

Negotiating Ballard's Missing Link of the Burke-Gilman Trail: How Bicycle Infrastructure Can Integrate a Sustainable Design Solution

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Abstract

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As cities expand and evolve, urban infrastructure systems must become multifunctional, complementing one another in efficient ways that create synergies and contribute to the resilience and livability of our built environment. Existing and future land uses complicate how and where new infrastructure is designed. This Master of Landscape Architecture research and design thesis proposes a negotiation between proponents and designers of active transportation facilities and existing industrial landowners along the “Missing Link” of the Burke-Gilman Trail. Several research methods were used in the development of a design approach that integrates stakeholder feedback from ten interviews with documentation and analysis of existing conditions. Through a proposed design that addresses both landowner and trail user needs, a vital regional bicycle corridor can be realized that also combines bicycle infrastructure with green stormwater infrastructure, integrating advances in multiple arenas to create a hybrid sustainable design solution.

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CHAPTER 1 INTRODUCTION:

Businesses and Bicycles in Ballard

Figure 1. End of the Burke-Gilman Trail and start of the “Missing Link”

This thesis investigates the potential for design interventions addressing both public and private needs that merge bicycle infrastructure with green stormwater infrastructure (GSI). The inquiry is grounded in a site in the Ballard neighborhood of Seattle, WA, known as the “Missing Link” of the Burke-Gilman Trail—a major rails to trails bicycle artery. This document evaluates the existing conditions, the needs of the community—focused both on existing industrial business and on the safe mobility of all users—and related precedents in the formulation of a design framework and site design.

The application of site and community based research, combined with contemporary urban design practices that facilitate bicycling and walking, inform the practice of design mediation. Navigating this stretch of right-of-way has been perilous for the bicyclist as well as the designer. Having safely ridden the missing link many times, I have applied my developing research and design skills in a proposed arrangement that finds a middle ground through the dynamic Ballard neighborhood.

My design aims to facilitate efficient flows of people and vehicles, increase safety and complete this well-used bicycle transportation and recreation corridor. I believe that these goals are achieved in this proposal by negotiating a creative compromise that responds to the needs of the city, businesses and the community while providing ecosystem services at the same time.

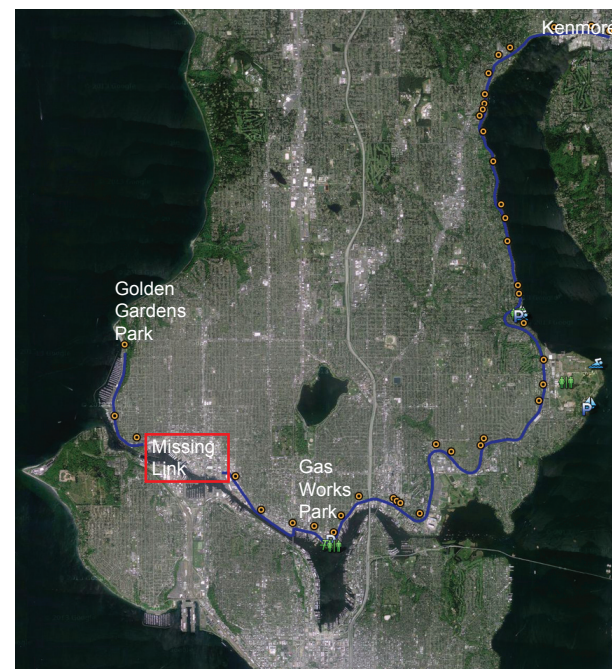
This design is informed by the research and analysis of the social, economic and environmental considerations of a site that has been contested for over a decade. As a graduate student, I do not presume to overcome the significant political and legal roadblocks that have become associated with this site. It has been my intent to understand the concerns of the players involved through systematic investigation and apply that basic understanding through design in a way that continues a dialogue, addressing multiple conflicting concerns and exploring feasible possibilities for the site. It is my hope that by working from a more removed academic context, I might reveal perspectives, ideas or combinations of strategies that could be beneficial as the actual design and implementation moves forward.

Several factors contribute to the increasing need and opportunity to complete the Burke-Gilman Trail through Ballard (map 1). This thesis highlights neighborhood changes in land use and density as well as challenges that result from urban stormwater. Attention is also given to maintaining a healthy marine industry while emphasizing the importance of an uninterrupted bicycle facility.

Recent developments demonstrate the political momentum and community support related to bicycling in Seattle. The revised 2013 Seattle Bicycle Master Plan (BMP) was released in December 2013 and unanimously adopted by the City Council in April 2014. This comprehensive and visionary document has further built momentum related to bicycle infrastructure in Seattle. In August 2013, the Seattle Department of Transportation (SDOT) commissioned an Environmental Impact Statement (EIS) for the incomplete portion of the trail in Ballard. The following background section provides a brief overview of the trajectory of the incomplete section of the Burke-Gilman Trail through the completion of this document in Spring 2014.

Background: Bicycling, Ballard and the Burke-Gilman Trail

Seattle has had a strong bicycle culture dating back to the late 1800s. At the turn of the cen-



Map 1. The 20-mile Burke-Gilman Trail from Golden Gardens to Kenmore. (SDOT/Google Maps)



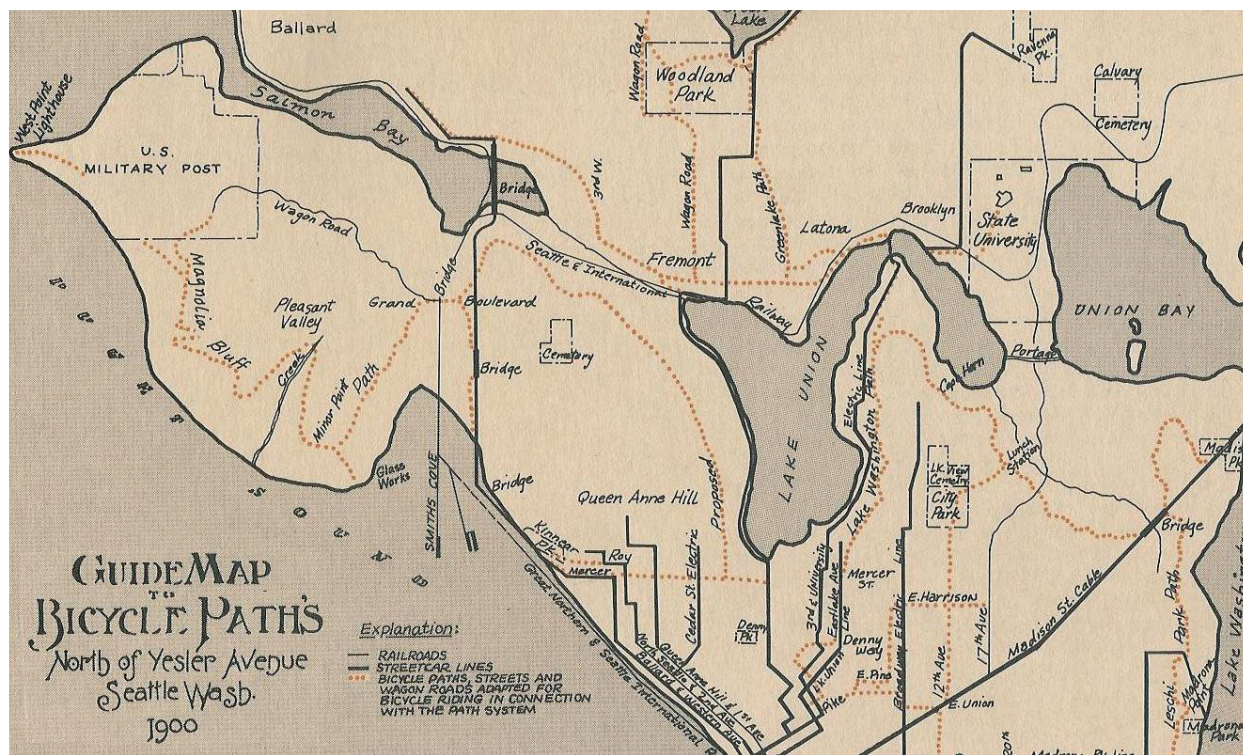
Figure 2. The cover of Seattle's first Bicycle Master Plan, 1972

tury the city had over 25 miles of bicycle trails and people were proud of the network (map 2). “Probably [in] no city in the United States is there a system of bicycle paths so excellently conceived, so well constructed and kept constantly in as good repair as are those in and around the city

of Seattle,’ the *Seattle Times* boasted in 1902” (Berger 2013). A century later, Seattle is again working to attain this status.

