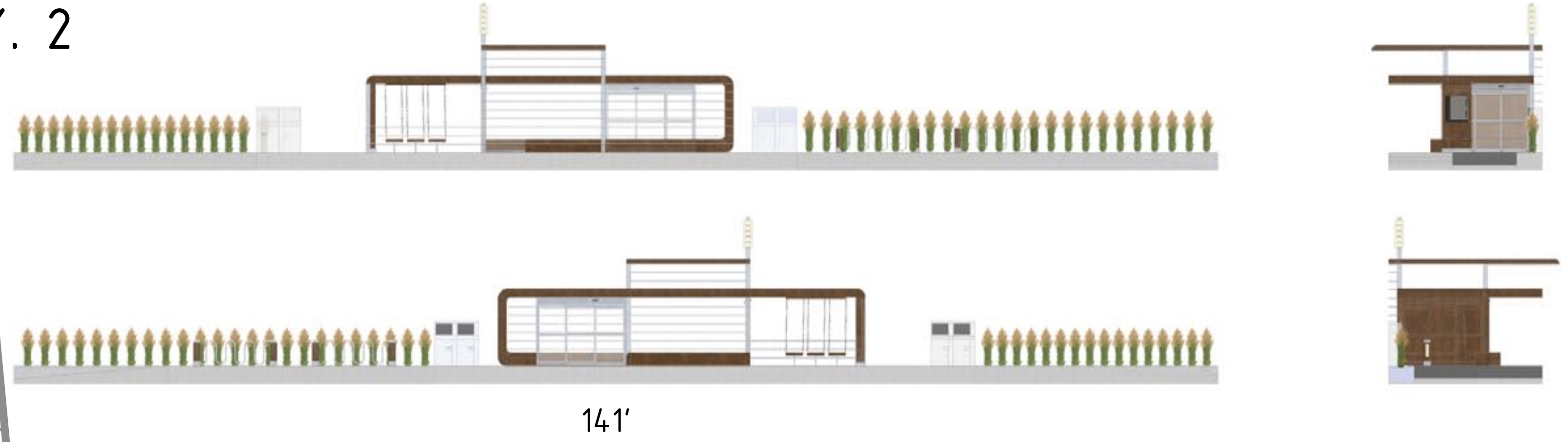
The Elevations to the right show the two types of on-street stations. The platforms are sized to accommodate the influx of people getting on and off the buses. The station platforms were designed to fit at the block intersection and extend approximately 1/3 (for Ty.1) and 2/3 (for Ty.2) of an average block. This allowed for there to be mid block crossing points. As, shown, there will be Karl Forester, or another type of tall screening grass to block the platform from traffic and pay stations on either side as you enter onto the platform. Both station types are ADA accessible from either side.

