

Seattle's Bicycle Stations:  
A Social and Infrastructure Support Network  
For Tired, Wet, and Caffeine Deprived Cyclists

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University of Washington

**Abstract**

Seattle's Bicycle Stations:  
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For Tired, Wet, and Caffeine Deprived Cyclists

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Globally, bicycling is becoming a major means of transportation for its adaptability, affordability, and convenience. However, as compared with other developed nations, the US lags behind in conventional bicycle use, due to automobile driven policies. As cities continue to grow, there is a demand for dense, urban environments which support walkable lifestyles. Bicycling is well suited to high density living, and can improve the quality of life in cities by reducing air pollution, improving community health, and enabling social equity.

Seattle is a progressive city in the US that has advocated for the implementation of a new bicycle network for riders of all ages and abilities. Moreover, at the city, state, and national level, increased bicycle ridership has become a transportation priority. This thesis proposes a network of bicycle stations throughout Seattle to encourage ridership, and add safety and convenience for cyclists, and signify bicycling is a normal, everyday activity.

I would like to acknowledge my friends and family for their endless patience, love, and support over the past six years of architectue school.  
-Victoria Kovacs

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## Introduction

Worldwide, bicycling is emerging as a major mode of transportation, celebrated as a practical and efficient means for commuting to work, running errands, or simply for leisure. The bicycle is trending as the popular mode of choice for a variety of reasons; including escalating energy prices, traffic congestion, time constraints of mass transit, heightened ecological and health consciousness, and quality of life concerns. Most recently, new infrastructures such as bicycle share programs, protected bicycle lanes, neighborhood greenways, secure bicycle parking facilities, and bicycle-transit integration are transforming what was typically perceived as a recreational activity into a functional way of life for people of all ages and abilities.

Conventional bicycle use is much less common in the United States than in other developed nations. Rapid urbanization in the late 1890's and subsequent vehicle-oriented development policies resulted in many low quality streets for bicycling or walking today. Sidewalks are absent or too narrow for walking in groups, and bicyclists are either weaving through pedestrians on sidewalks or are too often in conflict with cars and other vehicles. While current transportation infrastructure may serve the fearless and experienced cyclist well, it is inadequate for the needs of a growing number of bicyclists who want to ride on safer streets (Fig. 1). The low level of perceived safety has impeded bicycling from becoming commonplace in American cities.



**Figure 1**

Bike to School Day in Seattle's Bryant Neighborhood. Rebecca Nelson, Bike-to-School Day ride and rally at Bryant Elementary, *Ravenna Blog*, 8 May 2013, Web.

However, bicycling in the US can become a viable, respected, and entirely normal means of travel with proper planning and design. Seattle is a progressive example, as the city has surveyed its transportation infrastructure and policy shortcomings and drafted a comprehensive bicycle master plan to address the needs of present and future generations. This plan has stated the goals of tripling the amount of bicycle riders, cutting the collision rate in half, and ensuring that every household is within a quarter mile of a bicycle facility (SDOT 26). With such an ambitious vision, there is a pressing need for comprehensive, quality bicycle infrastructure in Seattle to encourage and accommodate a growing number of bicyclists.

This thesis proposes a system of bicycle stations throughout the city as a complementary safety net and structured social support; an added layer to Seattle's bicycle master plan. These stations would provide practical necessities, such as lockers and secure bicycle parking to enable and motivate hesitant cyclists, transit connections and a place to rest to extend an individual cyclist's trip radius, and bicycle repair and maintenance resources for the surrounding neighborhood. Additionally, these bicycle stations provide the public space to encourage and support the social growth of a broadening community. Moreover, through the high quality architecture of these buildings, bicycling can be visually celebrated and reflect the city's prioritization of bicycling as a travel mode equal with transit or driving.

This thesis is organized into three scales: first, a planning and regional analysis of bicycle demographics and the city bicycle network, second an urban design analysis of a particular neighborhood and portion of the bicycle network in Seattle, and finally a specific site selection and bicycle station design. The sections are as follows:

Chapter One: Why Encourage Bicycling?

Chapter Two: The Seattle Context

Chapter Three: Present Bicycling Conditions and the Planned Network

Chapter Four: Program Analysis

Chapter Five: Neighborhood Analysis and Site Selection

Chapter Six: Site Analysis and Urban Design

Chapter Seven: Design Development

Chapter Eight: The Bicycle Station

## Chapter One: Why Encourage Bicycling?

### Population and Development Trends

By 2050 it is predicted that 6.3 billion people, or 67% of the world's population, will be living in urban areas (UN 4). As cities are becoming increasingly dense, sustainable growth practices are imperative to ensure a high quality of life and the overall livability of cities. In recent years, there has been a growing global movement of promoting bikeable and walkable communities for their social and ecological benefits, especially as the space limitations and negative health and transportation aftereffects of car-oriented design are recognized. Bicycles are affordable, take up less space, emit no pollutants, encourage social interaction, enable independence, and improve physical health. These attributes make the bicycle a remarkably efficient form of transportation perfectly suited to more dense environments. In fact, the bicycle has proven successful as a transportation option even in hyper-dense cities such as Taipei and Hangzhou (Fig. 2).

In the United States, walkable neighborhoods have become the predominant real estate development trend, as housing prices in dense urban cores lead over once popular suburban communities (Badger). This market trend signifies a shift from isolationist, car centric culture to more community focused, health conscious

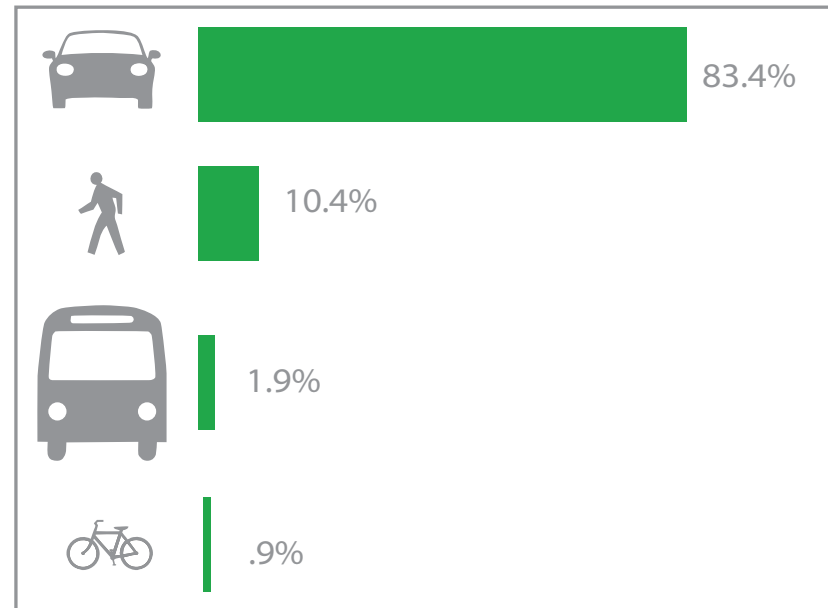


**Figure 2**  
Bicycling in Hangzhou. Elizabeth Press, *The Biggest, Baddest Bike Share in the World: Hangzhou, China*; *Streetsblog*; June 2011; Film.

culture. Indeed, there are now bicycle friendly business districts, policy initiatives for healthy community development, walking and bicycling rating scores on real estate listings, and locally implemented pedestrian and bicycle master plans. Undoubtedly, there is an increasing consumer demand for a bikeable, walkable lifestyle; the implementation of which is encouraged and advanced by political policy.

### US Public Policy

Historically, the automobile has been heavily promoted through government subsidies and taxes, which have made driving much more economically desirable than other forms of transportation (Fig. 3). Though vehicles have added personal convenience, it has come at tremendous social and environmental costs. There are monetary, health, and visual detriments borne by the whole population; such as the costs to build and maintain roads, environmental pollutants, and neighborhood fragmentation by large and unsightly freeway structures. Car oriented developments consume large parcels of land at low densities, and social and commercial destinations become so few and far between that travelling between them leads to overconsumption of energy and expenditure of time. In *Suburban Nation*, a book describing the rise of the American suburbs and alternative design practices to remedy sprawl, the authors point out that,



% of Trips Made by Transportation Modes in the US

**Figure 3**  
Transportation mode split in the United States is dominated by private automobiles. Data Source: (USDOT NHTS)

“...government subsidies for highways and parking alone amount to between 8 and 10 percent of our gross national product...The cost of these subsidies-approximately \$5,000 per car per year- is passed directly on to the American citizen in the form of increased prices for products or, more often, as income, property, and sales taxes. This means that the hidden costs of driving are paid by everyone: not just drivers, but also those too old or too poor to drive a car.” (Duany, Plater-Zyberk, and Speck 94)

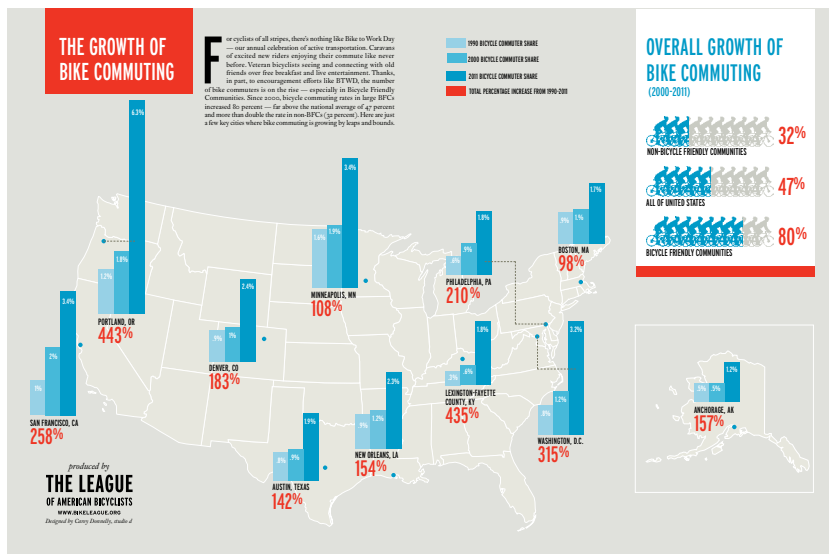
These pro-vehicle policies mask the true cost of driving a car and instead make vehicle ownership much more accessible and convenient. Thus, the tremendous popularity of the car comes as no surprise. Regrettably, incentivizing car use has marginalized non-vehicle users both monetarily and socially.

Fortunately, bicycling and walking officially became part of the national agenda with the Department of Transportation’s release of *The National Bicycle and Walking Study* in 1994. This document which states ambitious goals of doubling the percentage of bicycle and walking trips from 7.9% to 15.8%, and reducing the number of pedestrian and bicyclists killed or injured in traffic accidents by 10% (USDOT). Moreover, it is now federal policy to incorporate walking and bicycling facilities into all new transportation projects. The official 2010 Federal Highway Administration statement reads, “Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate

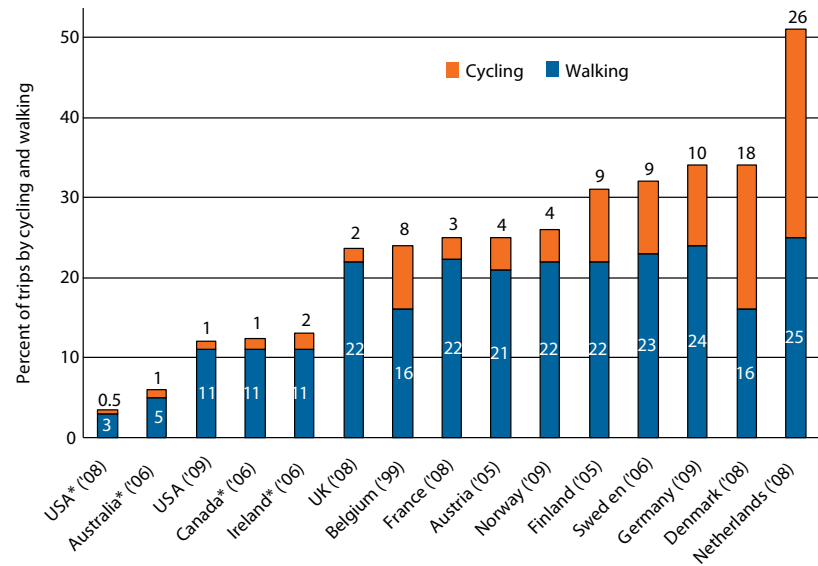
walking and bicycling into their transportation systems.” The policy also recommends bicycling and walking to be regarded as an equal transportation mode that is available as a choice for people of all ages and abilities (USDOT statement). As a result, every state has a pedestrian and bicycle coordinator, and most states have pedestrian and bicycle master plans, or at least components thereof within state comprehensive plans.

### **Mode Split**

Though national bicycling rates in the United States are increasing (Fig. 4), the predominant transportation mode is by car. According to the 2009 National Household Transportation Study(NHTS), 83.4% of all person trips are made by private vehicle, less than 1% by bicycle, 1.9% use transit, and 10.4% walking (the remaining percentage is attributed to other less frequented transit modes such as airplanes, taxis, and ferries) (USDOT NHTS). Comparing US active transportation rates with other developed European countries, Germany has a 10% share of trips made by bicycle and 24% by walking; the Netherlands 26% by bike and 25% by walking; Denmark 18% by bike and 16% by walking; and the UK 2% by bike and 22% by walking (Fig. 5). Even the most bicycle-friendly cities in the U.S., such as Portland, Oregon (6.3%), or Boulder, Colorado (10.5%), have lower bicycle rates than the least bike friendly cities in Germany, the Netherlands, and Denmark (League; Buehler 10). Such low



**Figure 4**  
 Nationwide Increase in Bicycling Commuter Rates. Notice the higher rates in bicycle friendly communities. The League of American Bicyclists, *The Growth of Bike Commuting*, *Bicycle Commuting Data*, Web.



**Figure 5**  
 The United States is far behind other developed nations in sustainable transportation rates. Ralph Buehler and John Pucher, *Walking and Cycling in Western Europe and the United States: Trends, Policies, and Lessons*; *TR News*, May-June 2012, Web.

percentages can be attributed to lower levels of perceived safety and comparative lack of bicycle infrastructure; both for routes travelled and provision of end of trip facilities, such as bicycle parking (Fig. 6).

Interestingly, the average trip made by an individual (by any mode for any purpose) is less than ten miles, and more than half of all person trips are less than five miles (USDOT NHTS). A utilitarian bicycle trip typically ranges from two to five miles long (USDOT NHTS), a distance that can be easily traversed in 12-30 minutes at an average speed of 10 mph. For destinations further afield, bicycle trip distances can be increased by integrating bicycles with public transit via racks and secure parking facilities at transit stations. There is reasonable potential to change individual car trips to bicycle, transit, or walking trips; and a series of economic, environmental, and social gains to give incentive to do so. The advantages of riding a bicycle are explained in the following sections.

### **Bicycle Economics**

As compared to a car, a bicycle is a much more affordable and efficient alternative (Fig. 7). In 2009, the NHTS estimated that the average household spends \$3,300 a year on gasoline (NHTS 63). By choosing to bicycle instead of drive, not only are fuel and oil dependencies eliminated, but there are no insurance or licensing costs, little and low cost maintenance, no parking fees, and likely



**Figure 6**  
Secure bicycle parking facilities at the University of British Columbia. The University of British Columbia, “Shared Bike Cages,” *Campus + Community Planning, Transportation Options*; Web.

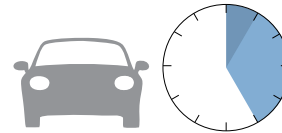
reduced travel time. In an article by Paul Tranter, “Effective Speed: Cycling Because It’s ‘Faster’,” he explains that after considering all of the components affecting travel time, including the time spent earning the money to pay for the indirect and direct costs of the mode of transportation, the bicycle is by far the most efficient. This analysis derives from an economic model of converting monetary costs of travel into a total time cost to result in an “effective speed.” He articulates the hidden costs of driving,

“Increasing the trip speeds of cars has little impact on effective speeds because the main time component for many car drivers is not the time spent in cars, but the time spent earning the money to pay for all the costs of cars. In fact, car drivers who try to save time by driving faster will likely reduce their effective speed because of the extra costs involved in more hectic driving (more fuel used, more wear and tear on the vehicle, and greater stress on the drivers)” (70).

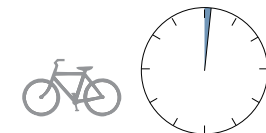
Bicycles are not only a faster transportation option for the individual, but they actually reduce travel time for other transportation modes. After reallocating street space in New York City for pedestrians and bicyclists, traffic congestion remained the same, but average vehicle speeds increased (Flengenheimer).

Bicycling can also encourage local market growth through bicycle related business revenue and bicycle-tourism. Cyclists also tend to spend more money at retailers than those arriving by other transportation modes (SDOT 4). A study in New York proved that

On Average,



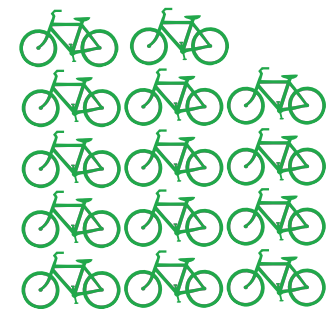
It Takes Between 5 and 25 Minutes to Park a Car



It Takes 1 Minute to Park and Lock a Bicycle



One Parking Space



Space for 14 Bicycles

**Figure 7**

Bicycles take up less time and less space. Data Source: Seattle Department of Transportation, Bicycle Data, Web.

after implementing bicycle infrastructure on a street, local retail sales improved as much as 49% (NYCDOT 4). In sum, bicycles are more affordable, available to a broad demographic, and the cyclists themselves generate business by spending money on goods and services rather than on fuel or insurance.