The modern bicycle infrastructure network in Seattle took off during the 1970s. Two milestones in the city’s cycling infrastructure are the creation of the Burke-Gilman Trail and the creation of the first Bicycle Master Plan (figure 2). In 1971, after the decline of rail usage, Burlington Northern Santa Fe (BNSF) Railroad transferred a declining rail alignment to the City of Seattle. In

1972, Seattle formulated its first Bicycle Master Plan, called the “Comprehensive Bikeway Plan.” These two events were the catalysts for the creation of the 20-mile Burke-Gilman Trail. The first portion of the trail was completed from Gas Works Park to Kenmore in 1978 and was one of the first rails-to-trails projects in the U.S. Today, the Burke-Gilman Trail (BGT) is celebrated as one of the best off-street bicycle facilities in the country. In July 2013, *USA Today* listed the BGT as the third best urban bike path



Map 2. Seattle bicycle path network, 1900 (Seattle Comprehensive Bikeway Plan)

in the country. “One of the most heavily ridden multi-use paths in the country, it’s often called the ‘backbone’ of Seattle’s cycling infrastructure” (Lebetkin 2013).

In order to provide a brief overview for how the incomplete portion of the Burke-Gilman Trail came to exist, I will share my understanding of the timeline. Only a brief account is provided as context, since the focus of this thesis is on the design of the corridor and the research methods used to create a foundational design framework.

A letter dated August 16, 2013, to the Seattle Department of Transportation (SDOT) from the Cascade Bicycle Club details this timeline of the creation of the Burke-Gilman Trail and how a segment along the proposed rail alignment has not been completed (see Appendix p 99). The Cascade Bicycle Club is a reoccurring player in the story of the Burke-Gilman Trail and bicycle infrastructure in Seattle. It is a non-profit organization of over 15,000 members that organizes major bicycle events, conducts bicycle infrastructure and related advocacy work and bicycle education programs.

After the first stretch of the Burke-Gilman Trail was completed in 1978, the next major development related to the completion of the Burke-Gilman Trail was in 1989, when Burlington Northern agreed to give the City of Seattle rights to any “railbanked” (see sidebar) corridor when they ended service on the western portion of the line.

Railbanking

Railbanking is a temporary land use rights transfer that allows a rail corridor that would otherwise be abandoned to be used as a trail, while preserving the corridor for potential rail use. The National Trails System Act established this practice in 1983. “The railbanking statute allows a railroad to remove all of its equipment, with the exception of bridges, tunnels and culverts, from a corridor, and to turn the corridor over to any qualified private organization or public agency that has agreed to maintain it for future rail use” (Rails to Trails Conservancy 2014, Under “What Is Railbanking?”). This is a mutually beneficial arrangement that allows for public use of the corridor, while at the same time keeping it intact, making it easy and affordable for a railroad to re-appropriate the property for future use.

In 1996-97 BNSF halted rail service and revealed its intention to abandon the rail line. It was purchased by Sea Lion Railroad and transferred to the Ballard Terminal Railroad under franchise and operating agreements between those entities and the City of Seattle. The city completed additional segments of the Burke-Gilman Trail from 8th to 11th Ave NW on the eastern side of Ballard and later from the Hiram M. Chittenden Locks (Ballard Locks) to NW 67th St near Golden Gardens Park on the western side of Ballard.

In 2003, Seattle City Council’s Resolution 30583, based on the 2003 Ballard Corridor Design Study, approved completion of the Burke-Gilman Trail along the rail corridor from 11th Ave NW to the Ballard Locks. SDOT issued a Determination of

Non-Significance (DNS) for the route based on the State Environmental Policy Act (SEPA) checklist that was filed for the project completion. SDOT's DNS states that there will not be "probable significant adverse impacts from the proposal" (SDOT

2013). This is a common judgment regarding the environmental impacts of a project based on the SEPA checklist that would have allowed the project to proceed.

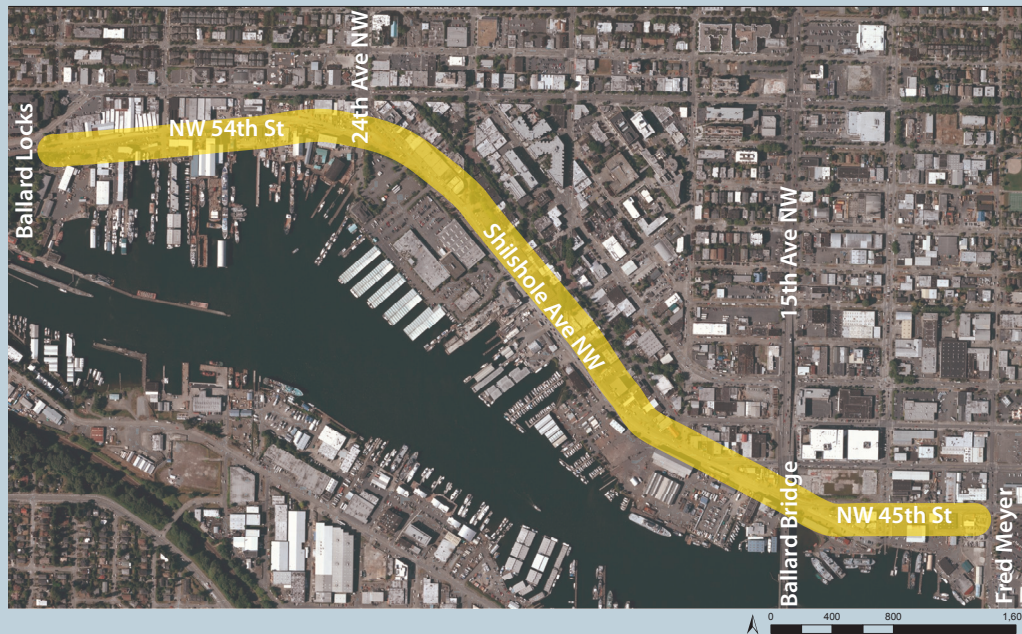
At this point litigation in the King County Superior Court began to impact the progress of completing this remaining 1.3-mile segment of the Burke-Gilman Trail. Several lawsuits have been filed by local property owners in response to the multiple Determinations of Non-Significance issued by SDOT. This cycle has been continuing for over six years.

The current development of an Environmental Impact Statement (EIS) by SDOT is in response to the most recent requirement by the King County Superior Court and the City of Seattle Hearing Examiner to examine "the potential traffic hazard impacts" for one part of the Missing Link. SDOT has expanded the EIS to the entire Missing Link and will look at, "transportation (including parking, traffic and traffic hazards); land and shoreline use; earth; plants and animals; historic and cultural resources; and economics" (SDOT 2013).

The EIS process for a project of this size is long and involved, some-

What Is the "Missing Link"?

Throughout this document I refer to the un-built segment along NW 45th St, Shilshole Ave NW and NW 54th St as the Rail/Shilshole Ave NW alignment to complete the "Missing Link." It is important to note that several other options for completing the Burke-Gilman Trail through Ballard have been considered. Later in the introduction of this document, the case is made for why the alignment proposed in this thesis was chosen for design exploration.



Map 3. Missing Link in Ballard

times lasting up to two years. As a result, the study was not complete during the writing of this document so unfortunately the findings could not be incorporated into my research and design of the Missing Link. However, in this project, I have taken into account the most current arguments and findings published to date, combined them with my analysis of the current physical and social conditions and synthesized them in the design.