ELEVATIONS

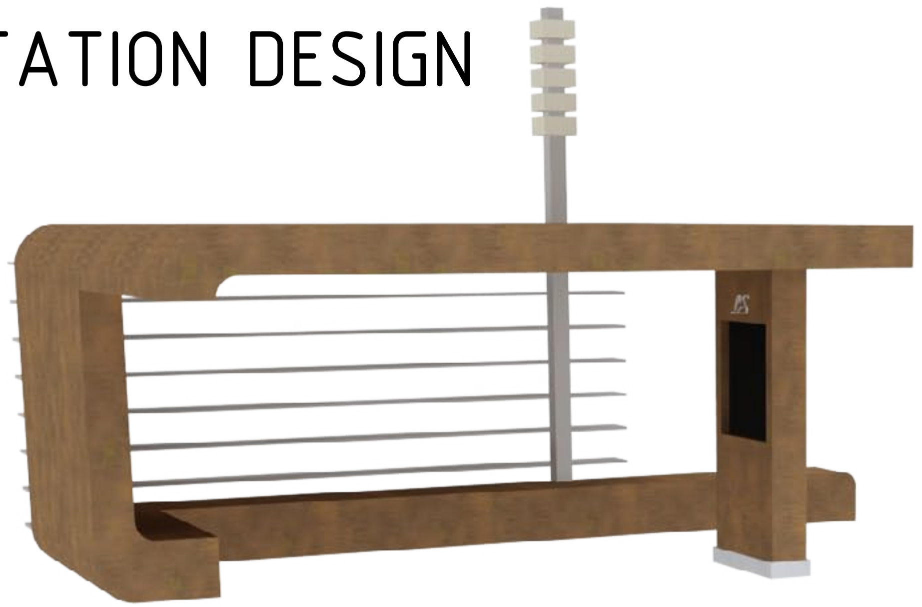
STATION TY. 1



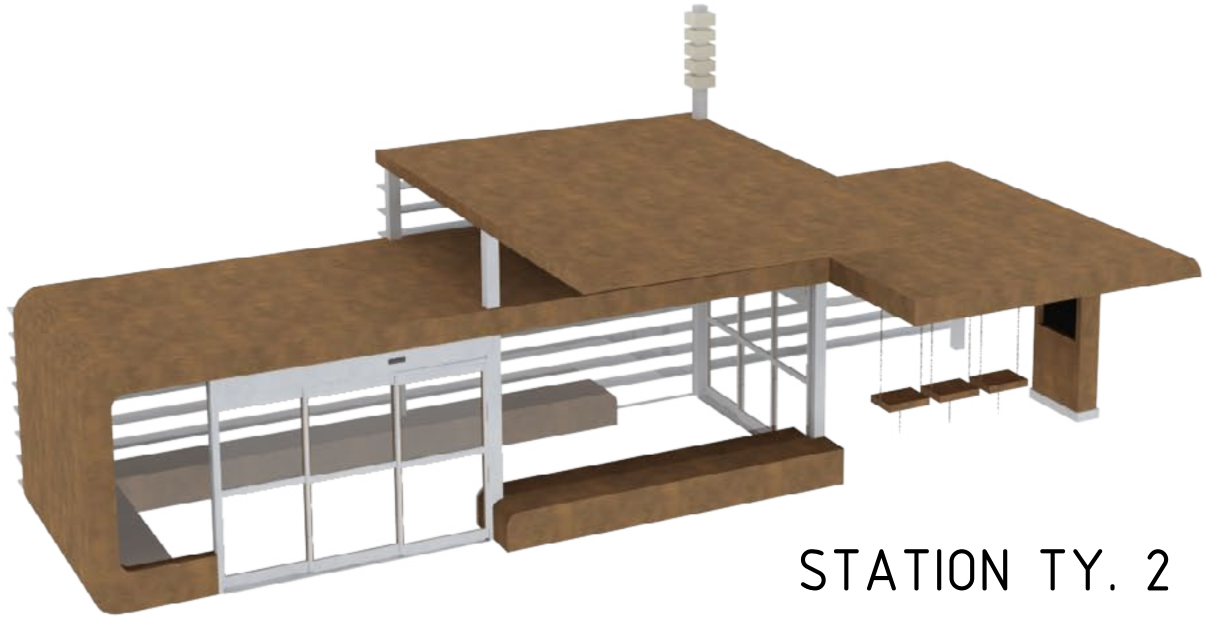
STATION TY. 2



STATION DESIGN

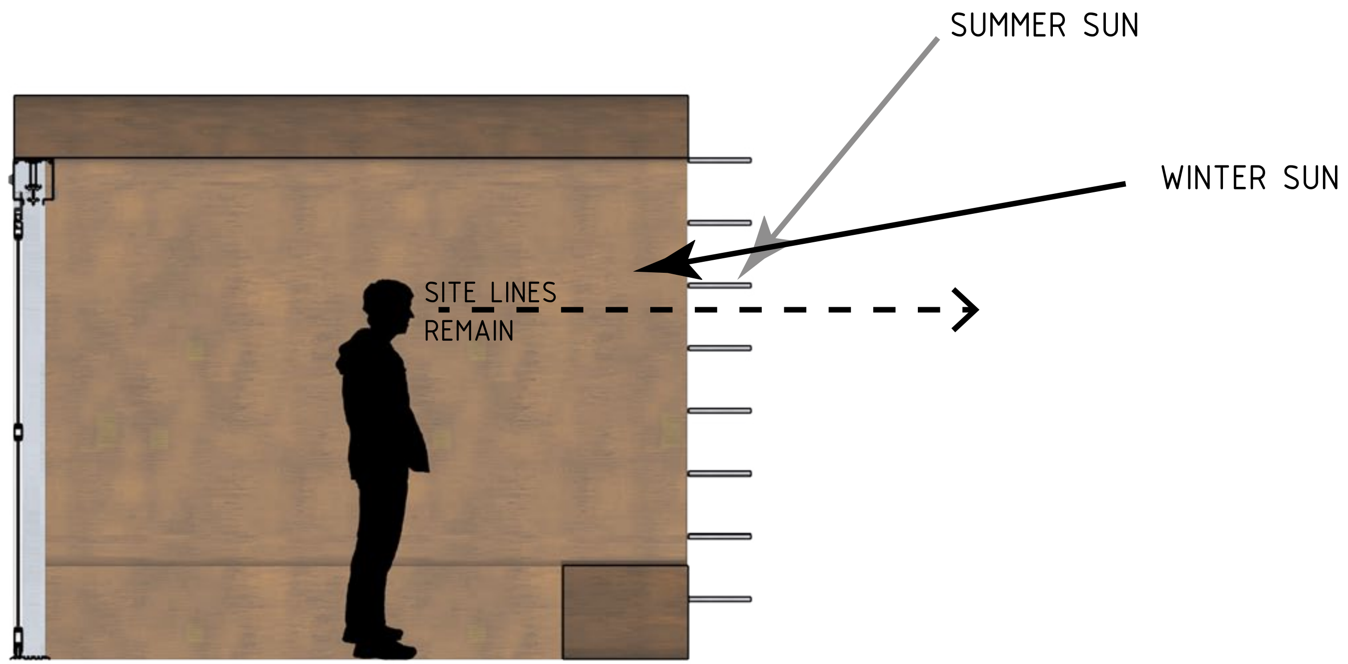


STATION TY. 1



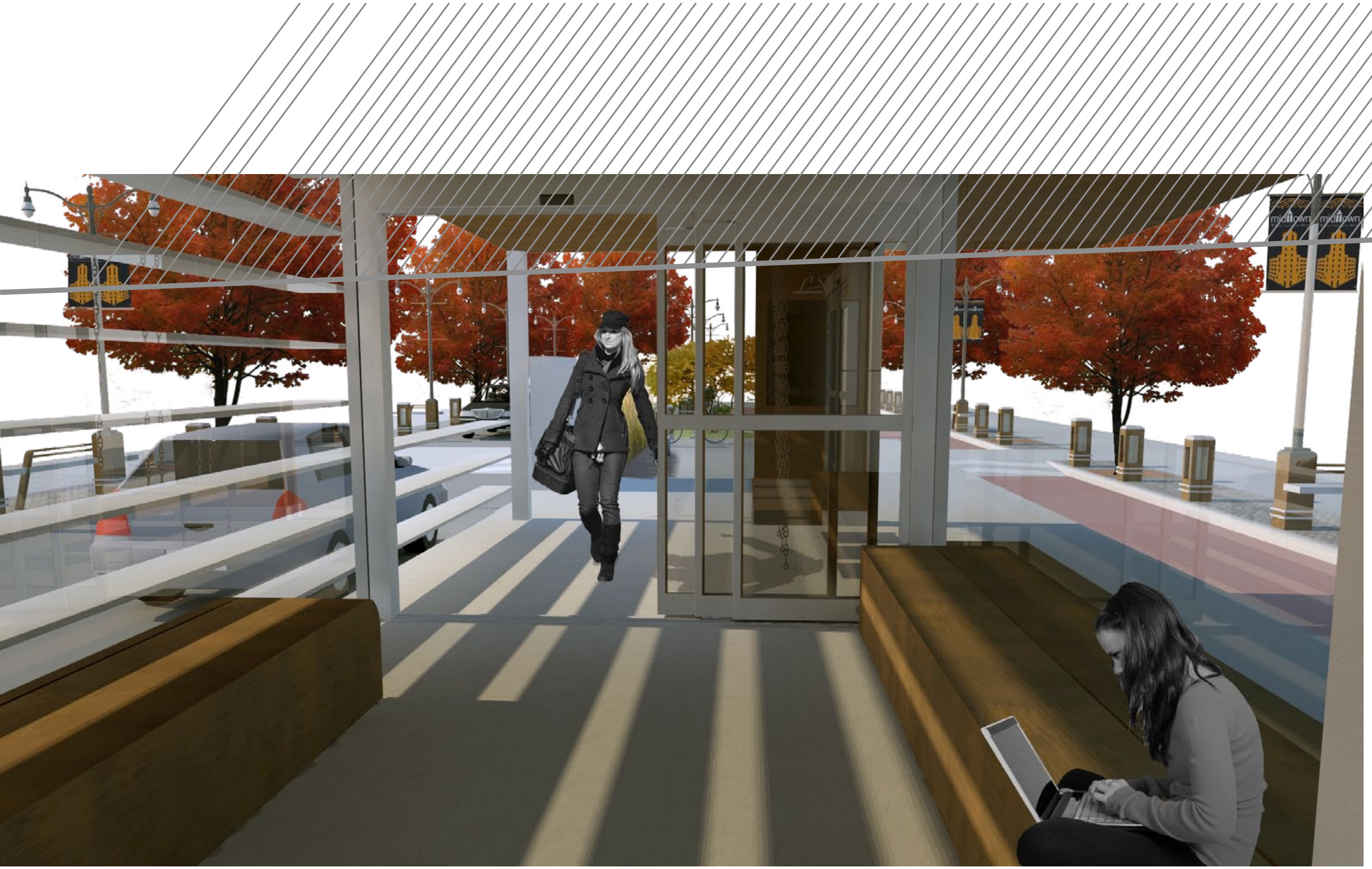
STATION TY. 2

PLAYING WITH LIGHT



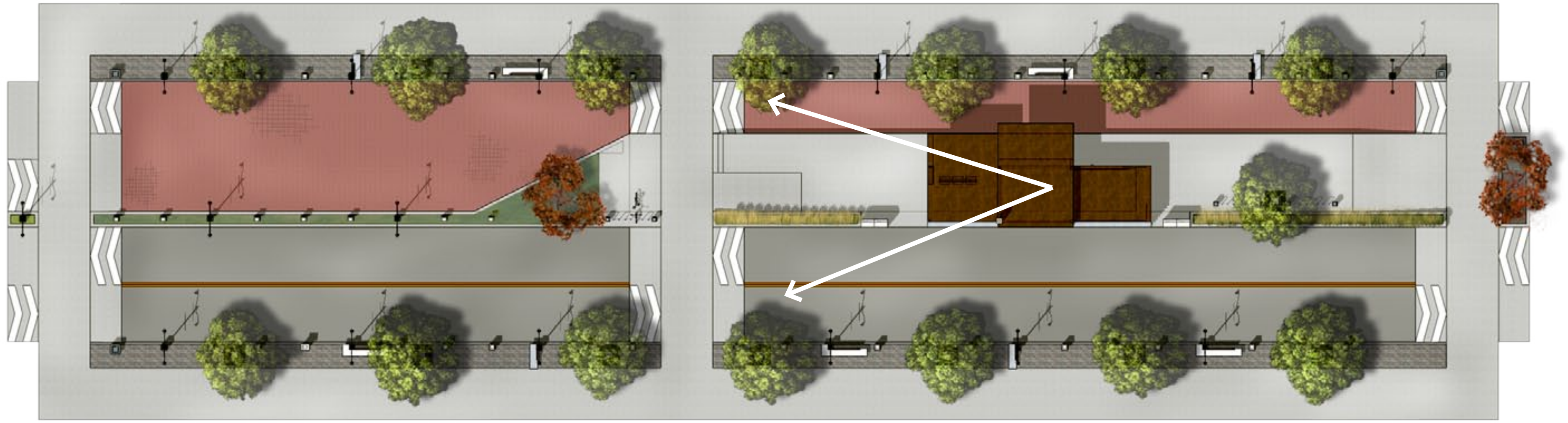
UNIFIED & STRONG

The design for the shelter stemmed from the character of Lake Street. Lake Street and the surrounding area has been an attractive area for immigrants all over the world to establish roots. It is now one of the most diverse neighborhoods in all of Minneapolis. Although diverse, Lake Street demonstrates an ability to unite in celebration of culture. It is said that Lake Street is where culture meets. The concept behind the shelter came from this concept of unity and strength that has been demonstrated along Lake Street. No better shape represents this than a circle. The design stemmed from a circle and morphed into a functional shelter. The form remains as a whole, although there re different elements (i.e. bench seating, overhead planes, informational systems). The breaks in the form are functional for efficient circulation. The indoor/outdoor transition is to appear seamless, strengthening the unified theme of the shelter. The slates along the south side of the shelters are not only an aesthetic signifying speed, but they also server a purpose as a light and shading system. The diagram above displays how the sun interacts with the shelter in the contrasting summer and winter seasons.