### **The Social Power of Bicycles**

The bicycle is an empowering tool of personal freedom, as anyone can learn to ride a bike: young or old, able-bodied or handicapped, men or women, wealthy or poor. As such, the bicycle has the equity potential to reach disadvantaged social groups and enable transportation independence; for example, individuals who cannot afford to purchase or maintain a car, or individuals without access to transit. In its universal adaptability, the bicycle can become a point of commonality for forming relationships between varying social groups.

Symbolically, the bicycle is also a tool of political and social change. Historically, it has played a role in feminist, socialist, and eco-political movements (Vivanco 105). For the women's rights movement, the bicycle represented a form of social liberation (Fig. 8). Susan B. Anthony once said "Let me tell you what I think of bicycling. I think it has done more to emancipate women than anything else in the word. It gives women a feeling of freedom and self-reliance" (quoted in Garrard, Handy, and Dill 214). Even today the bicycle is a veritable



**Figure 8**  
1922 advertisement for Peugeot bicycles. Jean Carlu, "Peugeot Bicycles," Colville-Anderson sets: Vintage Bicycle Posters: Peugeot. Flickr. Web.

emblem of positive change, and sustainable transportation has become a part of any politician's platform, evidenced in Seattle's and Chicago's recent mayoral races.

Finally, bicycling encourages socialization and physical interaction with one's environment. Experiencing a city on a bicycle is different than riding in a car or a bus as you are intimately aware of what the streets feel like, smell like, how people interact, topography, distances, building types and densities, and so forth. Mónica Dávila Valenica, a women's bicycle advocate in Columbia once said, "Traveling by bike allows one to penetrate the world of the city: to be in it, with it, of it; it is to know, with each trip, its organization, its disorganization, its history, its future, its holes, its trash, its parks, its walkways, its channels, its people, its lives." (quoted in Vivanco 57). Riding a bicycle opens one up to the opportunity to socialize, and increased socialization leads to community engagement, attachment, and inclusion. These are the positive amenities which create the social support of neighborhoods. Jane Jacobs, renowned social activist and urban planning critic, describes streets and the opportunity for chance interactions as the very lifeblood of the city in her book *The Life and Death of Great American Cities*. In discussing the social life of sidewalks she writes, "The sum of such casual, public contact at a local level...is a feeling for the public identity of people, a web of public respect and trust, and a resource in time of personal or neighborhood need"(56).

## **Health Benefits**

Bicycling for recreational or utilitarian purposes is beneficial for physical, emotional, and environmental health. Worldwide, obesity has nearly doubled since 1980. Obesity is attributable to cardiovascular disease, type II diabetes, and all of the afflictions listed on the World Health Organization's top ten causes of death for high income countries (WHO). Encouraging active transportation is a positive means to integrate physical activity back into everyday life. Moreover, as public health care costs are increasing, promoting active lifestyles is a practical, positive way to mitigate these costs.

Bicycling, and more generally exercise, can also improve one's emotional well-being. Psychological benefits range from increased self-esteem by treating anxiety and depression, to improved cognitive functions (Garrard, Rissel, and Bauman 37).

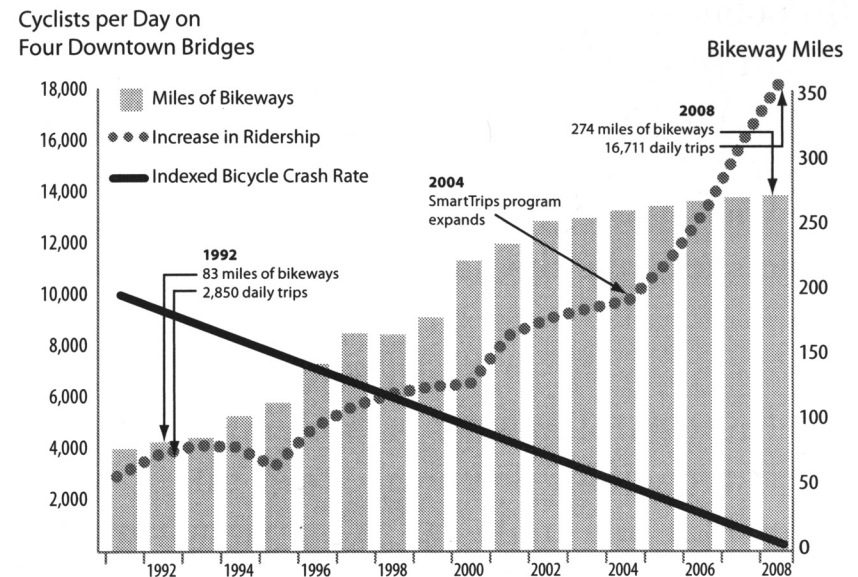
Lastly, bicycling benefits the environment by reducing noise, air pollutants, and greenhouse gases otherwise generated from automobile use. Poor air quality from auto pollutants is not only unpleasant to live and breathe in, but is often related to public respiratory health problems, such as asthma.

## Why More People Aren't Riding

With so many benefits, why aren't more people pedaling to get around? The positive news is that there has been a documented increase in the amount of cycling in recent decades. However, these numbers still fall far below national and local government set targets. To increase the rate of bicycling, it is important to identify and mitigate potential barriers keeping individuals from making a modal shift. Numerous articles have been written on the subject, but the two most prevalent impediments are safety concerns and degree of convenience. Safety and convenience are both subjectively measured, but are indirectly controlled by objective factors such as topography, weather, presence or absence of infrastructure, network connectivity, traffic, and trip distances. While weather and topography cannot be easily altered, the latter categories can be improved upon by policy and design measures.

### If You Build It, They Will Come.

There has been a proven latent demand for bicycle infrastructure. Portland in the 1980s had very low bicycle participation or bicycle facilities, but with infrastructure investments in the mid-1990s, by 2008 bicycling had increased 400% (Geller 1). In fact, in Portland it was shown that implementation of bicycle infrastructure was positively correlated with bicycle use and negatively correlated with



**Figure 9**  
Positive correlation of ridership and bicycle infrastructure, while collisions have an inverse relationship. Documented on Portland's four bridges. Mia Birk, *Joyride: Pedaling Toward a Healthier Planet* (Portland: Cadence Press, 2010) 199. Print.

bicycle-vehicle collision rate (Fig. 9). Cross sectional studies of other populations have also confirmed the correlation between infrastructure and higher cycling rates (Dill and Carr 122).

Installing separated bicycle lanes and an integrated trails network would positively increase a cyclist's perception of safety on the road and encourage participation of riders of all ages and abilities who might otherwise be discouraged. Additionally, an improved bicycle network which connects neighborhoods and destinations makes the bicycle a much more convenient and attractive travel option. Bicycle infrastructure is not limited to just paths and on street facilities, however. It is also important to provide end of trip facilities such as bicycle parking, lockers, and showers to promote bicycle commuting. Signage and repair stations mid-trip would improve navigation and create seamless emergency support network. Bicycle share or loaner programs also make bicycling available to those who do not own a bicycle, such visitors or tourists. Well located bicycle share stations can also enable trip chaining with public transit. All of these components enacted in conjunction with education and enforcement policies would make any city ideal for bicycling, a standard championed by European cities such as Amsterdam and Copenhagen (Fig. 10).



**Figure 10**  
Cycling is the most common form of transportation in Copenhagen. Kasper Thyge, "Bike City," VisitCopenhagen the official website, April 2013, Web.

## Chapter Two: The Seattle Context

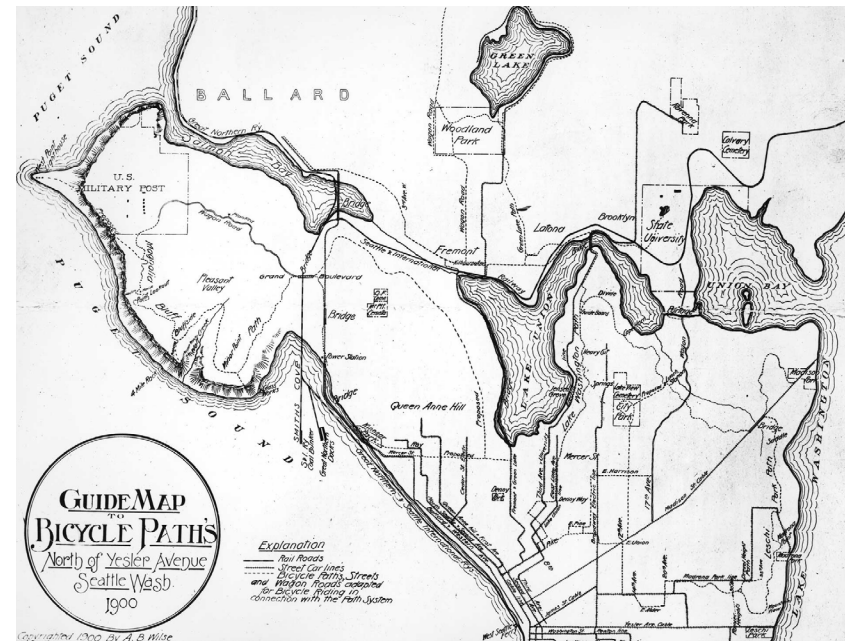
### Seattle Ridership

Seattle has repeatedly been praised as one of the nation's top cities for cycling. Bicycling magazine rated Seattle as number ten for America's top 50 bike-friendly cities (Dille); the League of American Bicyclists rated Seattle as number two of seventy for bicycle commuting in large cities, and Washington as the number one most bicycle friendly state (League). The city has a comprehensive bicycle master plan, bicycle advisory board, numerous grassroots advocacy campaigns, and the Cascade Bicycle Club boasts one of the largest memberships of bicycle clubs in the nation with over 15,000 members.

Currently, Seattle's bicycle mode share is 3.45% (League). However, Seattle has evidence of an increase in the annual rate of bicyclists, documented by the Washington State Bicycle and Pedestrian Documentation Project and downtown bike cordon counts. In addition to already rising numbers of cyclists, the city has the ambitious goal of tripling the amount of ridership in Seattle by 2030 (SDOT 26).

### The History of Seattle Cycling

This rich bicycle culture stems from a history extending to the early 1890s, as the arrival of the safety bicycle created a boom of popularity for bicycling. Queen City Cycle Club, later renamed the Queen City



**Figure 11**  
Anders Wilse, *Guide Map to Bicycle Paths, Seattle 1900*; Paul Dorpat, *Seattle Now and Then: Fort Lawton Barracks*, Dec. 2011, Web.

Good Roads Club, was founded in 1896 to advocate for road paving and the construction of bicycle paths as existing roads were muddy, rutted, and ungraded. The first bicycle path was opened in 1897 along the shores of Lake Union, outfitted with a Halfway House to provide sandwiches and drinks for cyclists in need of rest (Fig. 11). By the turn of the century, there were over 10,000 cyclists braving thirty five miles of cinder paths winding through the city and surrounding forest (Cameron 6, 13-15).

Shortly thereafter, the automobile became the new fashion, and the bicycle fell out of vogue. The cinder paths for cyclists were widened and paved to become boulevards for cars; the golden age for the bicycle had come to a close. Not until oil shortages and the environmental movement in the 1970s, was there a significant resurgence of interest in bicycling. This powerful reawakening prompted Seattle's first comprehensive bicycle plan to address growing safety concerns for bicyclists riding on city streets with cars. (City of Seattle 5). Concurrently, as the railroad companies began to downsize and leave many railroad corridors abandoned, the city was able to acquire these rights-of-way and construct multiuse trails in their place, such as the beloved Burke-Gilman Trail today.

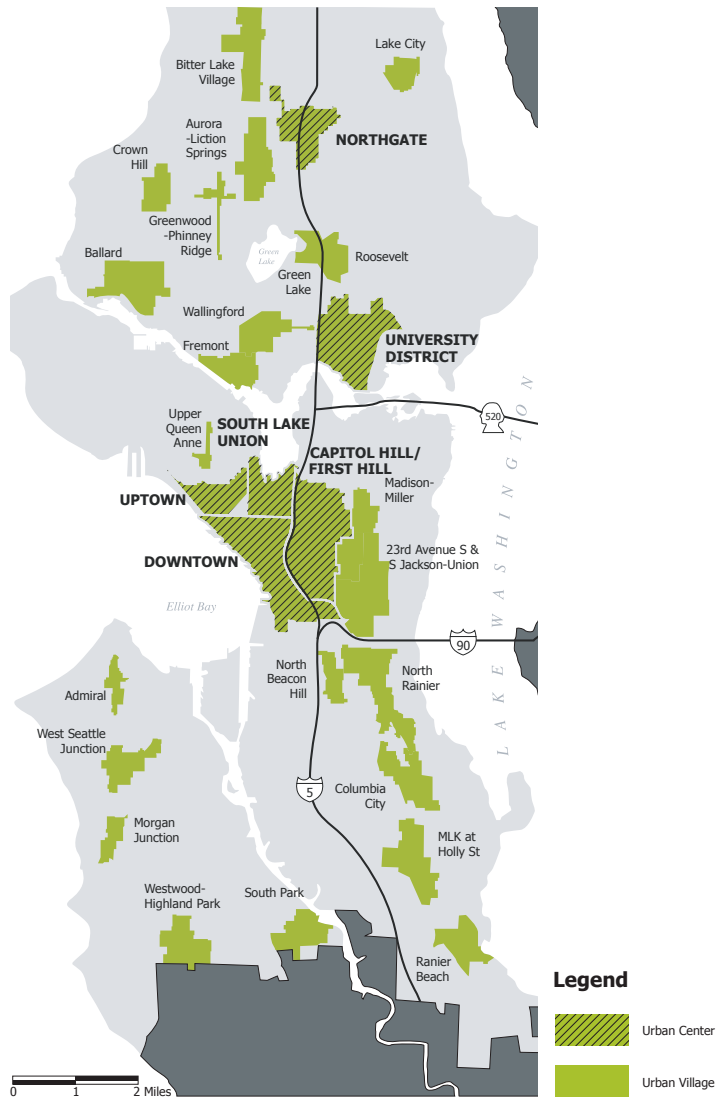
In 2007, the city drafted a new bicycle master plan to develop an on-street network of bicycle facilities to supplement the recreational, off street trails. These facilities mainly consisted of sharrows and painted

bicycle lanes. Four years later, this plan was updated to establish a bicycle network better suited to bicyclists of all ages and abilities, which is discussed further in the following chapter. The latest update to the bicycle plan has set aggressive targets for the build out of bicycle infrastructure, stating the goals that no part of the city will lack bicycle facilities by 2030, and every household will be within a quarter mile of a bicycle facility by 2035 (SDOT 26).

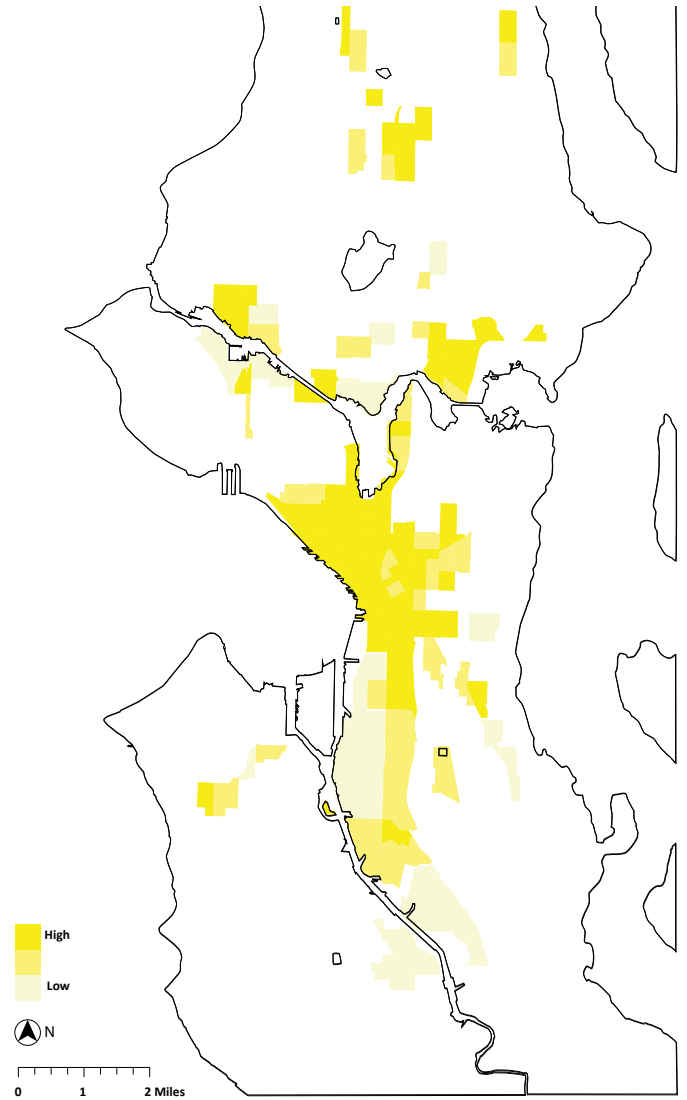
### **Projected Growth**

Population forecasts indicate that the Puget Sound region will increase by 414,500 people by 2040 (Conway 5). Seattle's own census data has shown an increase of about 45,000 people over the past ten years, or approximately a 0.8% growth rate per year (SDPD "Population"). Though this increase is modest, this growth will be concentrated in urban centers as designated by the Seattle comprehensive master plan (Fig. 12). The zoning measures in this plan will limit buildable area and encourage developers to maximize their investments by constructing high density, multi-use projects. There will likely be an undersupply of parking, and considering the growing real estate demand for walkable-bikeable communities, these dense urban centers will need high quality amenities and infrastructure for bicycles as well as convenient and frequent transit service.

Much of Seattle's growth will relate to increased employment, as the



**Figure 12**  
 Designated urban centers and urban villages targeted for population growth. Seattle Department of Planning and Development, “Urban Centers and Villages” *Reader’s Guide City of Seattle Comprehensive Plan: A Plan for Managing Growth 2004-2024*, January 2005, PDF file.