Sustainable Urban Design Principles and Policies

Some fundamental principles and policies related to sustainable urban design are at the core of this thesis investigation. In order to outline the problem I am addressing in this thesis, and to frame my research questions and approach, I will briefly explain some important concepts. The following are broad areas of inquiry that inform my theoretical framework and approach to design that I am simply identifying here to introduce this framework. I go into greater detail regarding each of these principles and policies in the next chapter.

Green Stormwater Infrastructure (GSI) (aka Green Streets or Green Infrastructure)

This strategy for managing rainwater uses vegetation and soil to treat and absorb the water immediately where it falls. This approach mimics natural hydrologic processes rather than strictly piping untreated runoff into streams and receiving bodies of water like

our local Puget Sound. It is implemented with the redundancy of the traditional sewer pipe system as a backup. In 2009, Seattle adopted the City Stormwater Code, requiring the implementation of GSI to the MEF (Maximum Extent Feasible*) as part of an amendment to the Seattle Municipal Code (SMC) 22.800-22.808 (City of Seattle 2009).

**“Maximum extent feasible means the requirement is to be fully implemented, constrained only by the physical limitations of the site, practical considerations of engineering design, and reasonable considerations of financial costs and environmental impacts” (City of Seattle 2009, under “22.801.140”).*

Active Transportation

Walking and bicycling are considered the primary forms of what is known as “active transportation.” The livability of urban environments is increasingly being measured by how well infrastructure supports these alternative modes of transportation. In order for Seattle to be a leader in this realm, the city will need to support the design and construction of such infrastructural supports. Trends in bicycling in particular are dramatically increasing and proven to have economic, social and environmental benefits for a community (League of American Bicyclists 2009).

Complete Streets

This new type of policy is being enacted in municipalities across the U.S. It requires

transportation agencies to balance the needs of all users in the design and operation of our streets. This means that the safety of pedestrians, bicyclists and transit users of all ages and abilities, is considered an equal priority with the needs of motorists and freight vehicles. In 2007, Seattle adopted a Complete Streets ordinance (City of Seattle 2007).

Ecosystem Services

The benefits that nature (a biological community and its habitat), provide to humans are measurable and range from providing basic needs (food and clean water) to protection (from flood and disease) to culture (recreation) (NOAA 2013). As an example, Seattle's trees provide: \$5.9 million/year energy savings, store 2 million metric tons of carbon (\$10.9 millions value) sequester 140,000 metric tons of carbon per year (\$768,000/year value) and remove 725 metric tons of air pollution per year (\$5.9 million/year value) (Green Cities Research Alliance 2012).

Seattle Green Factor

This local zoning policy for building developers utilizes a scoring system for a project. It has minimum requirements and incentives for creating high performance buildings and landscapes that improve a community's water and air quality, safety and aesthetics. Developers can select from a menu of green exterior features (DPD 2013).

Problem Statement

Bicycle infrastructure needs to be continuous and connected to be safe and successful. The focus of this thesis is on completing a segment of a regional, shared-use trail that is primarily utilized by bicycles. By trying to understand the complexities of the Missing Link, I seek to develop a safe, equitable and sustainable design solution based on both the local context and national trends and best practices related to cycling and traffic.

Safety is a top priority for transportation projects. The question is *how* do you make a corridor safe and what strategies can be used to balance the needs of all users? By striving to achieve this balance we begin to create an equitable transportation network. Bicycles are an embodiment of equitable transportation because they are affordable to own and operate. They are a component of convenient, zero emission urban mobility that promotes healthy and compact communities. What if we can design these networks in tandem with providing ecosystem services? Could we get triple benefits—environmental, social and economic—from a single infrastructure investment?

The lessons and experience gained from this research and design endeavor can be translated to future bicycle infrastructure projects and lead to more frequent adjacencies and synergies with green stormwater infrastructure. These two types of infrastructure can be paired together, complementing each other to enable our right-of-way to provide greater ecosystem services.

Critical Stance

In this thesis, I addressed the challenges outlined in the Problem Statement with a particular lens and set of values. My belief as an aspiring landscape architect and urban designer is that urban transportation projects must be approached with greater attention to ecosystem services. Active transportation projects that support bicycling and walking are a prime opportunity to integrate ecosystem services in the right-of-way. I assert that Seattle's Complete Streets policy lays the foundation for the inclusion of green stormwater infrastructure (GSI) in transportation projects in a way similar to how the Seattle Green Factor promotes GSI in development projects. Complete Streets and Green Factor are policy frameworks that need to be expanded and strengthened to create an urban built environment that is more livable and resilient.

Landscape architects are uniquely positioned as interdisciplinary leaders to contribute to the enhancement of the public realm by considering ecological function at the same time as facilitating urban mobility. When evaluating this project and site, there are several factors I will address that are essential to a long-term sustainable design solution. The integration of all of these factors will lead to the most intentional and multifunctional design adaptation to the right-of-way while completing the Missing Link.

The lens that I bring to the profession places considerable value on high quality, connected

bicycle infrastructure. This stems in part from my collective bicycle related experiences, particularly my life journey as a bicycle commuter, as a former urban design intern in Copenhagen, Denmark, and as a road bicycle racer for the Union Bay Cycling Club since 2007. I believe in facilitating a culture of cycling that increases active transportation and its percentage of travel mode share. Bicycling is an elegant transportation alternative and way of life that embodies the concepts of sustainability. It is proven to provide economic, social and environmental benefits to individuals, but more importantly to the community.

A significant focus of this design proposal is on how bicycle infrastructure can safely co-exist with industrial land uses and vehicular traffic in support of the growth of cycling in Seattle, while at this same time integrate ecological quality. Analyzing local and national cycling trends can justify and anticipate further investments in our bicycle infrastructure network and quantify the benefits to the community. Lessons from other cities and best practices from bicycle infrastructure guides are instructive for how to design intersections and separate user groups to create successful facilities. By adding an additional dimension of ecological performance the community gains exponential benefits for their transportation investments.

Research Questions

The following questions have informed the path of this thesis.

- What are the existing physical and social conditions of the Burke-Gilman Trail's Missing Link and how can these inform a design that would complete this gap in our community's transportation and recreation corridor?
- How can the design of the Missing Link demonstrate creative ways to combine right-of-way investments while establishing a hybridized infrastructure that provides ecosystem, mobility and community services?
- What aspects of Complete Streets are already being constructed as either green stormwater infrastructure or bicycle infrastructure that can work together to make the public right-of-way safer and more inviting as a public amenity and could be integrated into the design of the Missing Link?

Methods

My approach for developing a design proposal for the Missing Link includes a collection of research methods. Over the course of my thesis investigations I have used archival research, observational techniques, photo documentation, mapping and interviews. Using multiple methods is necessary in order to collect both the physical and social data required to arrive at a well-informed design solution. The site analysis presented in this thesis is more comprehensive as a result of a systematic documentation of existing conditions.

This design is further grounded in place by considering the input from key stakeholders, decision makers, and designers who have been involved in the Missing Link Project. The interviews that I conducted early in the design process yielded insights from four major groups of people invested in the project outcome. Comments from government officials and designers, marine industrial business interests, bicycle advocates and neighborhood representatives informed this design of the Missing Link. This is especially important, as the Missing Link has been the subject of legal action. I made it explicitly clear that their input was strictly confidential and in service to the development of my design framework and the resulting design proposal.

Alignment Selection

There are many ways to get from point A to point B. In the case of the Missing Link, point A could be considered the intersection of NW 45th St and 11th Ave NW and point B is NW 54th St at the Hiram M. Chittenden Locks (Ballard Locks). My decision to focus on the Rail/Shilshole Ave NW alignment (highlighted in yellow in map 4) for the completion of the Missing Link was based on a number of factors. In an ideal world it will be a part of a greater network that will alleviate congestion on the Burke-Gilman Trail, and also service a wider geographic area and bicycle skill level of neighborhood residents. The 2013 Seattle Bicycle Master Plan (BMP) also shows Rail/Shilshole Ave NW alignment with the following text:

These factors are influenced by my interviews with municipal staff/designers and with bicycle advocates. They do not include some of the additional considerations articulated by the industrial interests that I interviewed. The negotiation and balancing of priorities that I have endeavored to achieve is captured in Chapter Three with my design framework.