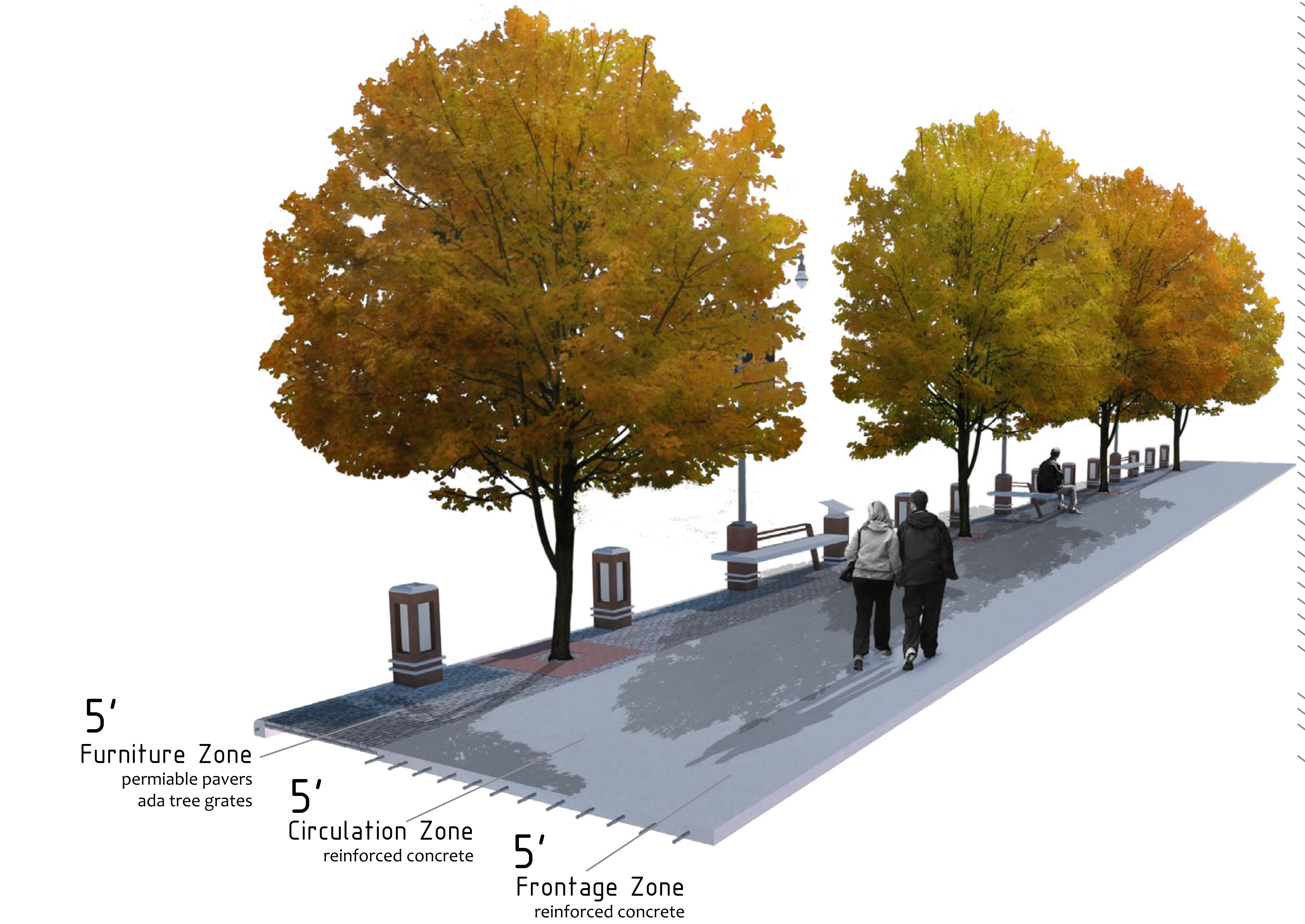
PERSPECTIVE IN SHELTER TY.2 LOOKING WEST

STATION TY. 2



FURNITURE DESIGN

The furniture is an element of the design that enchances the streetscape and helps to create an unifying identity along the corridor. The forms immitated the design of the shelter. Each piece was designed to be both functional and aesthetic, considering its purpose first and foremost. The bollard (F|2), for example. not only looks nice and serves as a barrier from traffic, but it is at the right height to lean againsts, and the inset light reflects onto the sidewalks.