**Figure 13**  
 Employment densities for Seattle in 2030. Major concentration remains around the downtown core. Data Source: Seattle Department of Transportation, *2005 Seattle Transit Plan*, Seattle.gov, Sept. 2005, Map 5.2. Web.

comprehensive plan aims to accommodate 84,000 new jobs in these urban growth centers. A 2030 employment projection (Fig. 13) shows that much of this employment will remain concentrated in the central business district and immediately adjacent areas. Thus, not only will the urban centers have dense residential populations, there will be an increasing number of commuters, shoppers, retailers, and suppliers flowing to and from these centers on a daily basis. To avoid chronic traffic congestion problems and promote sustainable growth practices for the city and the region as a whole, high quality bicycle and transit infrastructure will play a critical role in encouraging transportation modes other than the single occupancy vehicle (SOV).

### Transit Master Plan

Seattle's transit master plan is a forty year comprehensive vision of light rail, streetcar, and bus rapid transit high capacity corridor expansions to the north and south for complete coverage of the city (Fig. 14). Developers will be drawn to these transit corridors and areas surrounding new transit stations for their high density living potential. Symbiotically, high density housing works in favor of transit systems. According to Seattle's transit master plan, every 10% increase in population yields a 5-8% increase in transit ridership (SDOT TMP Briefing Book 2-1).

The planned high capacity transit network will also compliment the

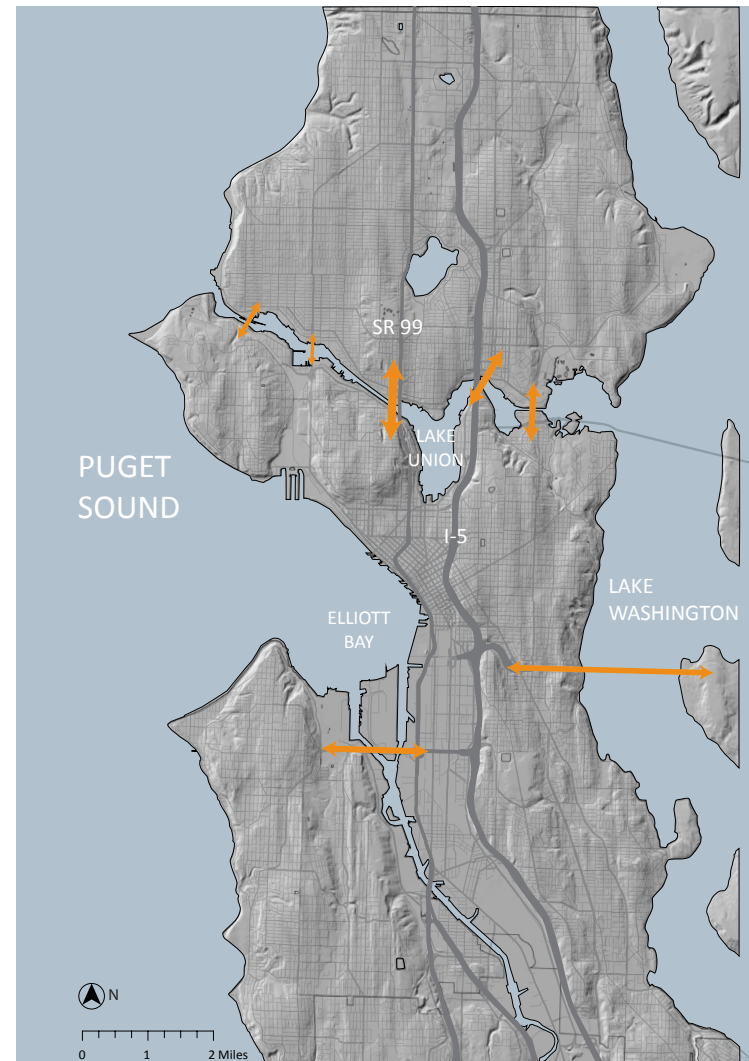


**Figure 14**  
 Seattle's transit master plan vision of commute corridors. City of Seattle Department of Transportation, *Transit Master Plan Final Summary Report*, April 2012, 3-2, PDF File.



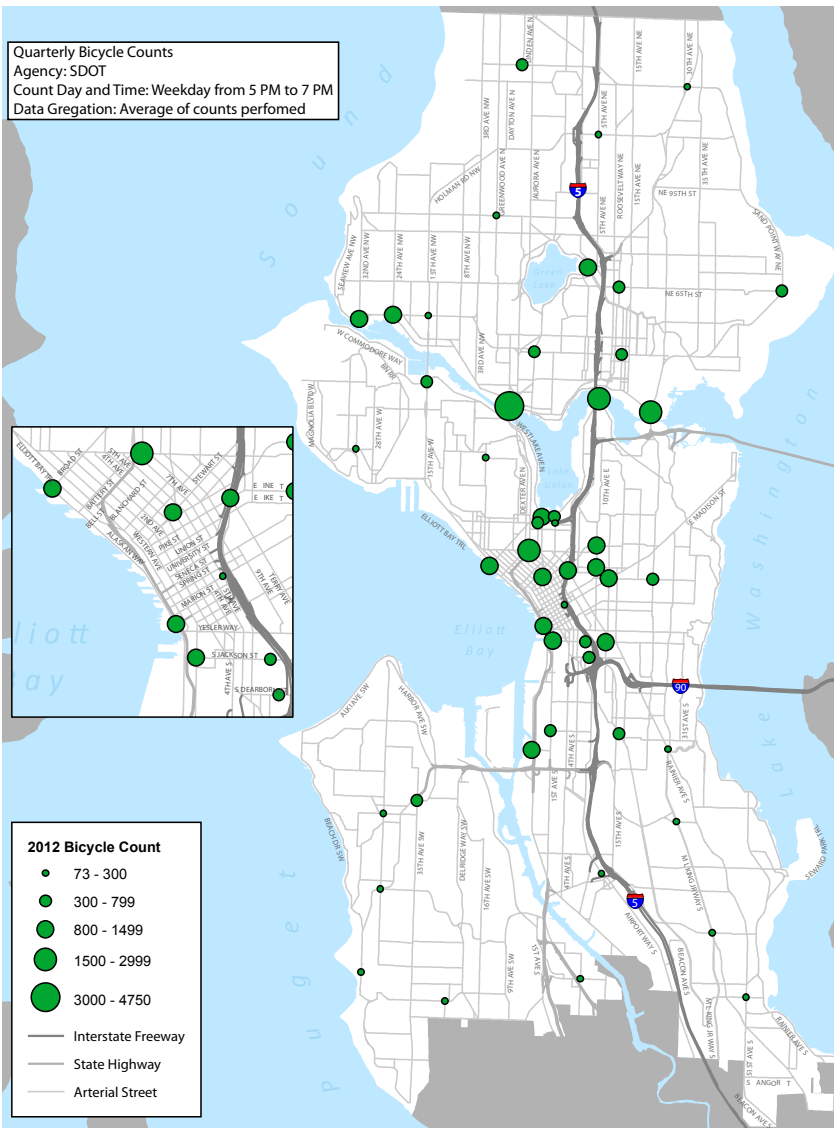
## Seattle's Geography

Seattle's hills are a deterrent to potential cyclists and grumbling point for the more seasoned riders, but it is what makes the city distinctive. Seattle topography has sloping valleys between several steep hills, and flatter areas along the waterfront perimeter. Bicycling in the north-south direction, hills can be circumvented by travelling along the waterfront edges or through the valleys, but east-west movement across the city has inevitable topographic challenges. Interstate-5 and State Route 99 act as additional east-west obstacles for cyclists, as there are few safe crossing points for non-vehicular traffic. Though north-south travel is generally easier as far as gradient is concerned, there are still water crossings with which to contend. The Puget Sound serves as the western boundary of the city, and connects to Lake Union and Lake Washington to the east via the Ship Canal and Montlake Cut. These bodies of water essentially act as a linear barrier between North Seattle and the central and southern parts of the city. Similarly, Elliott Bay and the Duwamish waterway separate West Seattle as a peninsula from the central downtown and south Seattle areas. The bridges across these water bodies act as a pinch points for cyclists traveling along the flatter valleys and waterfront areas to and from various neighborhoods and downtown, naturally funneling Seattle cyclists into distinct commute corridors (Fig. 16). Evidence of these corridors becomes apparent in the high number of cyclists counted



**Figure 16**

Highways, water, and topography dispose Seattle cyclists to commute corridors which funnel at the bridges (shown as orange arrows). Data Source: Geomorphological Research Group, 10 meter DEM files in Seattle, [gis.ess.washington.edu](http://gis.ess.washington.edu), Web; WAGDA, City of Seattle GIS Data, [wagda.lib.washington.edu](http://wagda.lib.washington.edu), Web.



**Figure 17**  
 Results from Seattle's quarterly bicycle counts. Note the larger counts at the bridges and downtown core periphery. Seattle Department of Transportation, Bicycle Master Plan, Nov. 2013, 22, PDF File.

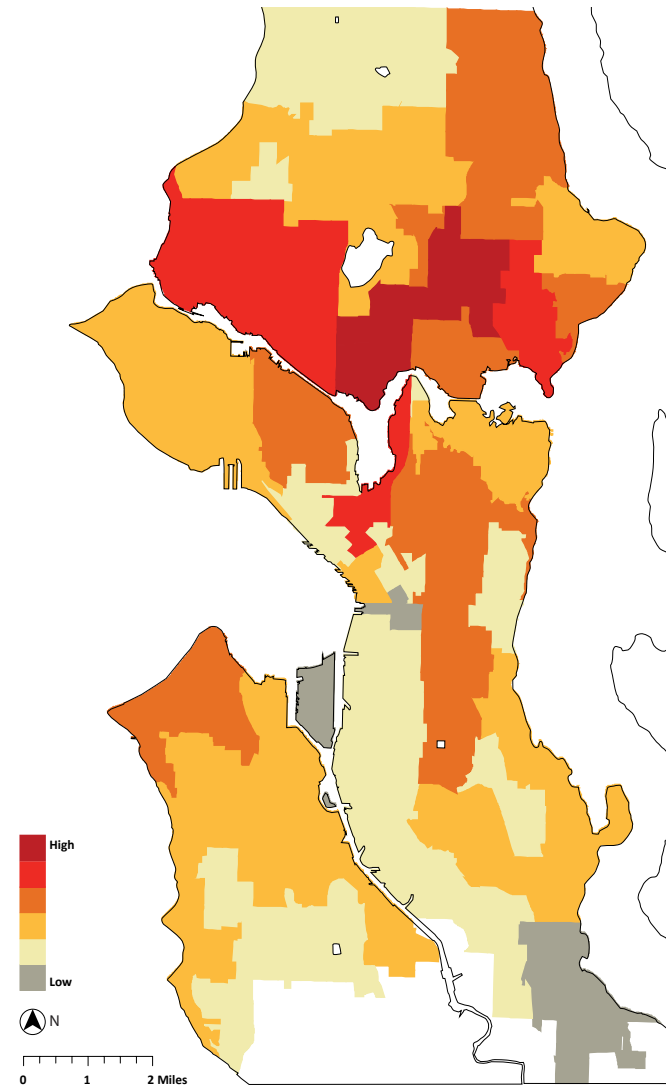
Location	2008	2009	2010	2011	2012
Fremont Bridge & N 34th St		417	577	800	
Ballard Bridge		79	138	111	136
Lakeside Ave S & Lake Washington Blvd S		67	68	61	81
Broadway E & E John St				69	81
University Way NE & NE 47th St			123	81	104
Highland Park Way SW & Duwamish Trail		11	29	37	
University Bridge & Fuhman Ave E		304		484	476
California Ave SW & SW Alaska St		11	26	20	
Beacon Ave S & Chief Sealth Trail		15	20	41	24
Queen Anne Ave N & Boston St		13	11	12	17
Rainier Ave S & S Edmunds St		10	20	31	33
MLK & S Henderson St & Chief Sealth Trail		10		12	
MLK & S Myrtle St @ Othello Station		10	4	10	9
I-90 Trail @ West Bridge Bridge)			161	108	
Elliott Bay Trail @ Myrtle Edwards Park				243	211
Elliott Bay Trail @ 21st Ave.				35	227
Alki Trail @ 53rd Ave. SW (				60	
Ballard Locks				57	69
Shilshole and 17th Ave NW				211	198
Montlake Bridge		226	267	271	279
Westlake Ave (Cheshuihud Trail)				271	252
12th Ave & 43rd St					60
Brooklyn Ave & 40th St					172
Duwamish Trail & Lower W Seattle Bridge		139	123	289	258
Aurora Bridge & Burke Gilman Trail			113	197	239

**Figure 18**  
 Bicycle counts at set locations, the bridges highlighted in orange. Fremont Bridge does not have a count for this year as an automatic counter has been installed, but the trend from past counts is clear. Washington State Department of Transportation, *Washington State Pedestrian and Bicycle Documentation Project 2012, 2013, 36*, PDF File.

at the bridges in the city quarterly counts and the Washington State Bicycle and Pedestrian Documentation Project (Figs 17-18). This data also reveals that some of these bridges are better suited to bicyclists and pedestrians than others (e.g. comparing the University Bridge and the Ballard Locks).

### Seattle Cyclist Neighborhood Origins and Central Destinations

The *Seattle P-I* did an analysis of bicycle ridership in Seattle neighborhoods according to census block groups (Fig. 19). This map illustrates the major origin points of cyclists, which are predominantly from the north end of the city. Looking at current and projected employment densities, the main concentration of workplaces is the downtown central business district. This is an interesting point, as most Seattle cyclists from the north end of the city must cross one of the five bridges across the Ship Canal/Lake Union barrier in order to reach the downtown core on a daily commute. Moreover, considering projected employment growth, population densities, and future land use; it is not unreasonable to assume that the denser areas bicycle ridership will attract an even higher percentage of bicyclists in years to come. Thus, the main movement of bicyclists is commuting from north to south; and this trend will likely increase over time. The problem for the city of Seattle then becomes addressing this influx of cyclists at the bridge pinch points, especially as some bridges are deemed more bicycle friendly than others.



**Figure 19**  
Ridership percentages by census block group. Data Source: Gene Balk, "Is Your Neighborhood One of Seattle's Cycling Hotspots?" *The Seattle Times*, 22 February 2013, Web; WAGDA, City of Seattle GIS Data, wagda.lib.washington.edu, Web.

## Chapter Three: Present Bicycling Conditions and the Planned Network

### Existing Network

Seattle's current bicycle network has over 300 miles of bike lanes, shared lane markings, signed routes, and off-street paths (SDOT 11). While this may seem an impressive amount, many of these facilities are not suitable for riders of all ages and abilities. Bike paths and bike lanes often dead end or merge with major arterials without any physical barrier or separation from cars. At times, bike routes ambiguously end at intersections where there is a complete absence of any bicycle infrastructure (Fig. 20). Riding a bicycle alongside cars is perceived as a major safety threat, and fear of cars is perhaps the principal reason preventing bicycling from becoming a commonplace, accepted means of transportation. Without a seamless, dedicated bicycle network, risk averse and less confident cyclists are deterred, unable, or uncomfortable bicycling from their homes to workplaces or social destinations. In order to make bicycling appeal to riders of all abilities, and to meet the city's goal of tripling the amount of ridership by 2030, the existing bicycle network needs significant upgrades and added infrastructure.



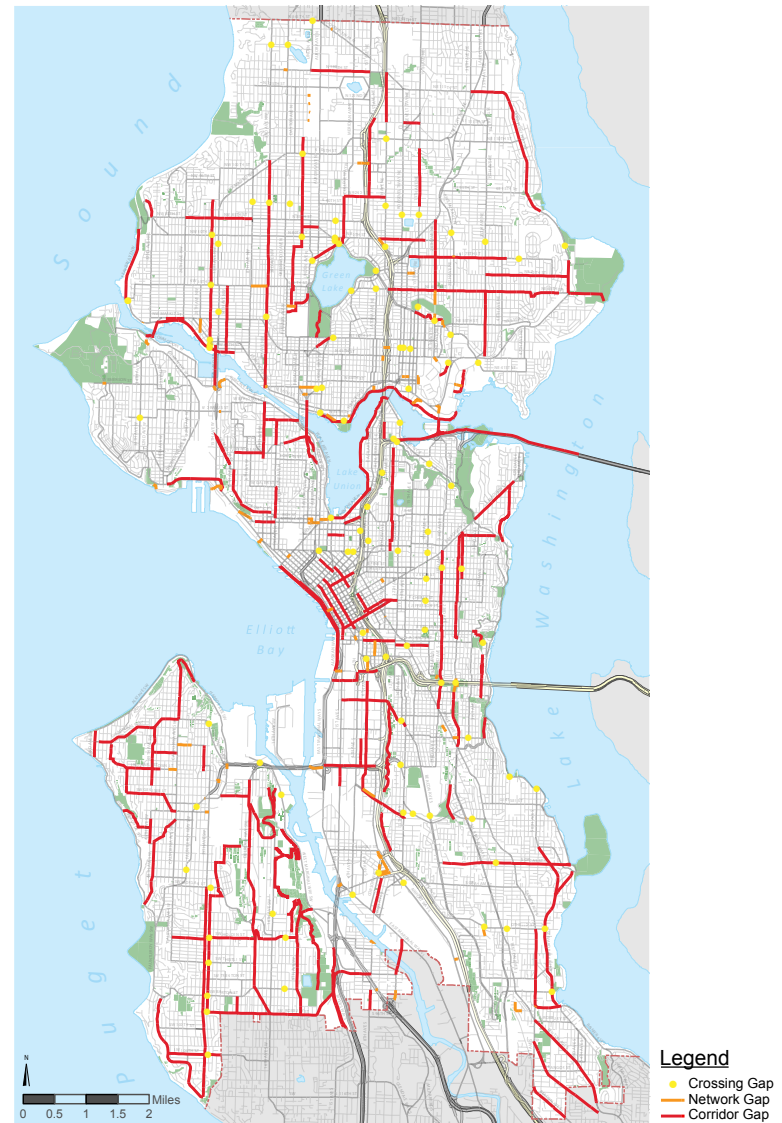
**Figure 20**  
Terminus of the Burke-Gilman trail at an intersection with railroad tracks and no bicycle lane. Bob Edmiston, "Terminus of Burke-Gilman Trail in Fremont," *walkscore.com*, Web.