Ideally, I would have been able to compare and contrast two alignments in detail, further enhancing the balance of my investigation.



Figure 3A/B. Existing condition of NW Market St (A - top) and author rendering of one-way cycle tracks featuring elements of green stormwater infrastructure (left) and Complete Streets on NW Market St through Ballard (B - bottom)

However, I came to the conclusion that a study of that magnitude was beyond the scope of a Masters thesis. I was able to briefly envision the potential for one-way protected bicycle lanes, or cycle tracks, on a street adjacent to the Rail/Shilshole Ave NW alignment (figure 3B). While this could be feasible, it introduces a new set of challenges. In addition to the five key factors previously stated, the complete reorganization of a major transit arterial with more utilities and businesses encouraged the focus on the difficult negotiation and design of the Rail/Shilshole Ave NW alignment.

Thesis Objective

The design proposed in this thesis for the Missing Link aspires to complete a vital pedestrian and bicycle corridor and address community concerns related to safety, while at the same time facilitating the circulation of people and freight. These goals are achieved by integrating of a collection of design techniques to enhance the experience for bicyclists and pedestrians while also addressing freight and

industrial traffic needs. An additional layer of ecological function further enriches the project and helps to advance Seattle's resolution supporting Complete Streets. My design is communicated through a series of typical plan segments and section cuts as well as a profile of a proposed elevated segment that together demonstrate how design could negotiate conflicts while at the same time incorporating elements of green stormwater infrastructure.

Summary

Seattle is in the process of building upon its history of bicycling dating back to the late 1800s. In an effort to realize the potential for the artery of the regional bicycle infrastructure network, a compromise must be reached to complete the Missing Link of the Burke-Gilman Trail. This chapter provided a brief overview of the history of the rail corridor, and the more recent contention over the Missing Link, which set the stage for the research and negotiation that underpins the design presented in this thesis.

The following chapter offers a literature review that builds upon the current principles related to sustainable urban design and active transportation briefly presented in the introduction. In the subsequent chapters, research specific to the Missing Link will be layered with more general research findings on relevant design principles and lessons. The design framework detailed in the Third Chapter includes lessons from some

of the research methods I utilized in my site and community explorations. Chapter Three explains how these ideas came together and how I arrived at a design that merges bicycle and stormwater infrastructure. Chapter Four presents detailed mapping and site analysis at a neighborhood scale. This overview of the 1.3-mile corridor sets the stage for locating and understanding the more detailed design explorations in context.

These investigations formed the foundation of my design study, which is presented in Chapter Five. It exemplifies how these seemingly disparate concepts can be combined, generating a synergy that can be greater than any single element. The design zooms in on the three distinct trail segments that each have different conditions, right-of-way width and traffic safety concerns. Finally, Chapter Six provides reflections on the thesis, research and design process.

CHAPTER 2 LITERATURE REVIEW:

Making the Case for Integrating Green Stormwater and Bicycle Infrastructure

Green Stormwater Infrastructure

Active Transportation

Complete Streets

Precedents

Indianapolis Cultural Trail Case Study

The following chapter represents my research on the fundamental design principles that provide the foundation of my design framework. The section on precedents looks at elevated pedestrian and bicycle facilities that provide lessons and inspiration for how an elevated strategy could effectively be implemented. I conclude with a case study of a landmark project that synthesizes many of these principles, the Indianapolis Cultural Trail, completed in May 2013. It has received wide recognition as a hybrid bicycle facility, green stormwater facility, public amenity and a driver of sustainable economic development.

Figure 4. Bioretention cells in Portland, OR, a key element of Green Stormwater Infrastructure (U.S. EPA)

GREEN STORMWATER INFRASTRUCTURE (GSI)

(Similar and frequently used terms include: Green Streets, Green Infrastructure, Natural Drainage Systems (NDS), Low-Impact Development (LID))

What Is GSI?

The use of green stormwater infrastructure for managing rainwater has gained significant momentum over the last decade. It re-introduces natural hydrologic processes (see figure 5) into the urban context to address the problems that large quantities of impervious surfaces (such as

concrete, asphalt and roofs) can create. The natural hydrologic processes that one might find on a local pre-development site utilize vegetation and soil to slow down and infiltrate the water into the ground. The evapotranspiration of water into the atmosphere from plants and soil is another natural hydrologic process. These natural processes are worth emulating because they can minimize flooding and polluted stormwater runoff making our communities healthier.

When using GSI in an urban context, we gain the added benefit of having the vegetation and soil clean and filter polluted runoff before it is discharged into local water bodies. Trees and other

vegetation also allow for evapotranspiration, releasing water back into the atmosphere. All of these natural processes keep excess stormwater from going into our sewer systems. This is especially important where they are combined with sanitary waste (referred to as a combined sewer system, see figure 7A/B, p 22).

The implementation of GSI has been promoted by the U.S. Environmental Protection Agency as a way to address combined

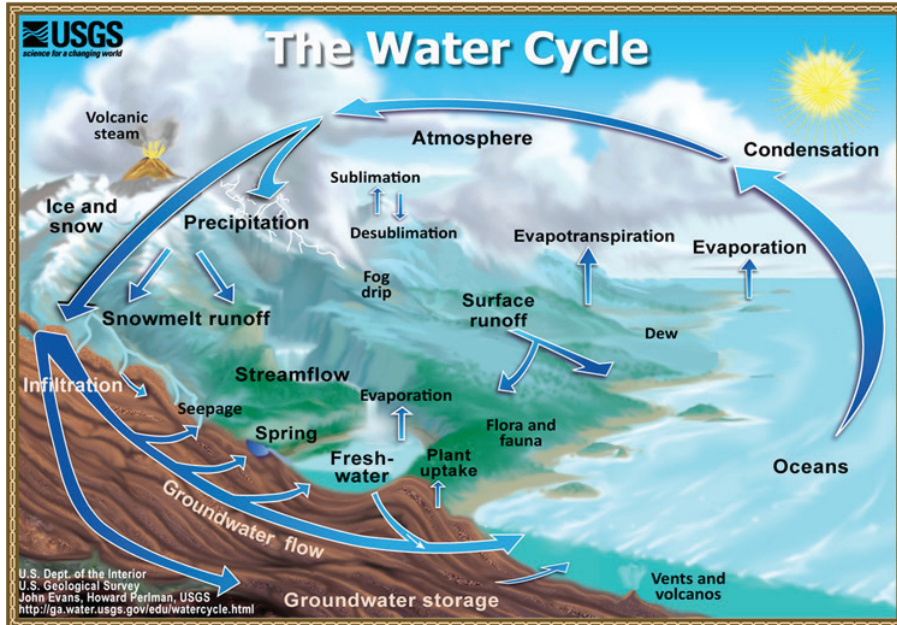


Figure 5. The Hydrologic/Water Cycle (USGS)

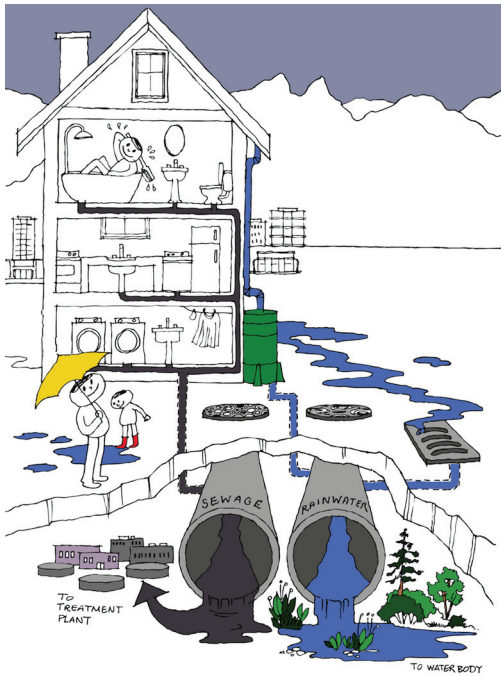


Figure 6. How a separated sewer functions (City of Vancouver, BC)

sewer overflows (CSOs). It has been effective at reducing peak flows by detaining stormwater that overloads our combined sewer systems, which results in untreated sewage being released into our water bodies. To provide an idea of how serious combined sewer overflows are, **in Seattle, during March 2014 the city reported 96 wet weather combined sewer overflows discharging approximately 48.6 million gallons of combined sewage into our**

water bodies (City of Seattle 2014).