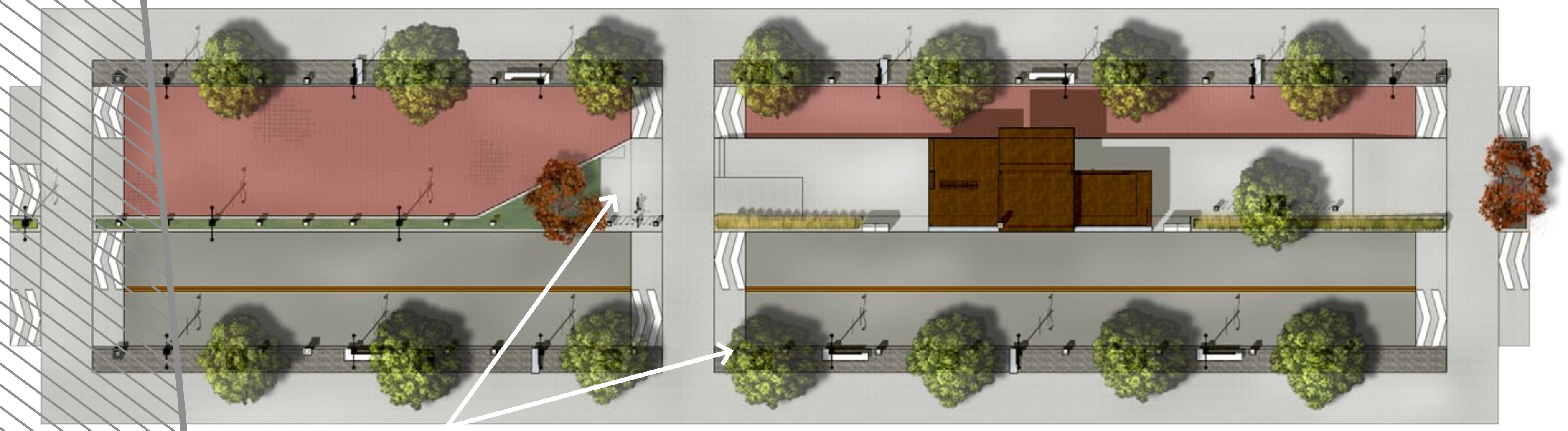


CREATE SPACES FOR THE PEDESTRIAN

The current sidewalks along the corridor range from 6-10' and are crowded with bus shelters, street post and other furniture. The sidewalk is inadequate in size for the pedestrian traffic in the area. The corridor is a destination because of its many shops and stores, and without the proper space people have a difficult time opening doors and looking in windows. A proposed widened sidewalk, would not only accommodate the large number of pedestrians, but would allow space for the store frontages, and accent a designate furniture zone. The perspective to the left shows the scale of the revamped sidewalk with a 15' minimum length between building and car. The furniture zone fits neatly and comfortable the essentials for a relaxing and safe stroll. Benches are placed every 36 feet and allow visitors and residents to enjoy the street vitality. Both the street trees and the light fixtures proved an overhead plane and aid in creating a sense of protection. Trees are enclosed in an ADA grate.