## Routes and Gaps

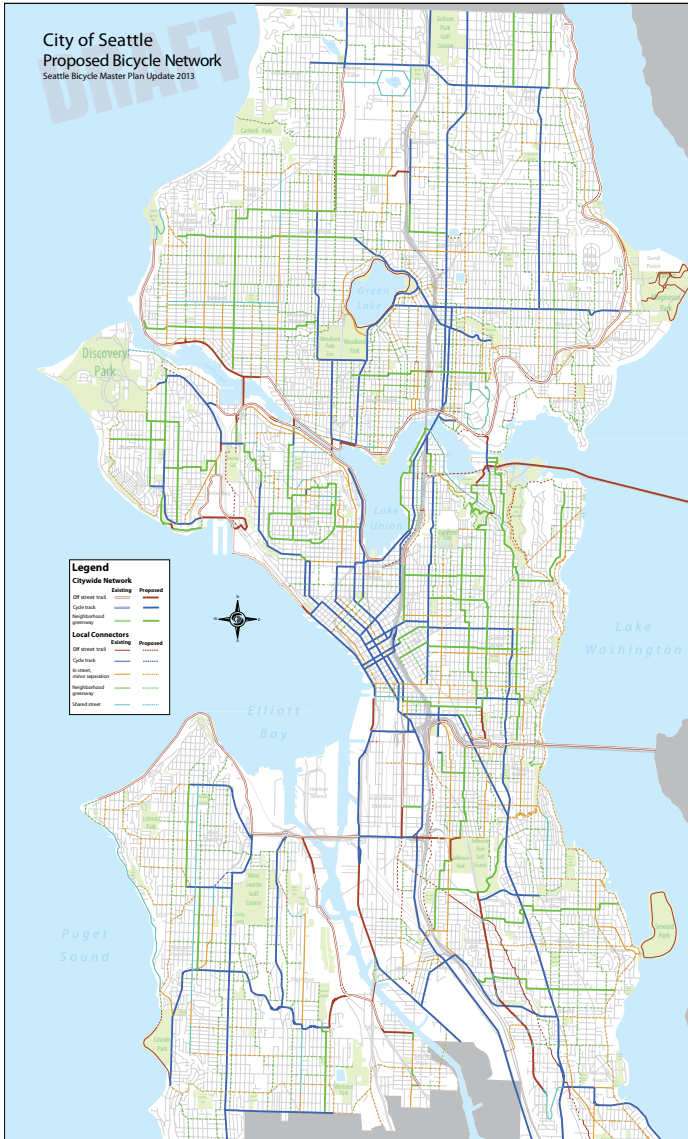
Interestingly, it has been shown that cyclists will detour away from the most direct route to a destination in order to ride on safer or more scenic routes (Winters et. al. 7). This fact illustrates the importance and perceived value of quality bicycle infrastructure; especially for tentative bicyclists. Unfortunately, Seattle's existing bicycle network currently suffers several problematic intersections for motorist conflict and sizable gaps in the off street trail system (Fig. 21). These network gaps force cyclists to detour away from designated bike routes to alternate or less safe streets. Moreover, key commute corridors, such as the Ballard Bridge, have marginal facilities for bicyclists and pedestrians and are consequently underused. As a result, undue pressure is placed on other more bicycle friendly streets, such as the Fremont Bridge and Dexter Avenue. The "silver lining" of the bicycle network's problems is that most of the gaps between trails and other bicycle infrastructure are only a mile long or less. To potentially link and integrate Seattle's bicycle network is not an insurmountable task.

## The BMP

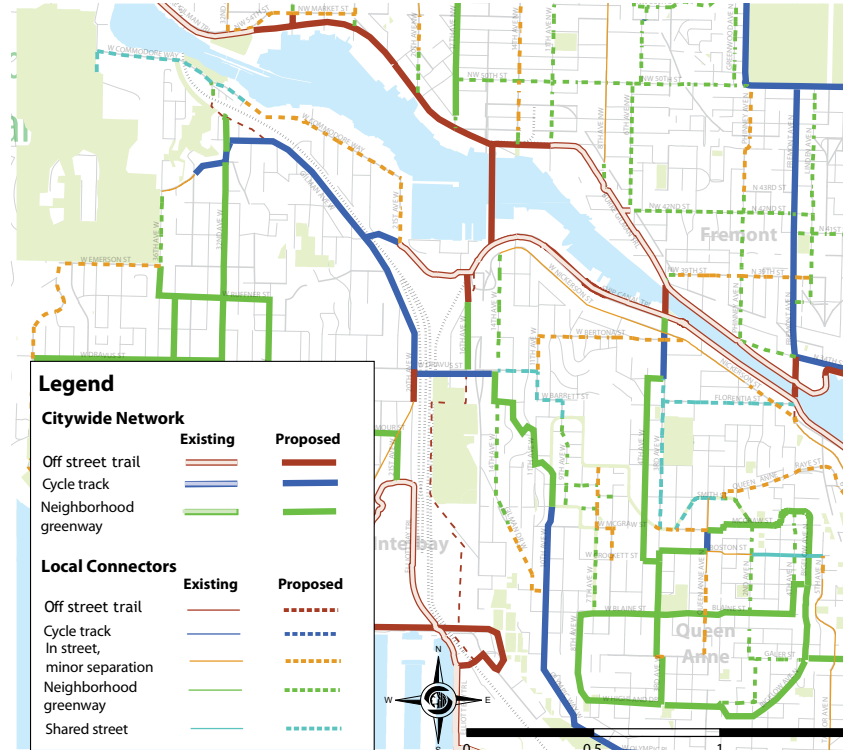
The Bicycle Master Plan (BMP) is a proposed network of bicycle facilities for all ages and abilities (Fig. 22), drafted out of numerous public meetings, consultations with the city's Bicycle Advisory Board, and prior bicycle plans (SDOT 6). The intent of this document is



**Figure 21**  
Network and corridor gaps in Seattle's bicycle network. Modified map from Seattle Department of Transportation, *State of Seattle Bicycling Environment Report*, Oct. 2012, Seattle.gov, 25, PDF File.



**Figure 22**  
A comprehensive network for riders of all ages and abilities. Modified 2013 draft Seattle Bicycle Master Plan. (SDOT 34-35)



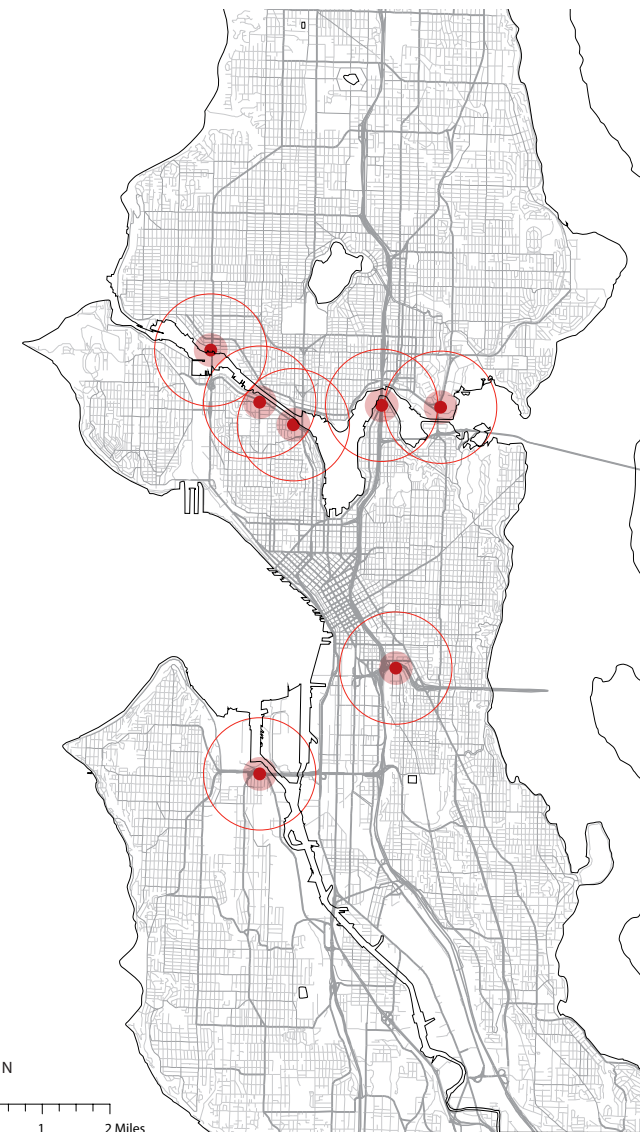
**Figure 23**  
An enlarged area of the ship canal showing the new bridge crossing. (SDOT 38)

to increase ridership, connectivity, livability, equity, and safety for bicycling in Seattle. Compared with the existing network, the BMP proposes an additional 451.7 miles of upgrades and new bicycle facilities for Seattle. Notable among the improvements are cycle tracks throughout downtown, a comprehensive system of neighborhood greenways, new off-street trails, improved highway crossings, and a new bridge over the Ship Canal (Fig. 23).

Accompanying the network targets, the Bicycle Master Plan also lays the framework for several policy measures and programs to be enacted in parallel, including codes to ensure bicycle parking minimums, performance standards and measurements, bicycle safety included in driver's education, primary education, and trip reduction incentive programs. These are all pro-bicycling strategies which do not de-incentivize the car.

### **A Support Network of Bicycle Stations**

A quality environment for bicyclists will be comprised of more than just the roads travelled upon. Every trip will end at a final destination and the cyclist will need a safe place to lock and leave their bicycle. Other trips are interrupted by flat tires, misdirection, or the weather, and cyclists will need a repair shop, a map or temporary shelter. Finally, as a community cyclists need a place to gather and socialize, a “third place” distinct from home or work, a term coined by urban sociologist



**Figure 24**  
Bicycle Station System Map. Note that a station has been placed at the new bridge location proposed in the bicycle master plan at the Ship Canal. Data Source: WAGDA, City of Seattle GIS Data, [wagda.lib.washington.edu](http://wagda.lib.washington.edu), Web.

Ray Oldenburg (146). A bicycle facility that could act as an emergency support network as well as social node for the bicycling community would effectively encourage and celebrate bicycling as an everyday activity. This thesis proposes this added layer to the BMP, a network of bicycle stations located at the commute corridor funnel points: the convergence of cyclist paths at the bridges (Fig. 24). These stations would be places to repair a bicycle, ask for directions, rest for a cup of coffee, or a meet up location for a group ride.

Depending on their immediate context, the programs of these facilities will vary slightly. If located near a major employment destination or transit hub, the bicycle station would feature more end of trip amenities, such as lockers, showers, and secure parking. Other stations may be more midpoint or outpost locations, and would feature short term parking, a café, or a sheltered self-repair tool stand (Fig. 25). Overall, the goal of these bicycle stations is to act as a social and infrastructure support for the increased number of cyclists in Seattle, and to make cycling an even more convenient and enjoyable means of transportation. These bicycle stations could be phased in development, the more critical placements at currently high trafficked locations, and secondary placements at projected areas of increased ridership.



**Figure 25**

Bike to Work Day Station in West Seattle. The proposed bicycle stations could be a more permanent type of infrastructure than these bike to work day energizer stations. The purpose is the same: a meeting place with emergency facilities as a social and infrastructure support for cyclists. West Seattle Bike Connections, "Bike to Work Day 2013: West Seattle, White Center Stops," *West Seattle Blog*, Web.

## Chapter Four: Program Analysis

### Precedent Studies

The idea of a bicycle station is not new; in Europe there are examples of expansive bicycle parking structures that are integrated into major transit hubs. Some of these parking areas have attendants on staff, bicycles to rent, lockers, and repair facilities. In the United States, bicycle stations are emerging near light rail stations, to appeal to transit users and high density developments, and universities, as student populations typically have a higher bicycle mode share than average. The following four precedent studies present a range of sizes and program pairings for a bicycle station.

Starting with the smallest example, the University of Minnesota has installed a bike center as a resource for faculty and staff (Figs 25-26). Located in the heart of campus, the bike center has an expandable secure parking area for bicycles, lockers, showers, a retail area for small accessories, a full service repair shop, self-repair space, and meeting rooms. This program is run by the students as a co-op and maintained by membership fees for use of the showers and long term parking as well as grant and transportation funding from the college. This facility also offers weekly training courses and an incentives program for bicycling that is funded by the campus health and wellness and transportation-parking departments.



**Figure 26**

Exterior of the UMN bike center. Notice on the left a secure bicycle parking area. The storefront and repair shop are to the right. Also notice short term parking in the foreground. The Hub Bicycle Coop, "University of Minnesota Bicycle Center Information," [thehubbikecoop.org](http://thehubbikecoop.org), Web.



**Figure 27**

Interior of the UMN bike center has a full service repair shop and small accessories for sale. Ramon Zavala, University of Minnesota Twin Cities Bike Center, Bike UCI-Community, Advocacy, Education; [sites.uci.edu](http://sites.uci.edu); Web.

Santa Monica Bike Center, in Santa Monica, California, was incorporated into a redesign of two car parking structures located in the downtown core near the future terminus of the exposition light rail line. The bike center is broken up into two facilities for a total of 5,300 sq ft, the largest bicycle center of its kind in the United States. The Santa Monica Bike Center can safely secure 360 bicycles, and has other amenities for members such as showers, lockers, bicycle repair, and valet parking. For daily visitors, there is also a retail shop, bicycle rentals, tours, share programs, and bicycle classes. Opened in 2011, the bike center had over 200 members in its first year of operation (Newton).



**Figure 28**  
Storefront of the Santa Monica Bike Center. Gary Kavanagh, Santa Monica Bike Center In The LA Times, & Could Be A Model For Region, LA.Streetsblog.org, Oct. 2012, Web.



**Figure 29**  
Membership Services. Venicebikepath.com, Santa Monica Bike Center Recommended!, August 2012, Web.

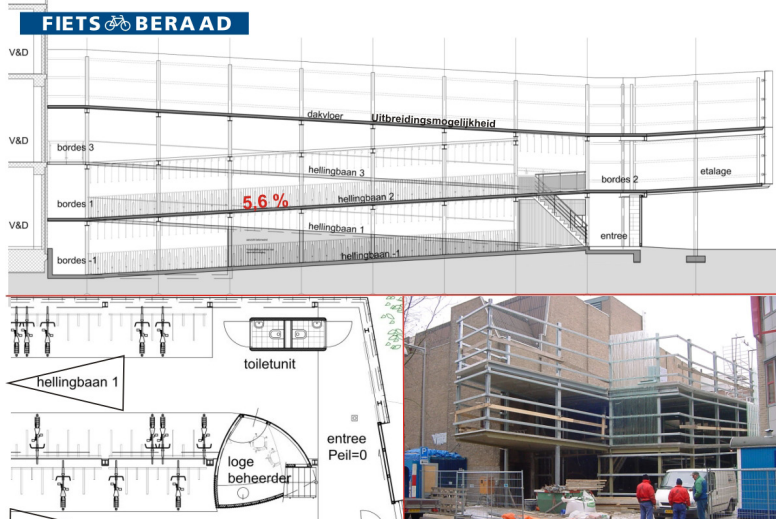


**Figure 30**  
Exterior of Santa Monica Bike Center integrated with a parking garage. Jessica Lass, Make Biking to Work your 2012 resolution, *switchboard.nrdc.org*, Web.

The De Serre bicycle parking structure in Apeldoorn, the Netherlands, is a stand-alone structure near the pedestrian core of the town center. It was designed to exceed architectural quality in order to reflect Apeldoorn's exceptional bicycle policy. The bicycle parking structure uses a uniquely textured glass cladding to be visually apparent and distinctive as a bicycle station as many buildings of similar purpose are often obscured from the exterior save for a small sign. In approximately 8,850 sq ft, there is parking for 650 bicycles with an efficient two tier bicycle rack system along a low sloping ramp throughout three levels of the building (Fig. 32). Use of the bicycle parking is free, open seven days a week, and it is monitored by a security staff person and video cameras (fietsberaad.nl).



**Figure 31**  
The De Serre parking structure from the exterior. (fietsberaad.nl)



**Figure 32**  
A section through the De Serre showing three ramp levels of bicycle parking. (fietsberaad.nl).



**Figure 33**  
Two tier parking is accomplished by a hanging cable system called a velovator. (fietsberaad.nl)

The Radstation in Muenster, Germany, is also a landmark stand-alone structure with parking for 3,300 bicycles and direct access to a major train station. The bicycle parking is accessed by a long gradually sloping ramp down from street level, so one can easily ride in and out on a bicycle. Inside the Radstation, there is a manned repair station, automated bicycle wash, bicycle rentals, refurbished bicycles for purchase, lockers, small retail, and tourism consultancy. This station is so well used the bicycle parking is over capacity and there are plans to construct a secondary structure. Membership for a personal parking space can be purchased on a monthly or annual basis, but anyone can use the Radstation on a daily basis. This facility has been in operation since 1999 ([radstation-ms.de](http://radstation-ms.de)).



**Figure 35**  
Radstation from above. At street level it has a glass facade and the bicycle parking is below. Stadt Muenster, "Die Radstation," [www.muenster.de](http://www.muenster.de), Web.