In the context of the Ballard neighborhood of Seattle, where the Missing Link is located, there are both types of engineered stormwater infrastructure (also referred to as hard infrastructure or “pipe and pond”). The western portion of the Missing Link (near NW 54th St) is part of the combined sewer system and from 22nd Ave NW east it is a separated system (figure 6). For this separated system, the primary goal shifts from detention to filtration, as all of the polluted runoff from the right-of-way goes untreated directly into the local receiving water body in this case, Salmon Bay (See Ballard stormwater basin and outfalls map 9, p 65).

It is important to note that GSI is not appropriate everywhere, and that it requires analysis of

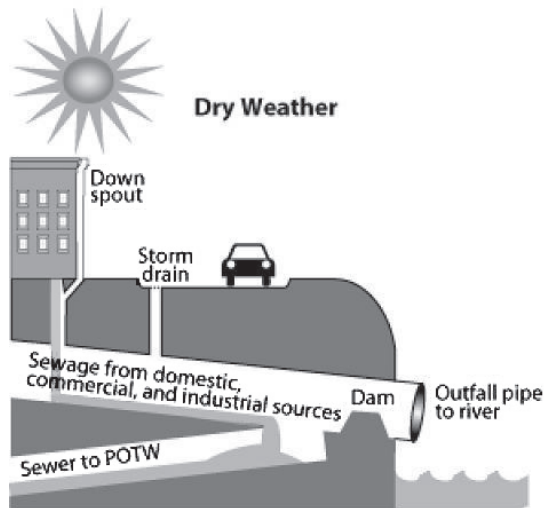
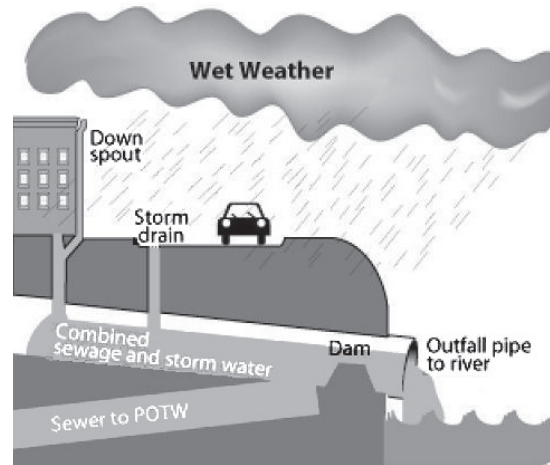


Figure 7A/B. How a combined sewer functions (U.S. EPA)



site hydrology, geology and context in order to design the appropriate facility. A one-size-fits-all approach can have negative consequences, or at the least may not properly address the need of a community or watershed. Potential consequences include standing water beyond 24 hours, system flooding, or unscheduled maintenance for issues with soil or plant material. When designed and engineered correctly, the com-

bined benefits are significant and provide value across scales, from the site to the watershed and its receiving waters.

The Benefits of GSI

Green stormwater infrastructure is a holistic, sustainable strategy that not only improves our environment, but can also have substantial economic benefits as well as improve urban conditions and interactions for people. The goal of this section is to highlight some of the fundamental drivers for this strategy, to underscore its value and to explain why it is a key element in the design.

The United States Environmental Protection Agency (U.S. EPA) refers to the triple benefit categories of GSI as people, planet and profit. There are many reports that have been published quantifying these benefits, and the U.S. EPA

catalogues over 15 examples of case studies and cost-benefit analysis reports on their website: water.epa.gov/infrastructure/greeninfrastructure.

Some of the recent literature on GSI is specifically targeted at the private sector including one report in December 2013 by the National Resources Defense Council (NRDC) entitled, *The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value*. Other reports such as, *Gray to Green: Jumpstarting Private Investment in Green Stormwater Infrastructure* (Philadelphia focused), by Sarah Francis and the Green Economy Task Force focus on stimulating green jobs in a region. I have summarized the benefits these and other reports (Emerson 2012, American Rivers et al. 2012) identify based on the U.S. EPA sustainability categories of people, planet and profit (table 1).

Table 1. The benefits of green stormwater infrastructure (GSI)

GSI Benefits for People	GSI Benefits for Planet	GSI Benefits for Profit
Public Health (air quality, etc.) Urban Livability Improves Bicycle & Pedestrian Safety Flood Prevention Eco-literacy & Education Reduced Crime Reduced Urban Heat Island Effect Reduced Noise Pollution	Water Quality Combined Sewer Overflow (CSO) Prevention Improves Habitat and Biodiversity Ground Water Recharge Carbon Sequestration	Job Creation Reduced Infrastructure Costs Urban Resilience & Adaptability Water Savings & Conservation Energy Savings Increases Property Value & Retail Sales Tax Credits & Rebates Development Incentives

To illustrate the overlap and interconnectivity of these benefits, we can examine what would be considered an economic benefit of GSI: reduced infrastructure costs and energy savings. GSI can frequently provide more benefits at a lower cost than traditional gray infrastructure using pipes. By capturing rainwater onsite, the volume of water entering the stormwater system that needs to be treated at wastewater facilities is reduced. This reduction in gallons of water requiring treatment also reduces energy use, which in turn reduces emissions from power plants. It can also reduce the size and capacity required for wastewater facilities. This is a great example of how all of the benefits of GSI are intertwined in this multifunctional systems approach.

Bicycling and GSI

Green stormwater infrastructure is highlighted in the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide. This guide establishes a standardized set of rules and recommendations for the implementation of bicycle infrastructure. The section on bicycle boulevards (aka “neighborhood greenways”) explains, “By incorporating green street elements such as bioswales, infiltration basins, permeable pavement, plantings and street trees into curb extensions, pedestrian refuge islands, and chicanes, roadway runoff is slowly attenuated onsite, water quality is improved, paving is reduced and habitat connectivity is improved” (NACTO 2012, p 273).

Equally important, the NACTO guide articulates how green stormwater infrastructure (GSI) benefits and complements bicycle infrastructure, creating a greater community amenity. These benefits include how GSI:

- “Provides an ecological and aesthetic enhancement of traditional traffic speed and volume control measures.
- Provides a more pleasant environment for bicycling, walking or sitting.
- Improves drainage, reduces sewer costs, and minimizes the risk of basement flooding.
- Improves street crossings because of reduced vehicle volume and speed and/or reduced crossing distance.
- Improves air quality, reduces the urban heat island effect, and can provide habitat connectivity by increasing urban green space.
- Reduces motor vehicle speeds along the corridor when used as curb extensions, edge islands, medians, and other speed management treatments.
- Reduces motor vehicle volumes along the corridor when used as diverters, closures, and other volume management treatments.
- Can use non-transportation funding sources, such as stormwater management or sewer treatment money, when needed improve-

ments are prioritized along bicycle boulevards” (NACTO 2012, p 274).

While some of these benefits are specific to bicycle boulevards, many are translatable to other bicycle infrastructure applications. When used with on-street facilities, GSI can be a critical element of separation between traffic and trail users. In all facilities, including off-street trails, introducing GSI makes significant improvements to the user experience, which can translate to greater use of the facility. The Missing Link is unique because it is a hybrid facility through an industrial area, with the majority of the facility being on-street, directly adjacent to the vehicle travel lanes. In contrast, the vast majority of the rest of the Burke-Gilman Trail is off-street in park-like and green corridors. Using GSI can maintain continuity with the rest of the regional transportation and recreation corridor, while integrating ecological function in an industrial area that can greatly benefit from its positive effects.