PERSPECTIVE LOOKING N.E. AT CROSSING

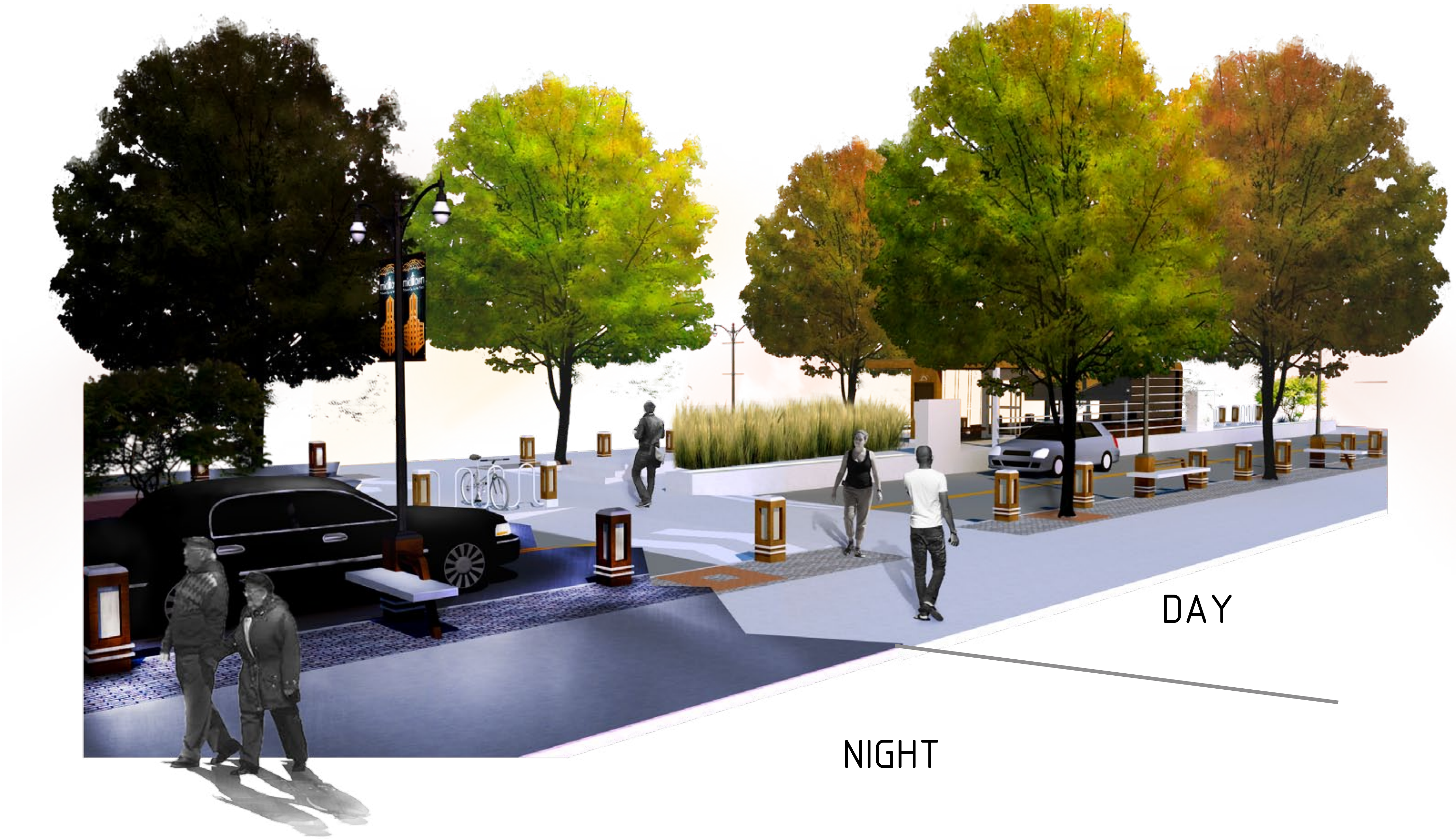
STATION TY. 2



MAKE IT SAFE

This perspective shows the many features in the design that create a safe and comfortable environment. The mid-street crosswalk is an important part of the design because it allows for the flow of pedestrian circulation to flow from the station platform to either side of the street. As you can see in the plan above and in the perspective, pedestrian sidewalks extend over the street and busway, and speed tables are placed for vehicles to cross over. This slows down drivers and makes them aware of the surrounding pedestrian dominated area.