**Figure 34**  
Personal parking spaces are access controlled by key card and are well lit. ([radstation-ms.de](http://radstation-ms.de)).



**Figure 36**  
There is a gentle ramp down to the bike parking from the transit platform. Soucre: Bruni Frobusch, "Allen Unkenrufen zum Trotz: Radstation ist ein Erfolgsmodell," [echo-muenster.de](http://echo-muenster.de), July 2004, Web.

### Mid Trip or End of Trip Facility?

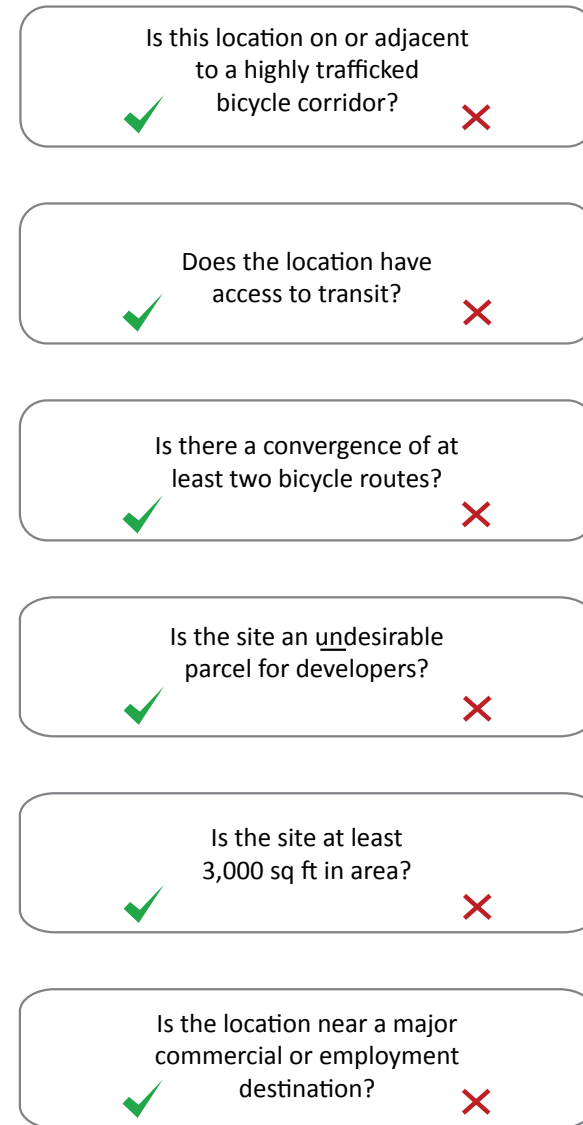
To determine if a bicycle station location is more suited to have a full array of end of trip facilities as shown in the precedents above, or a smaller, more compact mid trip facility with fewer programs, there are a series of site characteristics to consider. The flow chart on the right diagrams the site evaluation process (Fig. 37). The following is a list of minimum space requirements for the bicycle station programs.

#### Mid Trip Facility

Bicycle Repair Stand.....	18 sqft
Temporary Bike Parking..	72 sqft (6 spaces)
Coffee Counter.....	200 sqft
Seating Area.....	50 sqft

#### End of Trip Facility

Secure bicycle parking...	1,320 sqft (300 spaces)
Temporary bicycle parking..	360 sq ft (30 spaces)
Full repair service....	1200 sqft
Coop (DIY) Space...	1000 sq ft
Lockers....	140 sqft
Changing rooms....	800 sq ft
Showers...	60 sq ft
Classroom/meeting space..	300 sqft
Advocate office space...	400 sq ft
Café space....	600 sqft
Check in/Information...	150 sqft
Rentals and accessories...	150 sq ft
Recycled bicycles and parts	150 sq ft

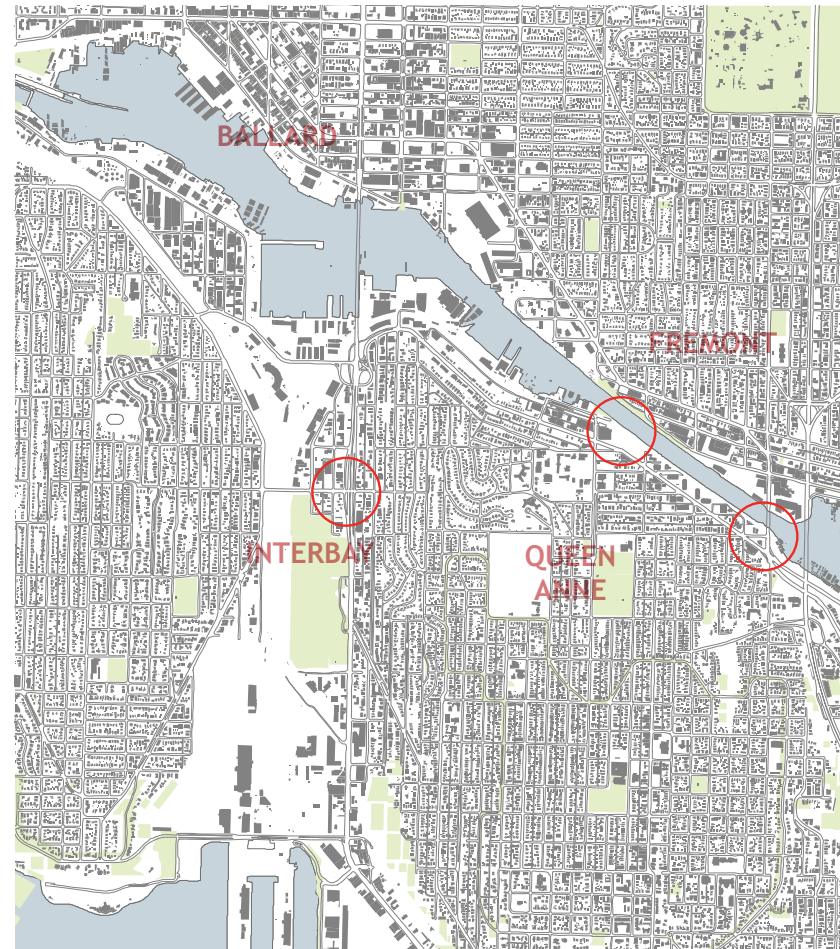


**Figure 37**  
Criteria for eliminating inappropriate sites

## Chapter Five: Neighborhood Analysis and Site Selection

### Ship Canal Area

Given the high percentage of bicycle commuters originating from Ballard (Fig. 19), the high number of cyclists crossing at the Fremont Bridge compared as to the other bridges (Fig. 17), and the difficulty for the riders in Ballard to reach downtown because of topography, the barrier of Aurora Avenue (SR99), and limited safe water crossing opportunities, there is a real need for bicycle facilities in the Ship Canal area. The three bridge crossings in this vicinity were assessed for feasible sites for a bicycle station: the Ballard Bridge to the furthest west, the Fremont Bridge to the furthest east, and the proposed new bridge crossing between those bridges at 3rd Avenue West. Ultimately, the new bridge crossing was chosen for further study for a bicycle station because it presented the greatest use potential. The new bridge crossing would relieve bicycle congestion from the Fremont Bridge and make it easier for riders in Ballard and Fremont to travel south towards downtown, and for cyclists in Queen Anne to reach the commercial areas in Fremont and Ballard. This bridge would also be valuable to students walking or cycling from the Seattle Pacific University campus located on 3rd Avenue West. Walking from campus to the Fremont Bridge takes 15 minutes one way, whereas a new pedestrian bridge would connect students and residents in Queen Anne to Fremont coffee shops, a farmers market, employment



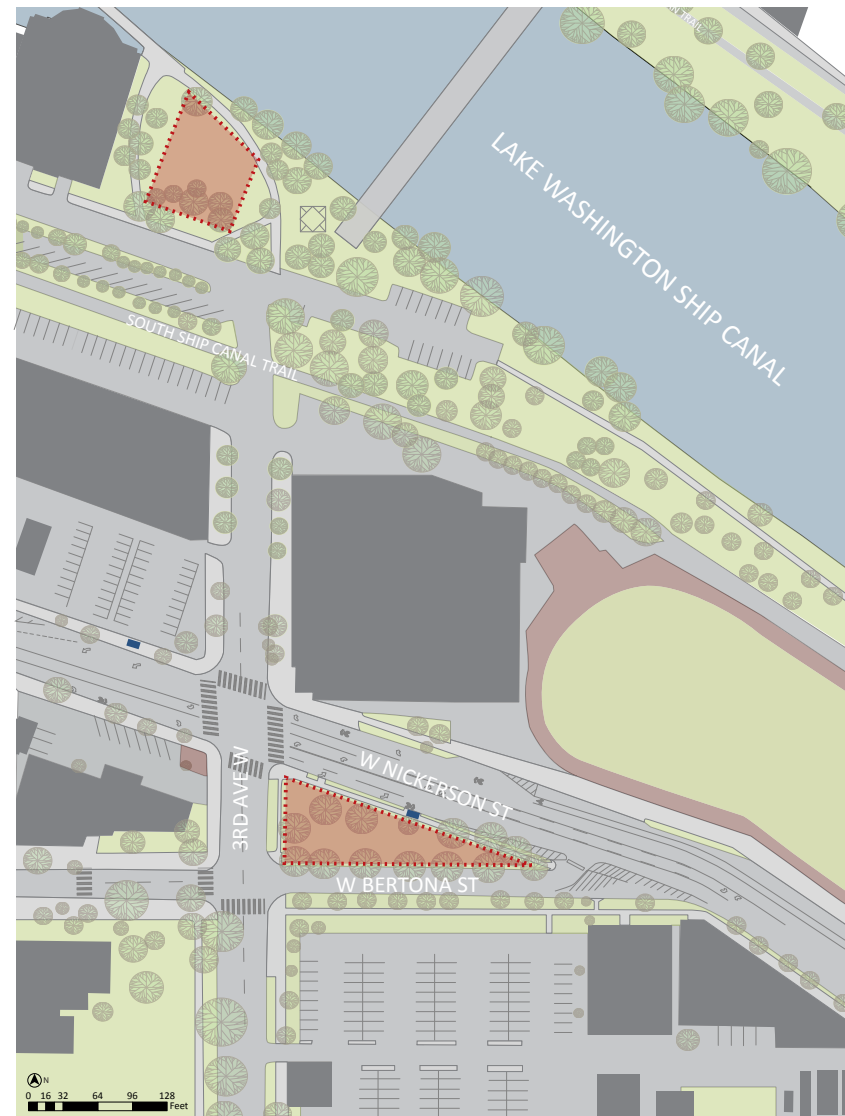
**Figure 38**

Three bridge crossings were examined in Ship Canal vicinity for feasible sites. Data Source: WAGDA, City of Seattle GIS Data, [wagda.lib.washington.edu](http://wagda.lib.washington.edu), Web.

centers, and retail shops in moments. Moreover, within the area of land bounded by the Ship Canal and the campus of Seattle Pacific University to the south, there is a concentration of population with a low ownership rate of private vehicles (Fig. 15). Lastly, considering the projection of dense urban development in both the Fremont and Ballard neighborhoods as they are designated urban growth areas (Fig. 13) and accounting for the fact that there are bike trails on both the north and south sides of the Ship Canal, this will be an area of high pedestrian and bicyclist activity.

Within the vicinity of the campus and the new bridge crossing on 3rd Avenue West, two potential building sites were evaluated (Fig. 39). The first site is to the north, immediately off of the Ship Canal bicycle trail and near the new proposed bridge crossing. The second site is further south, on West Nickerson Street and 3rd Avenue West, immediately adjacent to the Royal Brougham Pavilion, the student recreation center. Ultimately, based the criteria of strong access to transit and choosing an undesirable parcel for developers (Fig. 37), the site to the south was chosen.

This site is a triangle parcel in the public right of way so it would be unavailable and undesirable for developers. An open grassy area, the site is presently used as a bus stop on West Nickerson Street, with some utilities and large mature trees along the perimeter (Figs 40-41).

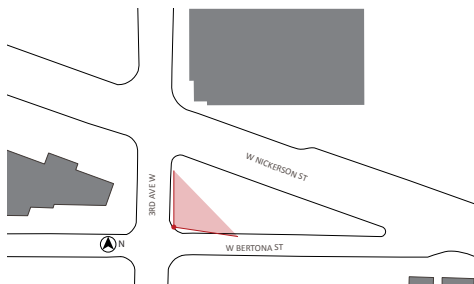


**Figure 39**  
Two sites were assessed, one area was immediately adjacent to the newly proposed bridge crossing at 3rd Avenue West. Just a bit further south, the site selected is a triangle piece of land located in the street right of way.



**Figure 40**

The site on 3rd Avenue West, Bertona Avenue West and West Nickerson Street. The site is currently used as a bus stop and has utilities and mature trees on the perimeter. Parking is allowed on West Bertona Street, but not the other arterials. The bus stop on West Nickerson Street is to right of center in this photo.

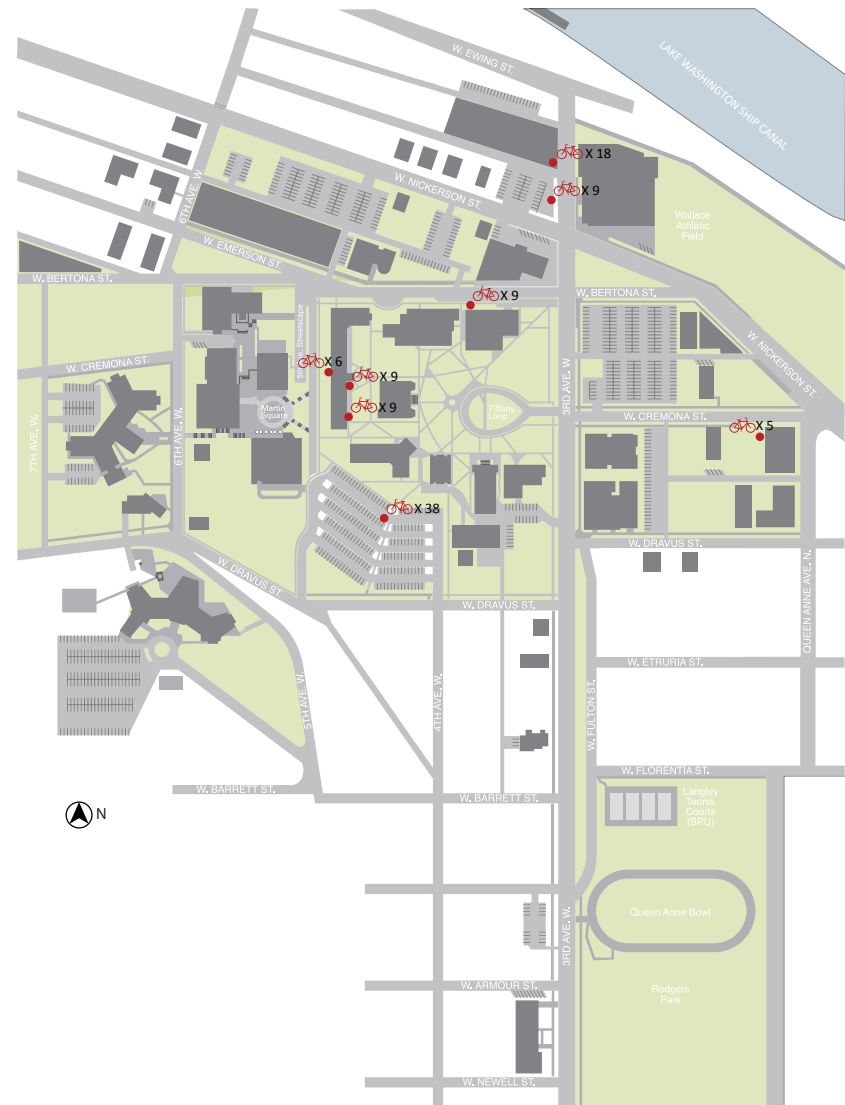


**Figure 41**

A key plan showing where the photo was taken. As it is a panorama, the perspective is slightly forshortened.

## Seattle Pacific University (SPU)

The University does not have a bicycle repair station, or any other bicycle infrastructure other than exterior racks, but bicycle commuters can register for a commute commitment of three days a week to receive free access to the recreation center showers and lockers. The campus master plan does ambiguously reference bicycle parking, stating, “Bicycle parking shall be provided that is at least equal to ten percent of the maximum students and five percent of the employees present at the peak hour” and that, “The University will continue to provide covered bicycle parking in residential facilities as new residential facilities are developed. Covered bicycle parking will also be provided in any new parking structures. Shower and locker facilities will be available to all employees and registered students.” (SPU 46). The campus enrollment for 2012-2013 for both undergraduate and graduate students was 5,000 (SPU Facilities Guidelines). Assuming an 8% mode share for students, like the University of Washington (King County Metro “UW”), that amounts to 400 cyclists in need of a place to secure their bicycle. Using the 10% mark in the campus plan, space for 500 cyclists, not including staff or faculty. Current bicycle parking on campus includes 6 covered racks and 3 uncovered racks scattered across campus for a total of approximately 101 bicycle spaces. This number is approximate as some bicycle handlebars prevent full use of a rack or racks are blocked by utilities.

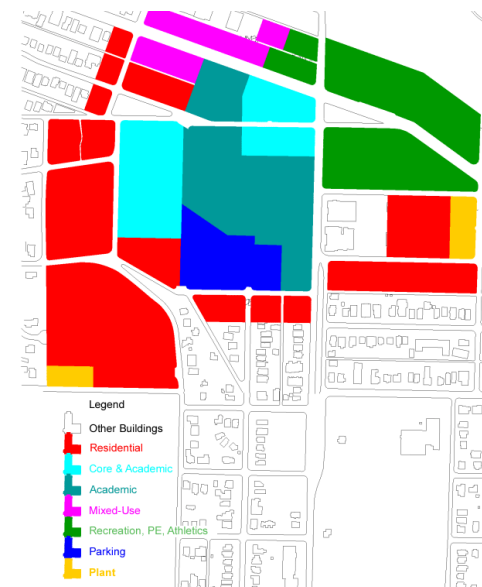


**Figure 42**

A modified campus map illustrating the size and location of existing bicycle parking. Data Source: “Seattle Pacific University 2011 Campus Map”, [spu.edu](http://spu.edu), Web.