ACTIVE TRANSPORTATION

Walking and bicycling are considered the primary forms of active transportation (Dannenberg et al. 2011). Bicycling is more efficient as a form of transportation because it is faster, more convenient and has a wider geographic range of access to places. The livability of urban environments is increasingly being measured by how well infrastructure supports these alternative modes of transportation. For example, walkscore.com’s Walk Scores

and Bike Scores are frequently used by real estate agents to demonstrate the potential for walking and biking in a community and the increased property value that result from a higher score.

Trends in Bicycling

According to the U.S. Census, the number of people bicycling to work or school in the U.S. has more than tripled in size over the last two decades. This is a parallel trend to the number of miles of bicycle facilities being constructed, which has the added benefit of a decrease in bicycle collisions. Good documentation in Copenhagen, Denmark, and Portland, OR, over the last decade demonstrates this trend (figures 8 (below) and 9 (p 26)).

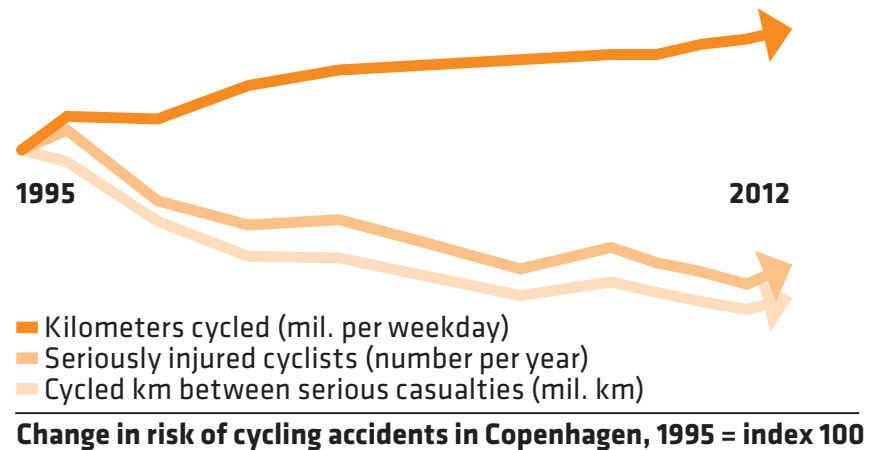


Figure 8. Copenhagen distance cycled vs. crash rate (Copenhagen 2013, p 8)

Convenience and Urban Mobility

The primary reason that people choose bicycling as a form of transport is because it is fast and

convenient. “Speed advantages of cycling, rather than health, fitness, or environmental reasons, are an important motivator for cyclists” (Pucher et al. 2012, p 57). This is especially true in cities

that have more developed bicycle facilities, because they help facilitate and expedite travel (from trails to cycle tracks to bicycle parking). In Copenhagen, Denmark, the city’s annual *Bicycling Account 2012* reports that when asked, “Why do you cycle to work/school?” 57% of bicyclists responded, “It’s faster” and 37% said, “It’s more convenient” (figure 10). With the vision provided in Seattle’s 2013 *Bicycle Master Plan*, the thoughtful design of bicycle infrastructure projects such as the Missing Link will expand and make cycling faster and more efficient locally.

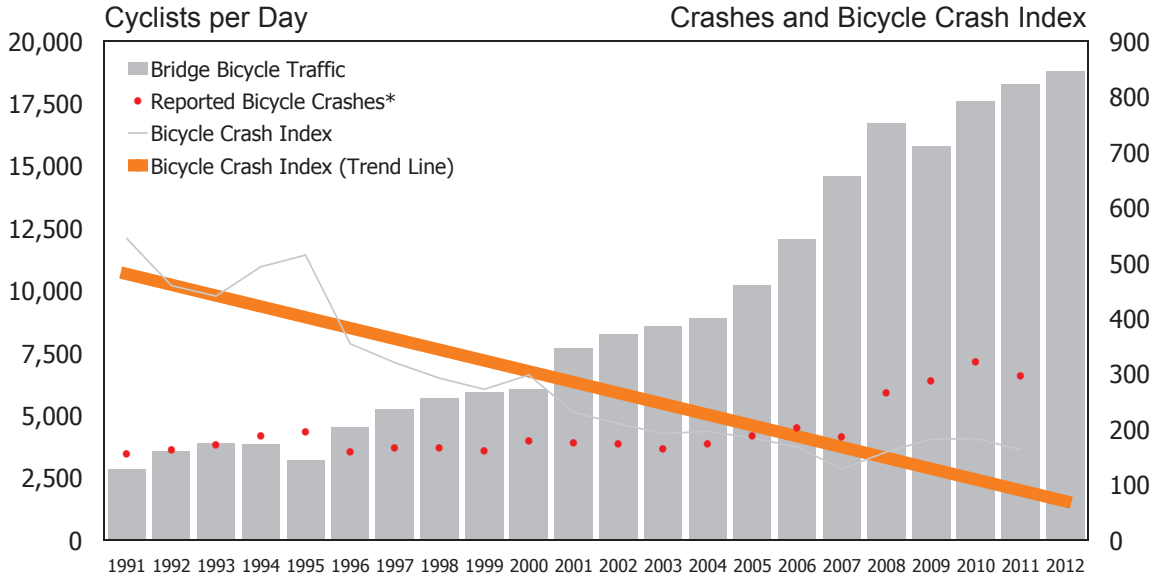


Figure 9. 1991-2012 As the bicycle traffic over five bridges in Portland increased (gray bars) the bicycle crash index trend decreased (orange line) (PBOT 2012, p 27)

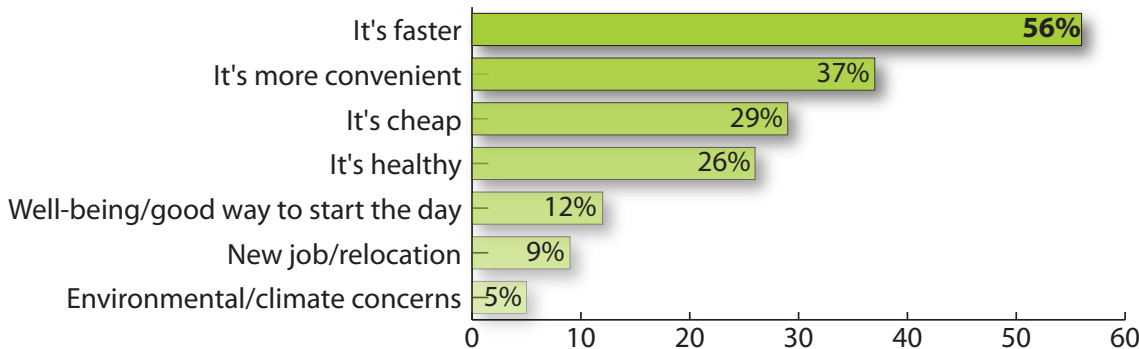


Figure 10. Why Copenhageners bike to work/school (Copenhagen Bicycling Account 2012)

resource *City Cycling* (edited by John Pucher and Ralph Buehler). He introduces the concept of “effective speed” which incorporates many other factors beyond the actual time of a trip and converts all costs into time, which is then used to calculate effective speed.

In order to calculate effective speed, Tranter (Pucher et al. 2012) factors money and non-monetary costs for motorists including, “registration, fuel, parking, tolls, fines, insurance costs, and other taxes associated with vehicle purchase and ownership. Nonmonetary costs include the time taking the journey . . . time spent filling the car with fuel” (p 58). But perhaps the most significant factor is, “how much time is devoted to earning the money to pay the costs” (Pucher et al. 2012, p 58). Tranter goes on to debate the inclusion of external (indirect) costs such as pollution or congestion. He concludes with tables that calculate the average costs for car ownership and its effective speed in 15 cities globally. Then he shows the average bicycle trip speed needed for the effective speed of cyclists to be faster than motorists. In Los Angeles the bicycle trip speed required is 9.3 mph and in New York it is 6.6 mph when factoring direct costs only. If one includes external costs like pollution and congestion it drops to 7.7 and 5.7 respectively (Pucher et al. 2012). This analysis helps place in perspective the dynamics of transportation choices and how and why people’s preferences and habits are evolving.