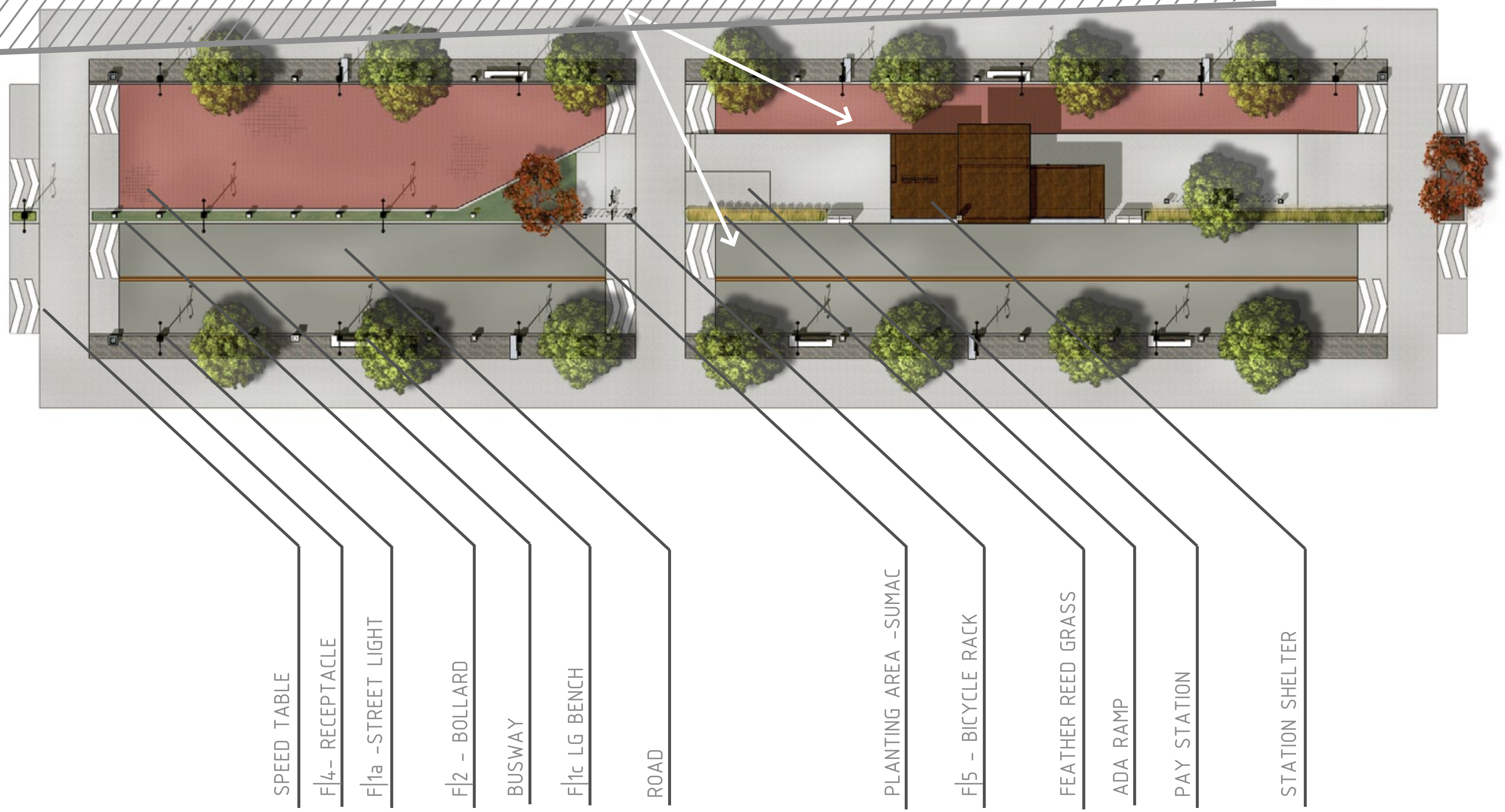
The design is intended to be utilized at all times of the day, so lighting is an important aspect. A portion of the perspective is rendered at night so the lights can be shown. The Bollards (F|2) luminously cast a light glow onto the sidewalk. This minimized the need for excessive overhead lighting.



PERSPECTIVE LOOKING S.W. AT STATION

STATION TY. 2

Details matter, especially when it comes to time and efficiency components related to BRT service. This fixture is a part the multi sensory notification systems. The light shines based upon how many minutes there is until the next bus. From a distance, one could see the light and plan for enough time to get to the shelter, but a ticket and wait to board. This is just one of the ways in which technology can enhance the efficiency of this transportation network.



CAN BRT TRANSFORM LAKE STREET?

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3
CONCLUSION

PREVIOUS STUDIO EXPERIENCE

2009

2010

2011

2012

LA 271 | Intro to LA Studio | K. Pepple

LA 272 | Parks & Public Spaces Studio | D. Fischer, M. Chambers

LA 371 | Env. Art & Site Design Studio | S. Famulari

LA 372 | Community Planning Studio | K. Pepple

LA 471 | Urban Design Studio | J. Kost

LA 472 | Term Abroad Studio | K. Pepple

LA 571 | Environmental Planning Studio | M. Madani

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PERSONAL IDENTIFICATION

I enjoy being able to use my creativity and love for the outdoors in my work as a professional! I am happy to be moving onward from my valuable time at North Dakota State University, into a field that I can honeslty say I am passionate about.

Thank you!

EMILY NEUENSCHWANDER
Class of 2013, NDSU