Several points in the campus facilities guidelines indicate that the triangle portion of land on West Bertona Street and 3rd Avenue West would be an excellent location for a bicycle station. The land use type for a bicycle station fits in with the campus facilities guidelines plan to group similar land uses (SPU Facilities Guidelines), as this parcel of land is adjacent to the recreational Royal Brougham Pavilion and the athletic sports field (Fig. 43). The SPU facilities guidelines also state that, “Bicycle parking should be provided in convenient and secure locations, but bicycling between campus buildings on major pedestrian routes should be discouraged or prohibited.” If a safe, secure building for bicycle storage and other amenities were provided immediately adjacent to the campus core, it would be a convenient location yet close enough to encourage students to leave their bicycle here and walk to their class building. Lastly, the opportunity this parcel presents has been recognized as a potential open space project provided West Bertona Street is also pedestrianized (Fig. 44). Proposed street changes are further discussed in the following chapter.

Campus building height limits adjacent to the triangle parcel range from 37'-50', so there is flexibility in the design of the size of this structure. Given the area and geometry limitations of the site as well as required area of program, the structure will be a minimum of two stories in height.



**Figure 43**  
Primary use zones on campus (SPU Facilities Guidelines).

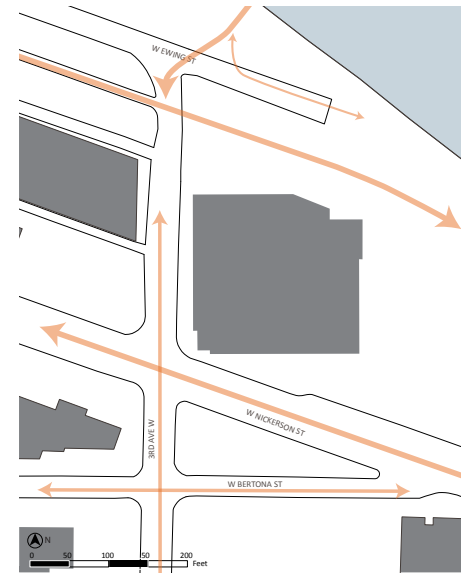


**Figure 44**  
Long range campus development plan. Blue is proposed buildings and green is open space projects. Note the triangle lot is set for transit, a recreation and garage is written to the land to the south (SPU Facilities Guidelines)

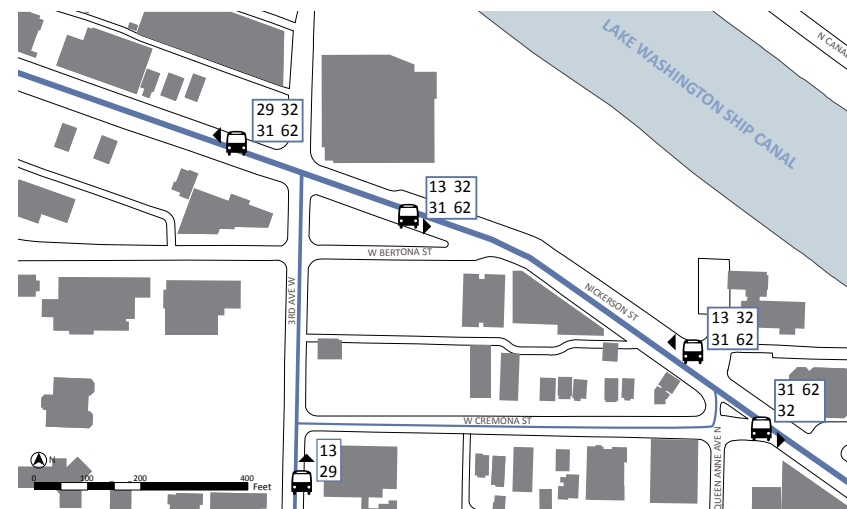
## Chapter Six: Site Analysis and Urban Design

### Circulation

The site selected for the bicycle station, on 3rd Avenue West and West Nickerson Street, is well positioned near bicycle routes and transit connections. Figure 45 diagrams the anticipated bicycle movement through the area. Once a new bicycle pedestrian bridge is built over the ship canal, riders from Ballard, Fremont, and off of the Burke-Gilman trail will be able to reach the station. The Ship Canal Trail runs east-west along the waterfront and intersects with 3rd Avenue West, which is the principal arterial route to Queen Anne for cyclists, as it is the least steep grade to climb. West Nickerson Street currently has a bicycle lane that changes to a shared lane at intersections in both directions, and West Bertona Street is a low trafficked street that could be better pedestrian and cyclists prioritized; especially as the short segment east of 3rd Avenue West is one-way. There are several transit lines travelling to and from the SPU campus (Fig. 46). Route 13 runs frequently throughout the week to central Queen Anne and to Downtown. The 29 runs less often and only on weekdays, but extends from Ballard, through Queen Anne and Downtown, and on to First Hill and Lake Washington. The 31 and 32 run throughout the week connecting Seattle Pacific and Magnolia with the University of Washington and northeast Seattle. Lastly the 62 runs to north Ballard and to south Downtown (King County Metro “Schedules”).



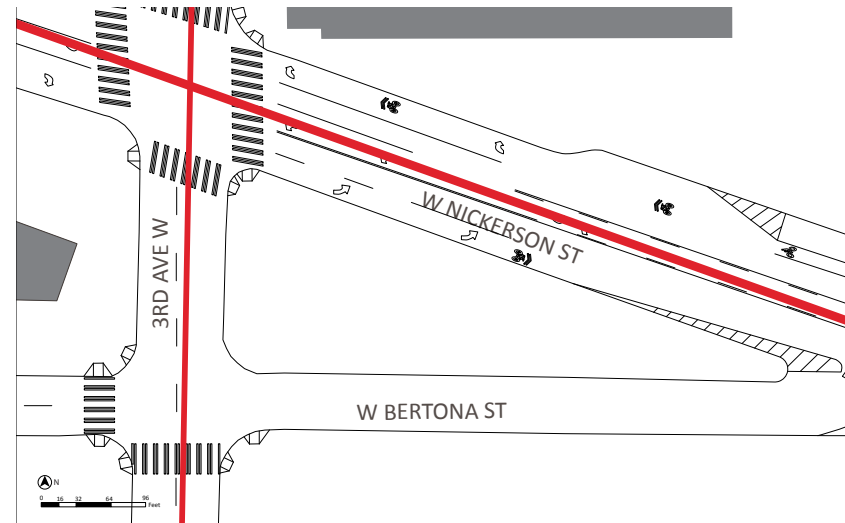
**Figure 45**  
Bicycle movement through the site vicinity



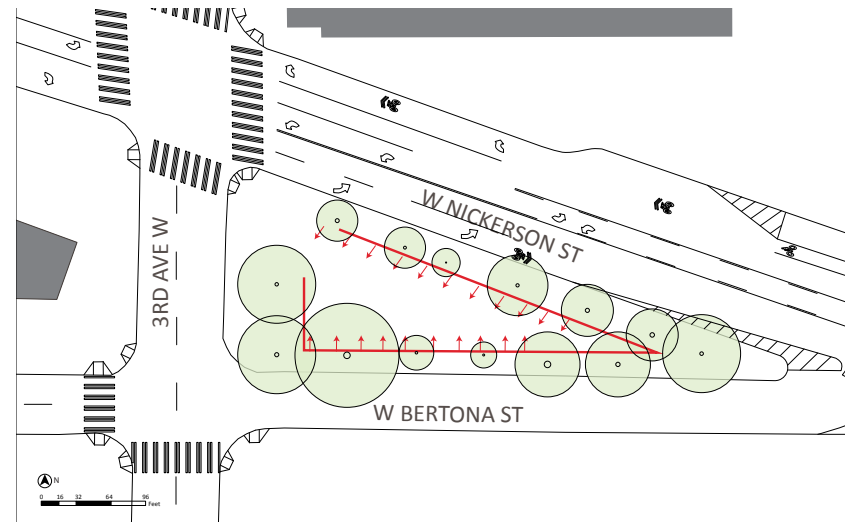
**Figure 46**  
Transit lines and bus stations located in the site vicinity

## Enclosure

Experientially, 3rd Avenue West and West Nickerson are felt as major arterials with fast moving traffic that bound the north and west edges of the site. West Bertona Street has much less, calmer traffic, and has parked cars on both the north and south sides to act as a buffer from moving vehicles (Fig. 47). West Nickerson Street has five traffic lanes at the intersection with 3rd Avenue West, so pedestrians never risk jaywalking through the light interval is a long wait. 3rd Avenue West and West Bertona Street west of 3rd Avenue have two lanes in each direction. The major asset of the site are its numerous and sizable mature trees. These trees act as a noise and visual buffer to the arterial streets, and contribute to the streetscape along West Nickerson Street. When walking through the center grassy portion of the site, the trees create a feeling of an outdoor room and pleasant enclosure from traffic noise (Fig. 48). However, these trees also limit the buildable area of the site. As a triangle, the geometry already excludes the eastern point of the site as it is too narrow for a usable, enclosed space. But because the trees will have large root balls which are proportional to their branching leaf canopies, almost no buildable surface area remains. In the design on the station, much attention was given to keeping the maximum number of trees and give the roots a healthy berth, yet strategically eliminating a few trees in order to accommodate adequate ground floor area.



**Figure 47**  
Main arterials hold the edges of the site



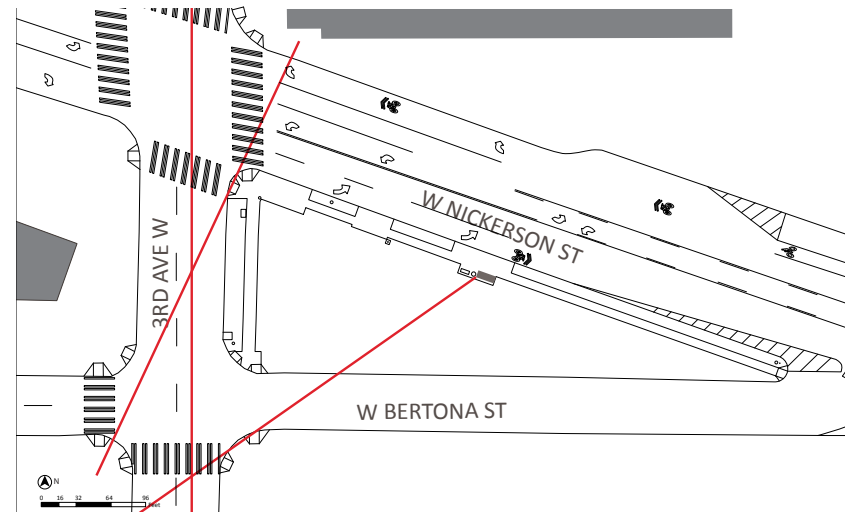
**Figure 48**  
The trees provide a sense of enclosure but limit buildable area

## Desire Lines

From the central campus core on 3rd Avenue West and West Cremona Street, there are strong pedestrian desire lines to the student recreation center, the Royal Brougham Pavilion. Although the main formal entrance is on 3rd Avenue West just north of West Nickerson Street, most students enter from the side entrance at the intersection of West Nickerson Street and 3rd Avenue West. Other desire lines extend from main campus to the bus stop on the triangle site, and from the recreation center to the bus stop (Fig. 49). Outside of the side entrance to the Royal Brougham Pavilion, there is a metal barrier with a sign directing pedestrians to cross at the corner with the crosswalk (Fig. 50). Because the desire lines cut diagonally from the campus, the crosswalk does not align with the desire line toward the Pavilion door. Clearly this barricade was an afterthought to the design of the Pavilion in order to prevent pedestrian casualties.

## Street Redesign

In 2010, West Nickerson Street underwent a road diet from a four lane road to two traffic lanes with one turning lane in an effort to improve pedestrian safety and reduce traffic speeds. The re-channelization resulted in 23% reduction of collisions and 60% reduction in drivers travelling over the speed limit (SDOT "Nickerson"). Though this road diet has improved West Nickerson Street, clearly there are still some

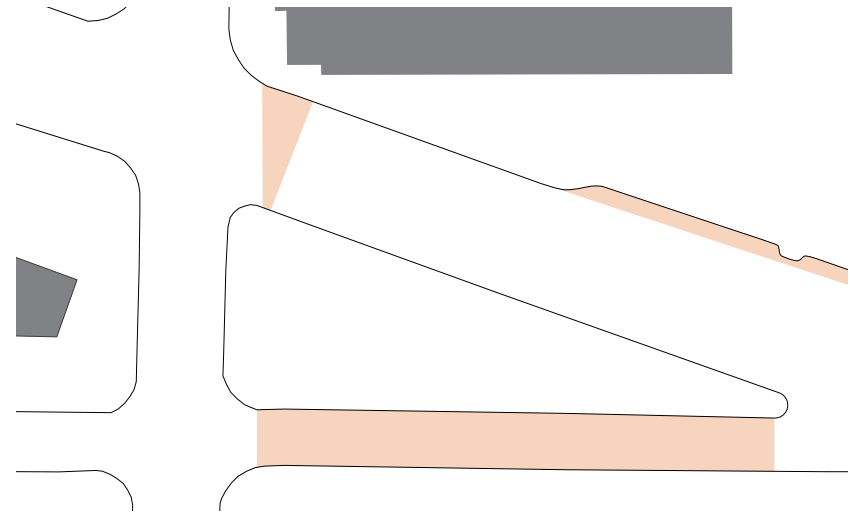


**Figure 49**  
Desire lines extend from main campus to the entrances of the rec center.

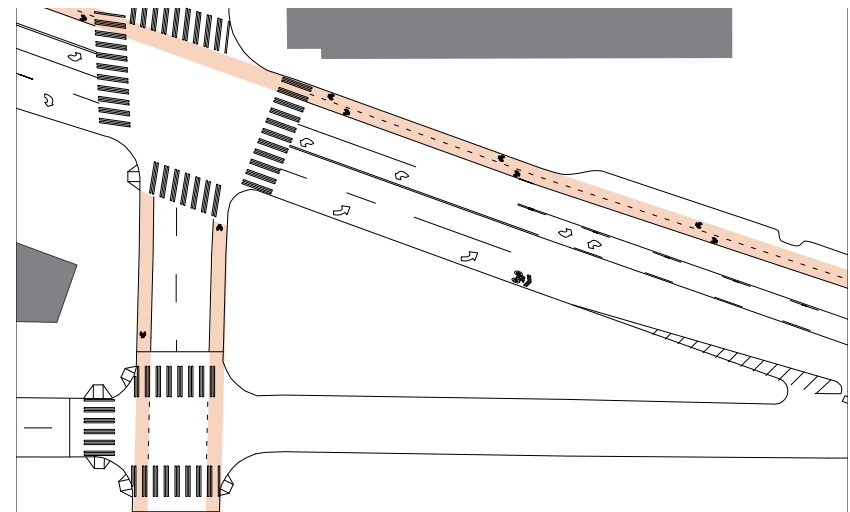


**Figure 50**  
This sign shows the current street crossing problem as the entrance to the rec center is set back from the crosswalk so pedestrians walking the most direct route from campus cut diagonally from the crosswalk and venture into the traffic lanes.

shortcomings for pedestrians at intersections. SPU states in the facilities guidelines, “Methods of improving pedestrian safety at the Third Avenue West pedestrian crossing of West Nickerson Street should be reviewed” (SPU Facilities Guidelines). To accommodate the pedestrian movement in a safer, more intuitive manner, the stop line for traffic could be redrawn at an angle to give a larger crosswalk for pedestrians (Fig. 51). As West Nickerson is a street with an average daily traffic volume (ADT) of 18,600, thought should also be given to bicyclists sharing the road with cars at intersections. The bicycle master plan states that any street with an ADT of greater than 17,000 should have cycle tracks, or physically separated lanes for bicyclists (SDOT 31). Figure 52 is a proposed configuration for a two way cycle track on the north side of West Nickerson Street, and one way cycle tracks on 3rd Avenue West. As parking inside a cycle track defeats the purpose of car bike separation, and for sidewalk continuity, the curb cuts should be filled in as part of the pedestrian improvements (Fig. 51). Lastly, as Bertona Avenue West is a low trafficked, one way street, it would be given pedestrian priority with change in pavement which also creates a plaza like space connecting to the block to the south. The SPU guidelines support this design treatment as they specifically refer to West Bertona Street stating, “When streets with substantial pedestrian use (e.g. West Bertona Street) cannot be vacated, traffic calming measures should be developed to reduce speeds and increase pedestrian safety.” (SPU Facilities Guidelines).