Health and Economic Benefits of Bicycling

Much research and documentation has been conducted on both the health benefits and economic benefits of bicycling in urban environments. These concepts are related and several recent studies have begun to quantify these benefits.

The literature on the health benefits of bicycling is expanding. There is an entire chapter devoted to “The Health Benefits of Cycling” in John Pucher’s book *City Cycling*. “In pro-cycling countries and cities, transportation cycling is undertaken by considerable numbers of children, adolescents, women, older adults, people with low incomes, and nonathletic people. Consequently, transportation cycling can make a substantial contribution to improved health through increased physical activity levels across diverse populations”(Pucher et al. 2012, p31). This quote also touches on the equity of good bicycle infrastructure. The chapter goes on to discuss the benefits of reduced car use from improved air quality to reduced noise pollution and reduced greenhouse gas emissions. Another key health benefit of everyday bicycling for transport, or utilitarian cycling, is that it is more likely to become a habit than going to the gym or even recreational bicycling (Pucher et al. 2012).

Some studies looked at specific measures of physical health as a result of bicycling, “Cross-sectional studies have shown inverse associations between active commuting and body mass index, lipid levels, and blood pressure . . . obesity rates

are inversely related to walking and bicycling rates . . . Active commuting is inversely related to diabetes incidence” (Pucher et al. 2012, p 33). A 2009 study, published in the *Journal of Public Health Policy*, of people in Portland, OR, found that participants bicycling for utilitarian purposes are able to attain healthy levels of physical activity from just their daily trips around town (Dill 2009). It is also helpful to understand that for this study the median trip distance was about 3 miles and the average trip speed was 10.8 mph. This is important, as about half of all trips of all modes of transport in metropolitan areas of the U.S. are less than 3 miles (U.S. Department of Transportation Federal Highway Administration 2009). This fact demonstrates the potential for everyday, convenient bicycling to become more widely adopted as safer and better-connected bicycle infrastructure supports this shift in travel mode.

The health benefits of bicycling extend beyond physical health benefits to include benefits in mental health and social well-being. Cycling can benefit psychological health by preventing and even treating anxiety and depression. It has also been found to improve cognitive functioning as well as increase a person’s perception of well-being. Bicycle commuters are also more likely to say their commute was pleasant, interesting or even exciting (Pucher et al. 2012).

One recent study documented the cost benefit analysis of investments in bicycle infrastructure and their effects on health care costs in Portland, OR:

“By 2040, investments in the range of \$138 to \$605 million will result in health care cost savings of \$388 to \$594 million, fuel savings of \$143 to \$218 million, and savings in value of statistical lives of \$7 to \$12 billion. The benefit-cost ratios for health care and fuel savings are between 3.8 and 1.2 to 1, and an order of magnitude larger when value of statistical lives is used” (Gotschi 2011, p 1).

This is the first study of its kind in the U.S. to project the dollar value of investments in bicycle infrastructure, specifically related to health care. It demonstrates how health and economic benefits are intertwined.

There have also been studies on the economic benefits of the construction of specific bicycle facilities as a before and after comparison. New York City has done extensive research on the construction of a new protected bike lane on 9th Avenue in midtown Manhattan. They measured a 49% increase in retail sales from locally based businesses on 9th Avenue (as opposed to 3% increase in the rest of the city during that time period). They also documented a 58% decrease in injuries to all street users on 9th Avenue (NYC-DOT 2012).

Three separate studies, in Portland, OR, New York, NY, and Copenhagen, Denmark, agree that people who arrive by bicycle spend more money per month at their destination than people who arrive by car. Those car-traveling customers typi-

cally spend more per visit, but the data shows that the bicyclists shop more frequently and spend more money over time as a result (Clifton, Morrissey and Ritter 2012; Transportation Alternatives 2012; Copenhagen 2013).

As a culture of bicycling expands in the U.S., the research that quantifies the health and economic benefits continues to grow as well. Several of these studies also suggest the various returns on investment when cities strengthen their bicycling infrastructure networks. This brief introduction to the benefits of bicycle infrastructure makes a strong case for why municipalities should make this investment. In the remainder of this thesis, I will investigate how bicycle infrastructure can be implemented safely and effectively.

Bicycle Facility Design

There are several accepted resources and guidebooks utilized by designers and planners of bicycle infrastructure in the United States. The two most common guides are published by the American Association of State Highway and Transportation Officials (AASHTO) and by the National Association of City Transportation Officials (NACTO).

The old standard was the AASHTO's *Guide for the Development of Bicycling Facilities* (1999). It was influenced by American traffic engineer John Forester's vehicular cycling theory that resulted in major setbacks in progress for creating separated paths in the U.S. (Pucher et al. 2012). Forester's

theory is essentially that "cyclists fare best when they act as, and are treated as, operators of vehicles" (Forester, 1994). In 2012, AASHTO released a new version of the *Guide for the Development of Bicycling Facilities* that is more accepting of separated bicycle paths.

The other recognized guide is the NACTO *Urban Bikeway Design Guide*, published in 2011 and revised in 2012. It is more strongly influenced by European standards and guides for bicycling facilities. "The NACTO *Urban Bikeway Design Guide* is based on the experience of the best cycling cities in the world" (NACTO, 2012, p5). It contains specific sections with design guidance for: bike lanes, cycle tracks, intersections, signals, signing and marking, and bicycle boulevards (aka neighborhood greenways).

Another important resource that is locally based is a city's bicycle master plan. After an extensive process, Seattle proposed an update to the 2007 Bicycle Master Plan in December 2013 and it was unanimously adopted by the Seattle City Council in April 2014. It is updated approximately every five years and the current plan is ambitious in its recommendations. Bicycle master plans are very useful for envisioning bicycle infrastructure at the city and neighborhood network scale. By analyzing this document and combining that knowledge with the detail scale from the design guides I have been able to develop my design thinking for bicycle facilities across scales. "Context sensitivity is important to ensure that bicycle facilities are

designed and built taking into consideration the overall characteristics of the street, the adjoining land use types, and other factors” (SDOT BMP 2013, p 24). This will be a reoccurring theme in the site analysis for my design.

Bicycle Infrastructure Implementation Strategies

Urban bicycle infrastructure has a number of design strategies that help to address some of the potential conflicts with vehicles. Some fundamental features that can be incorporated into bicycle facilities and help improve safety are access management, intersection treatments and speed management. These can be adapted to site-specific conditions.

One basic principle for any bicycle facility is to reduce the number of conflicts and crossings between bicycles and vehicles. “Access management—limiting driveways and minor intersections on streets whose main function is to carry through traffic—is a well-recognized safety practice in both Europe and the United States . . .” (Pucher et al. 2012, p 122). While limiting intersections is helpful, it is not always feasible. Where minor intersections exist, “Elevated crossings clearly signal cyclists’ priority over cross traffic and act as a speed hump, reducing both the likelihood and severity of crashes with motor vehicles” (Pucher et al. 2012, p 121). However, streets and intersections have a hierarchy and sometimes vehicles should be prioritized. Intersection markings and

signalization can be one solution, “Intersection crossing markings indicate the intended path of bicyclists. They guide bicyclists on a safe and direct path through intersections, including driveways and ramps. They provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane” (NACTO 2012, p 79). While markings alone will not make intersections safe, they are frequently a piece of the puzzle.

Speed management is one broad strategy that can have dual functionality. This includes reducing travel lane width for vehicular traffic. Designers can accommodate bicycle facility design and calm traffic by reducing travel lane width. “Gaining acceptance for 10-foot-wide travel lanes has been a key to several U.S. cities’ ability to find space for bikeways . . . (Potts, Harwood, and Richard, 2007), in an extensive study sponsored by the Federal Highway Administration (FHWA), found that on urban and suburban arterials, 9- and 10-foot travel lanes had the same safety performance as 11- and 12-foot travel lanes, except on undivided multilane arterials” (Pucher et al. 2012, p 121). Narrower streets provide visual cues to drivers that they are no longer on a highway and must adjust their speed accordingly.