**Figure 51**  
As part of the design for the building, streetchanges are proposed to reallocate space to pedestrians.

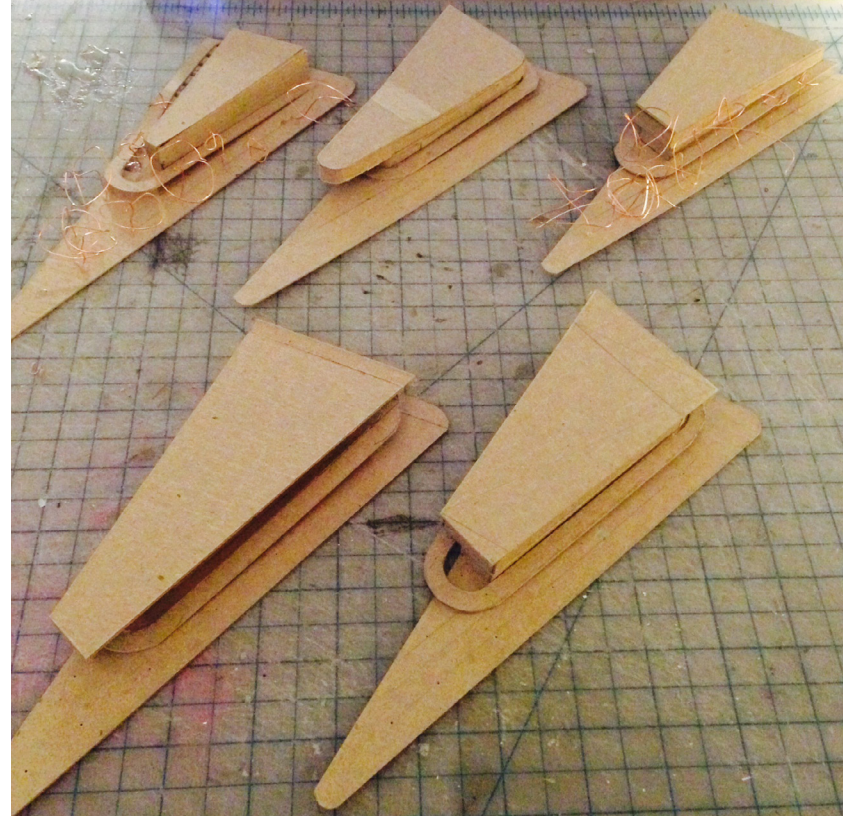


**Figure 52**  
As West Nickerson Street and 3rd Avenue West are major arterials, cycle tracks are proposed for safe cyclist access to the station.

## Chapter Seven: Design Development

### The Ramp

The site's geometry, trees, and needed program sizes of the bicycle station naturally disposed the building into a two-story structure. As such, there was a question of how cyclists reached the second floor in a convenient manner, and, if there are public programs located on the second floor, how an upper level could be easily accessed by the elderly or those in wheelchairs who cannot take stairs. This question led to an iterative series of studies of an exterior ramp that wrapped around the building mass (Fig. 53). The sequence of ideas is presented in order from left to right, top to bottom. Because the corner of West Nickerson Street and 3rd Avenue West has the greatest visibility from the proposed bridge crossing and the Ship Canal Trail, it was clear the ramp would need to end or begin on the northwest corner of the site (the upper right corner of the iterations in Figure 53). These iterations also tested a few massing schemes in which the upper storey cantilevered over various edges of the lower story to provide covering for the ramp, or potential shelter for building entries or bicycle parking below. In the final scheme, which is detailed in chapter eight, the ramp begins at the corner of 3rd Avenue West and West Nickerson, and wraps around the entirety of the building to terminate at the same place.

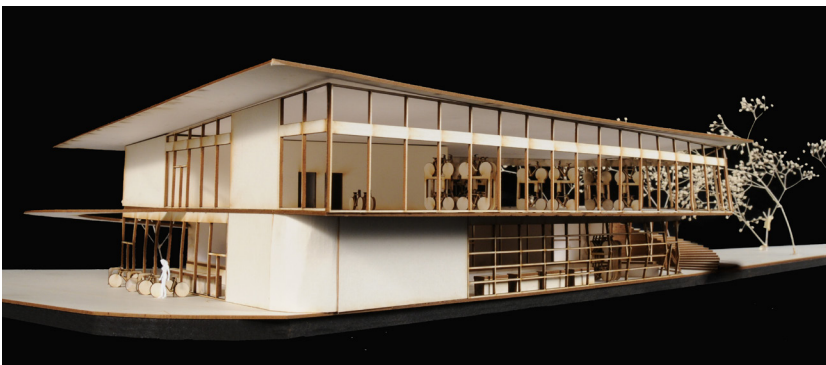


**Figure 53**

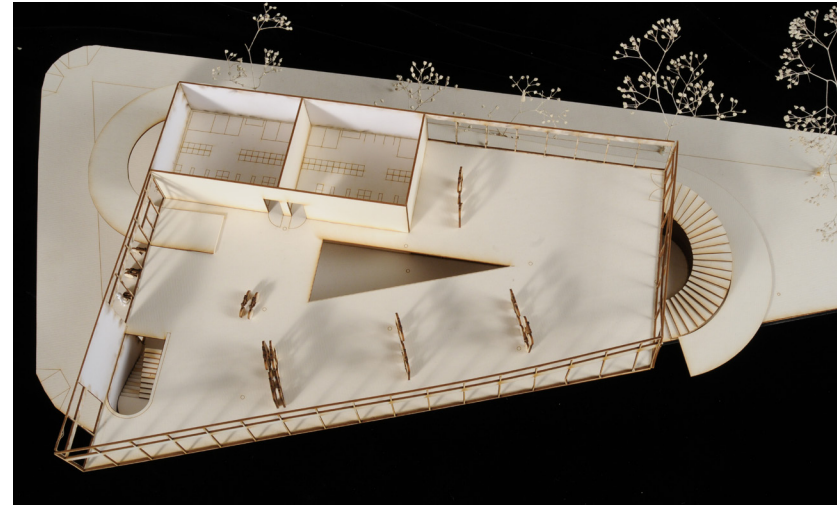
A series of ramp studies. The models are oriented to the southeast, so the long edge facing the viewer is West Nickerson Street

## Mid Review Scheme

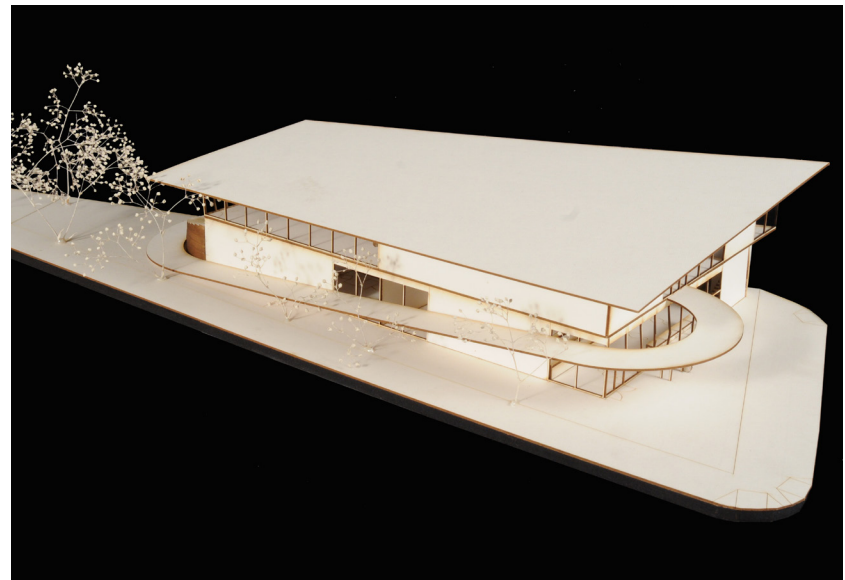
As a first complete design iteration, the building was oriented to the south for maximum solar exposure and to treat the pedestrianized Bertona Avenue West as a major entry point from the SPU campus. The program was divided so that the bicycle parking and lockers were placed on the second floor for 24 hour access, while the first floor had the other public programs including a cafe, a repair station, classroom space, and offices for the campus police and bicycle advocates. The ramp circulation began on West Bertona Avenue towards the eastern end of the building, and it wrapped around to enter the building on the western edge. The upper floor cantilevered over Bertona Avenue for bicycle parking beneath and dramatic gesture to the campus. Critiques of this scheme included safety concerns of accessing the second floor during late hours, and inconvenience of accessing the ramp if approaching from the north.



**Figure 54**  
View of the southern facade facing West Bertona Avenue.



**Figure 55**  
Second floor bicycle parking with atrium view to below.



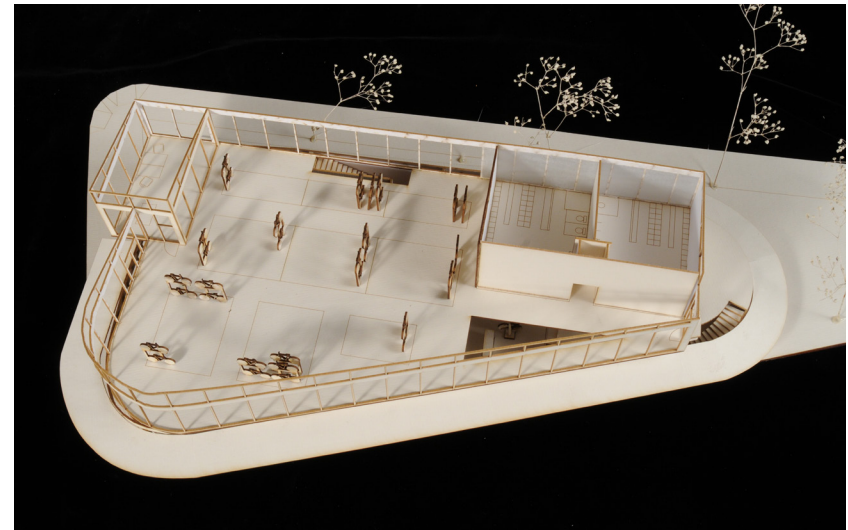
**Figure 56**  
Overall scheme with a ramp wrapping half of the building.

## Design Development

Following the midreview, the police office moved to the second floor to act as a security presence for late night access and to deter bicycle theft. The ramp elongated to wrap around the entirety of the building so that it began and ended in the same point, also for a central security vantage point. The stair at the eastern edge of the site also changed to include an exterior deck, and better relationships between the retail, cafe, repair, and co-op self repair space were spatially organized. The last major change was breaking the mass of the roof into two halves to also permit more light to the center of the second floor. The critique of this scheme were concerns for waterproofing a roof with clerestory lighting, need of more efficient bicycle parking on the second floor, and larger locker room space.



**Figure 57**  
Roof variation with a ramp wrapping entirely around the building.



**Figure 58**  
Upper level with police presence and smaller atrium

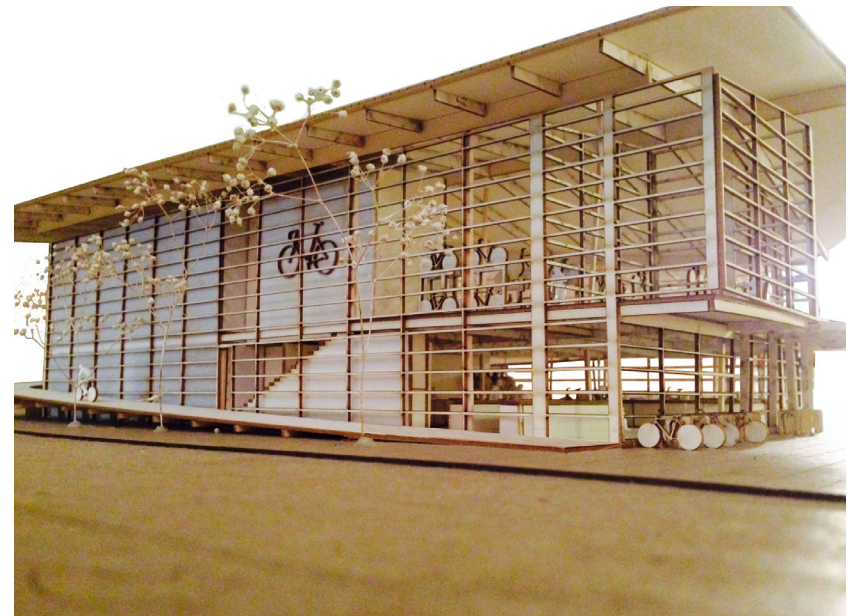


**Figure 59**  
Lower level showing relationships between the program spaces.

## Chapter Eight: The Bicycle Station

### Final Scheme

After program adjacencies and sizes were resolved, building structure and wall section details refined the design to a final solution (Fig. 60). Like the previous iteration, the ramp begins on the corner of 3rd Avenue West and West Nickerson Street, and wraps entirely around the building. The ramp has a structural system independent of the building. The second floor partially cantilevers over the floor below, creating an exterior covered area for bicycle parking and projecting a perceptible cue as an entry point. The cladding system is a regular rectangular glazing pattern for visual consistency and modular assembly. The horizontal lines of the glazing pattern are emphasized with extruded mullions to act as a counter point to the angle of the sloping ramp. The high transparency of the building makes the bicycles visible to the exterior for immediate and iconic identification of this building as a bicycle station. Program spaces without desired transparency, such as the lockers, restrooms, and storage, have opaque frosted panels on the exterior, or are a textured concrete on the interior. These solid walls present opportunities to hang artwork or other branding materials as a bicycle station (Fig. 60). The roof is a low sloping gable covered with standing metal seam sheets. This breaks up the mass of the roof and ensures good watershed, resolving the roof critiques of prior iterations.



**Figure 60**  
Final model view of the northwest corner.

## Program Sizes and Arrangements

The midreview scheme concept of clear division of program into an upstairs with 24 hour access and a downstairs with regular operating hours was carried into the final design solution. The upstairs has space for parking 300 bicycles, an office space for the campus police, and locker rooms with showers. The downstairs has a cafe, small retail space, full repair service, a self-repair co-op space, and flexible classroom or demonstration/lecture space. The sizes of these programs elements are shown to the right, and the arrangement can be seen in the floor plans of the building, Figures 67-68.

### Overall Building Assembly

Figures 61-66 illustrate the process of building conception, from the ramp structure to the roof structure. The ramp structure is separate from the building structure for easier construction and to allow for building movement. The program spaces rest within a regular column grid, allowing for future expansion or contraction of program. The ground floor is divided into a front and back by solid walls for the restrooms for the cafe and storage for the repair counter. This service band division also gives flexibility to the DIY repair and demonstration areas, as they could be combined for a large lecture and closed off from the noise of the front cafe and repair spaces. The second floor simply has efficient locker rooms and open space for bicycle racks.

## Upstairs

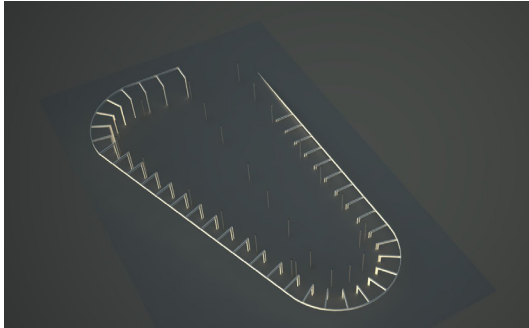
Police...	370 sq ft
Indoor bicycle parking... (300 bicycles)	3400 sq ft
Locker rooms and showers...	900 sq ft

## Downstairs

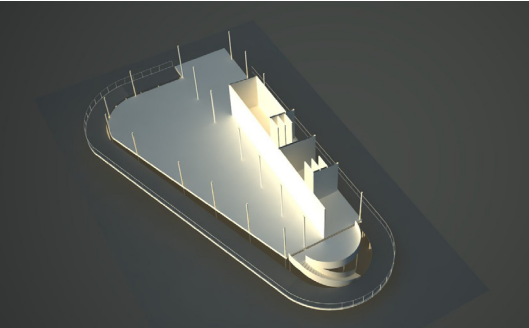
DIY repair...	920 sq ft
Lecture/demonstration...	985 sq ft
Repair...	1200 sq ft
Retail...	300 sq ft
Cafe...	830 sq ft
Storage and restrooms...	420 sq ft

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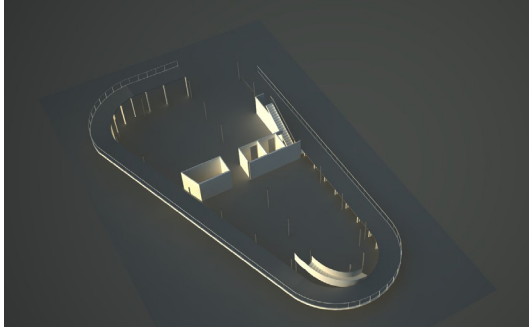
9025 sq ft of program  
10,548 sq ft total



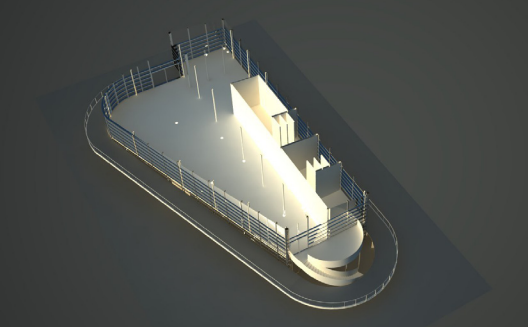
**Figure 61**  
Ramp structure and ground floor column grid



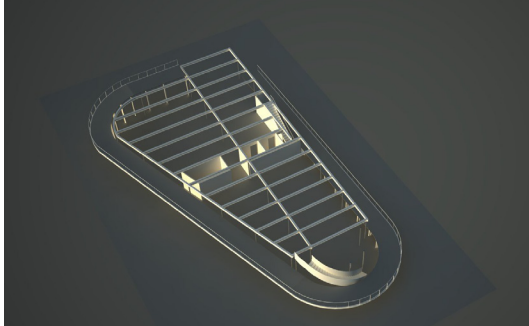
**Figure 64**  
Second floor column grid and locker room walls



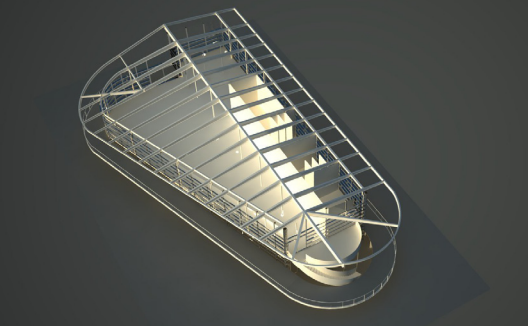
**Figure 62**  
Space division by service band walls and stair circulation



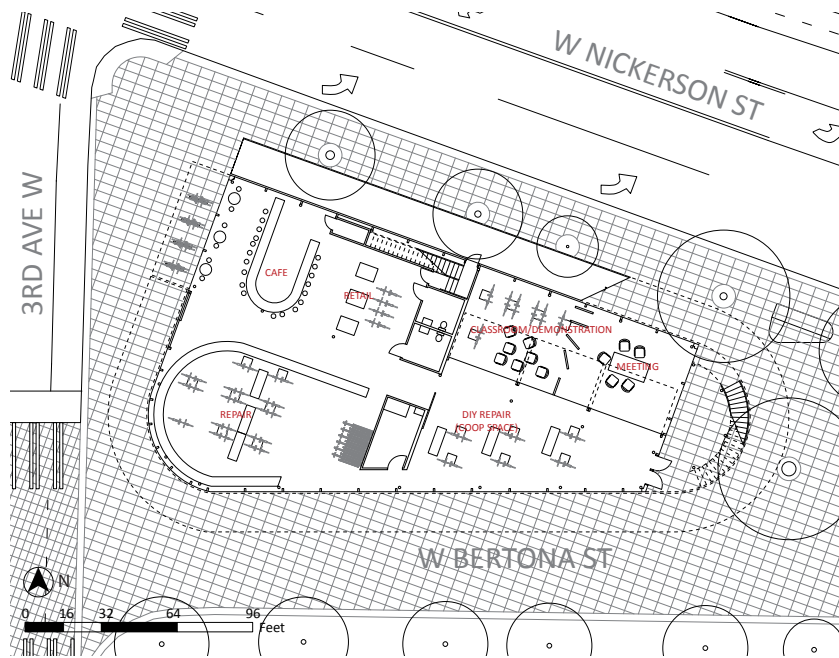
**Figure 65**  
Building enclosure



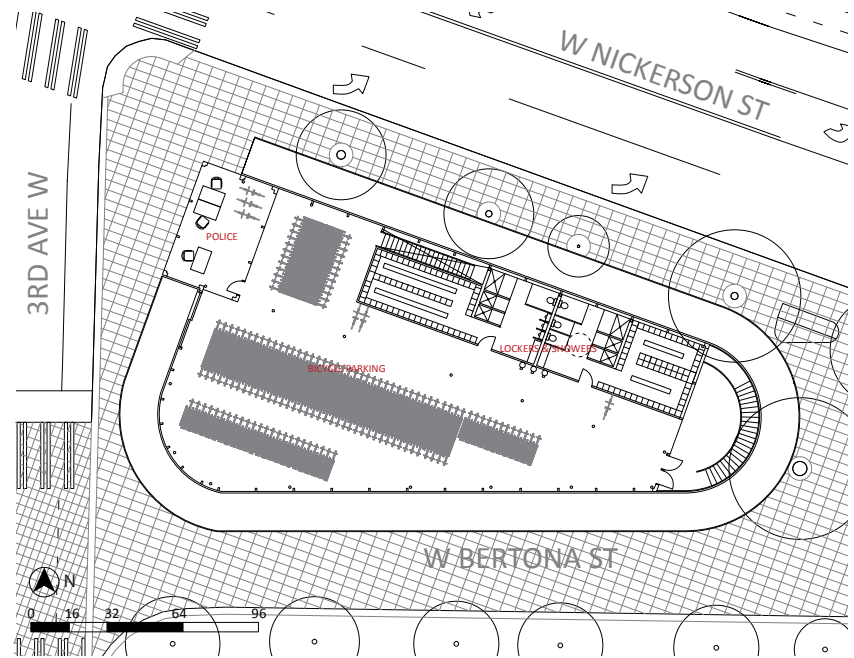
**Figure 63**  
Second floor framing structure



**Figure 66**  
Roof framing structure



**Figure 67**  
Ground floor plan

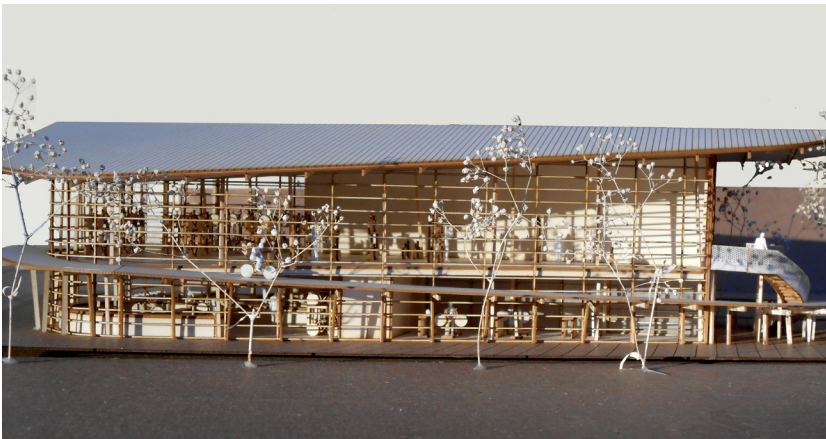


**Figure 68**  
Second floor plan

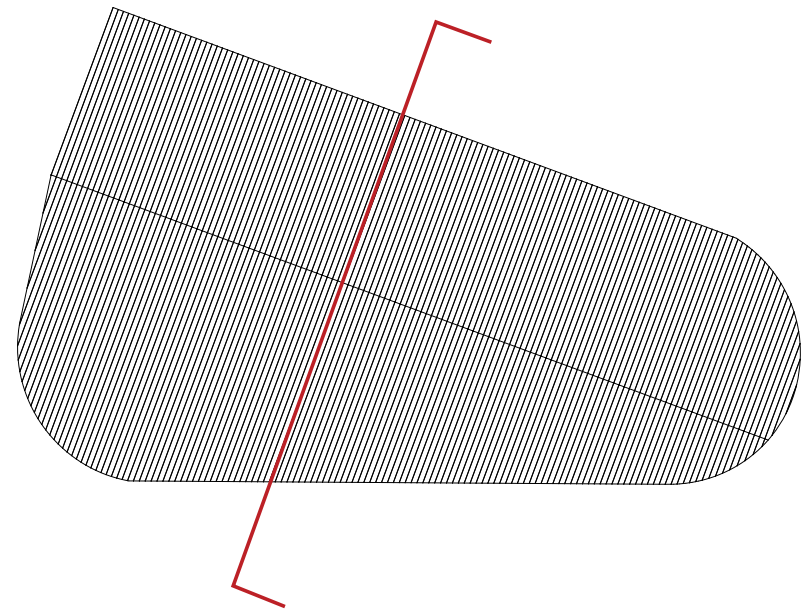
## Building Details

The roof of the building accommodates the triangular geometry by extending or shortening the roof rafter ends (Fig. 71). When viewed from the south, (Fig.69), the variations of the beam end results in a graceful lifting effect of the roof. The roof extends out over the ramp for rain protection (Fig. 71), and the curved roof ends echo the geometry of the ramp (Fig. 70). Likewise, the exterior stair at the far east end of the building has a curving tread and perforated metal guardrail to fit inside the radius of the ramp (Fig 69 and plan views Figs 67-68).

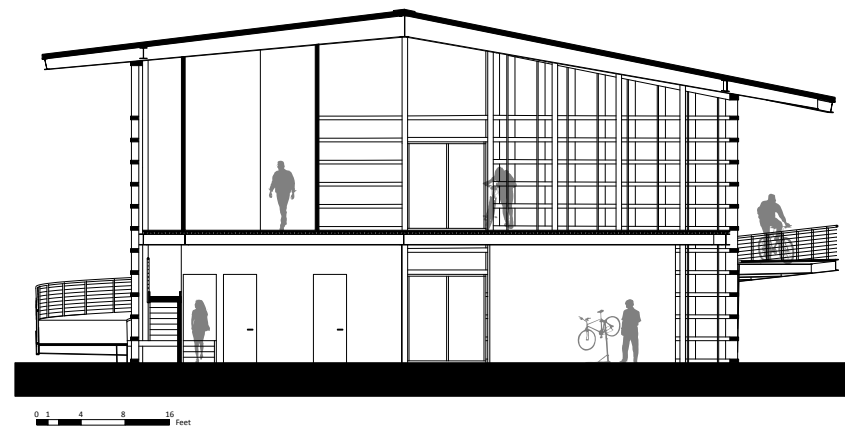
The ground floor has a ceiling height of 10' for more intimate space and the upper floor peaks at 17'6" for a roof slope with adequate water drainage and room for double stacked bicycle parking. The structure



**Figure 69**  
South elevation of the final model. Note the roof slope.



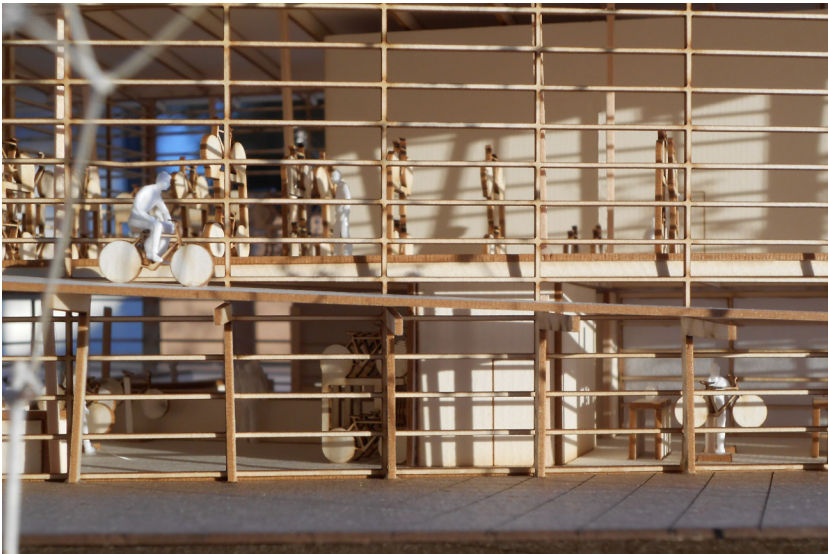
**Figure 70**  
Roof plan illustrating section cut



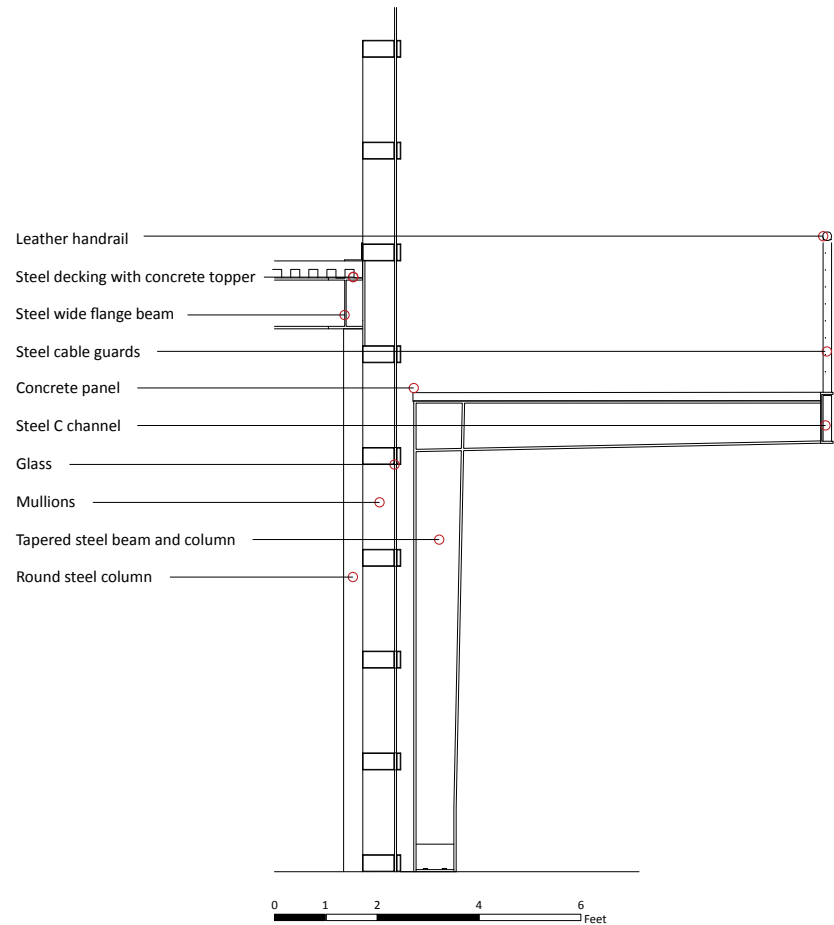
**Figure 71**  
Cross section of the building. Note varied roof rafter lengths.

is exposed and comprised of wide flange beams supported by round slender 8" steel columns. The floor is simple metal decking with a concrete topping. The building cladding is a simple curtain wall system with aluminum mullions.

The ramp has its own steel structure of tapered wide flange columns and beams, which creates a regular rhythm around the building (Fig. 72). The surface of the ramp is a precast concrete slab which has a finished edge by using a steel C channel. The handrail has steel cable infill and a leather handgrip to imitate the leather tape wrapped on a bicycle handlebar and thin glinting spokes (Fig. 73).



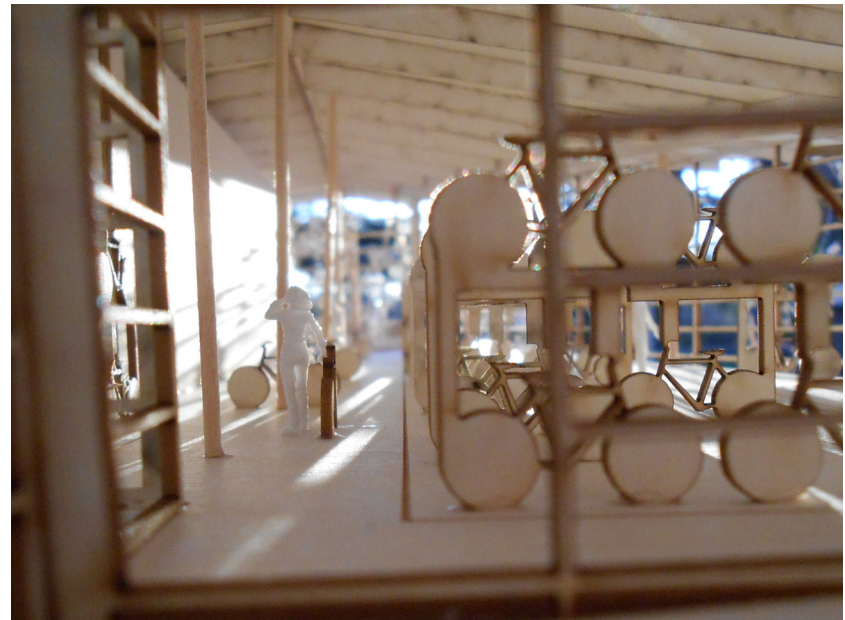
**Figure 72**  
The ramp supports create a regular rhythm around the building.



**Figure 73**  
Detailed section of the building wall and ramp materials.

## Building Experience

Imagining the typical cyclist arriving at this building, such as an SPU student coming to campus for a day full of class: She rides up the low sloping ramp from 3rd Avenue West and West Nickerson Street. Looping around the corner, there is a view of the Ship Canal just beyond the athletic fields over the trees, and a close up view of the curving exterior stairs with a unique metal guardrail. Arriving at the second floor and dismounting her bicycle, she has a feeling of relief leaving the bicycle here, knowing the campus police are watching over the bicycles parked inside. She locks up her bicycle to one of the racks and stows her wet rain pants and gear in a locker. Heading downstairs to the cafe for a quick coffee, life is bustling inside the bicycle station. Students are lingering in the cafe, and co-op members are tinkering with their bicycles in the back. She leaves and heads to class. At the end of the day, she returns to the bicycle station, which is well lit and glowing in the dark. She swipes her membership card at the door to the north stairs just off the ramp, heads upstairs to grab her belongings from the locker and her bicycle from the rack. The policeman gives a wave and she hops on her bike and zips down the ramp and back onto the trail. The illustration of this imagined experience is shown in renderings on the following pages (Figs. 75-78).



**Figure 74**  
The bicycle station filled with bikes.



**Figure 75**  
Riding up the ramp from West Nickerson Street and 3rd Avenue West.



**Figure 76**

Arriving on the second floor to plentiful bicycle parking.



**Figure 77**  
Enjoying an atmosphere of camaraderie in the cafe and repair area.



**Figure 78**  
A glowing beacon for safe, 24 hour access.

## Conclusion

A system of high quality bicycle stations strategically located throughout the city, as proposed in this thesis, would not only make bicycling more convenient for current and potential riders, but would elevate the status of bicycling to a normal, everyday means of travel. As cities grow and become increasingly dense, alternative transportation options to the private vehicle will be critical to avoid protracted traffic congestion and excessive environmental pollutants from idling cars. Promoting the sustainable growth of a city includes consideration of a citizen's quality of life, community health, and social and economic equality. Bicycle and pedestrian infrastructure positively affect these factors, and can better support high density living than vehicle oriented design. Locally in Seattle, nationally in the US, and globally, there is a burgeoning desire to bicycle for daily transportation. To accommodate a diverse and growing population of cyclists, and to encourage future positive growth of bicycling in cities, comprehensive policies and infrastructure will need to be implemented for safe, uninterrupted, and universally accessible travel. Lessons can be learned from exemplary cities such as Amsterdam and Copenhagen to prioritize, improve, and implement new bicycle and pedestrian facilities; from the path a cyclist rides on to the safe place to lock a bicycle. Ideally, these bicycle networks will expand and be replicated as cities and numbers of cyclists continue to grow.



**Figure 79**  
The author and her bicycle.

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