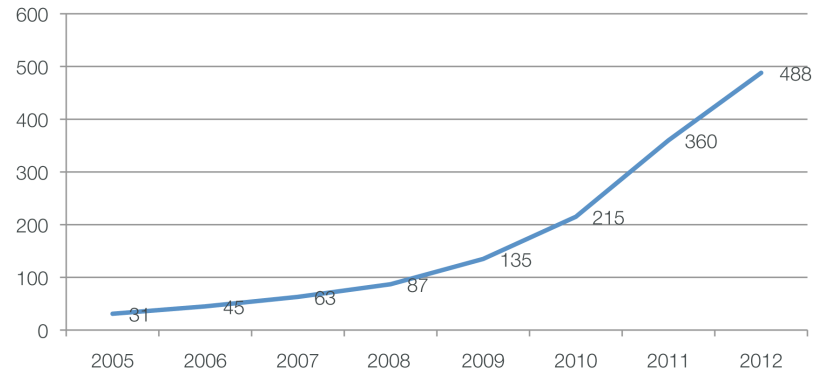
While many of these facility design guides and recommendations are more frequently associated with on-street bicycle facilities, they can be implemented along certain stretches of the Missing Link to address conflicts, driveways, intersec-

tions, and proximity to the road. This is especially true given that the nature of the route changes measurably over the course of the Missing Link, and may need to function more like an on-street bicycle facility than an off-street trail given space constraints and potential conflicts.

COMPLETE STREETS

Another related and dramatic trend in our urban centers is the creation of new policies and resolutions that provide a framework for building more equitable and livable streets. “Complete Streets policies formalize a community’s intent to plan, design, operate, and maintain streets so they are safe for all users of all ages and abilities. Policies direct decision-makers to consistently fund, plan for, design, and construct community streets to accommodate all anticipated users, including pedestrians, bicyclists, public transportation users, motorists, and freight vehicles” (Smart Growth America 2013 p 1). From 2005 to 2012 there was a 15-fold increase in the number of Complete Street policies nationwide.

Some skeptics might ask, “Why do you want to make these changes?” The consistent thread in the literature is sustainability, but more specifically in this case, it is also the triple bottom line of positive economic, environmental and social improvements to a community. The language of one more recent Complete Streets policy (adopted in 2012) captures the essence of these benefits:



In 2012, 125 communities adopted Complete Streets policies. Policies are in now place in 488 communities nationwide, including 27 states, the Commonwealth of Puerto Rico and the District of Columbia; 42 regional planning organizations; 38 counties; and 379 municipalities of all sizes.

Figure 11. Rising trend of Complete Streets policies in U.S. 2005-2012 (Smart Growth America 2013)

Northfield [Minnesota] intends and expects to realize long-term cost savings in improved public health, better environmental stewardship, reduced fuel consumption, and reduced demand for motor vehicle infrastructure through the implementation of this Complete Streets policy. Complete Streets also contribute to walkable neighborhoods, which can foster interaction, create a sense of community pride and improve quality of life” (City of Northfield 2014, under “Purpose”).

Seattle’s Complete Streets Policy, an ordinance passed in May 2007 by the City Council, establishes guiding principles for SDOT and their implementation of transportation improvements, as the following excerpt from Seattle City Council

Ordinance 122386 demonstrates:

“WHEREAS, Seattle’s Complete Streets guiding principle is to design, operate and maintain Seattle’s streets to promote safe and convenient access and travel for all users—pedestrians, bicyclists, transit riders, and people of all abilities, as well as freight and motor vehicle drivers . . .

WHEREAS, transportation improvements will include an array of facilities and amenities that are recognized as contributing to Complete Streets, including: street and sidewalk lighting; pedestrian and bicycle safety improvements; access improvements



Figure 12. Complete Streets enhancements can include intersection improvements such as bulbouts, green stormwater and bicycle infrastructure shown above in Victoria, BC (Creative Commons: Dylan Passmore)

for freight; access improvements, including compliance with the Americans with Disabilities Act; public transit facilities accommodation including, but not limited, to pedestrian access improvement to transit stops and stations; street trees and landscaping; drainage; and street amenities . . .” (City of Seattle 2007, under “Text”).

While Seattle was one of the earliest adopters of a Complete Streets policy it may need to be revised for it to be more successfully implemented in practice. Seattle’s policy does set the stage for the inclusion of green stormwater infrastructure (GSI) in transportation projects similar to how the Seattle Green Factor does for development projects. As the Complete Streets policy is more widely implemented and the understanding and scope of it expand, it will become easier to implement both green stormwater infrastructure and bicycle infrastructure in the same projects on our city streets. One improvement to the policy would be to make the integration of GSI more explicit than the term “drainage.”

The bicycle community also realizes the crossover between Complete Streets principles and bicycle infrastructure. “The bikeways of the future won’t just be safer spaces for people biking; they will also need to be anchors for pedestrian improvements and create greener and more aesthetic shared space throughout the city” (SF Bicycle Coalition 2012, under “Pilot Projects”).

It is likely not a coincidence that the number

one rated Complete Streets policy in the nation was adopted by Indianapolis, IN (Smart Growth America, 2013) around the same time that they finished one of the most innovative and celebrated bicycle infrastructure projects ever built in the United States. It was rated the number two project on the People for Bikes' list of "America's 10 Best Protected Bike Lanes of 2013."

Envisioning, Funding and Supporting "Complete" Infrastructure

The implementation of the vast majority of bicycle facilities falls under the auspices of a municipality's Department of Transportation or Department of Public Works. Most projects should be funded as capital improvement projects. However, there is a growing trend to complement these investments for unique projects, typically ones that could be considered catalyst projects, with funding from new partnerships. In some cases the additional funding comes from other municipal agencies such as the Public Utilities Department as part of their oversight of drainage. This partnership is vital when using green stormwater infrastructure as a component of separation in bicycle facilities. In other cases the funding is privately generated.

The Indianapolis Cultural Trail is an example of a project that succeeded through substantial private investment, in the form of a public/private partnership. \$27.5 million or 44 percent of the \$63 million total cost was invested in the project by private individuals, foundations

and local corporations, including an early \$15 million individual legacy donation. This is one way that collaborative investment in bicycle infrastructure can get projects built.

Memphis, TN, funded, designed and broke ground in February 2014 for a \$4.5 million two-way

Protected Bicycle Lanes

Protected bicycle lanes (aka cycle tracks) are on street bicycle facilities that are separated from vehicles. There are many techniques for creating this separation that run a wide spectrum of cost, comfort level of riders, and ease of implementation. Methods include using posts, parked cars, curbs, or planters (figure 13) to achieve this separation.



Figure 13. Two-way protected bicycle lane (aka cycle track) using planters in Vancouver, BC (Creative Commons: Paul Krueger)

Team Better Block

Co-founded by Jason Roberts and Andrew Howard, Team Better Block consults cities and neighborhoods worldwide to create participatory demonstrations that visualize, “. . . the potential to create a great walkable, vibrant neighborhood center.

The project acts as a living charrette so that communities can

actively engage in the “Complete Streets” buildout process and develop pop-up businesses to show the potential for revitalized economic activity in an area” (Better Block, 2014). The first Better Block project was implemented in the founders’ home town of Dallas, TX, and the majority of the cities that they consult for are in the U.S. This type of inspirational pilot project could be classified as “tactical urbanism” (Streets Plan Collaborative 2012). Their “living charrettes” introduce such public space and right-of-way strategies as demonstration cycle tracks, café seating, crosswalks and other traffic calming techniques as well as pop-up businesses all with the help of the local residents.

This is the community-organizing portion of both Complete Streets and bicycle facilities that can galvanize a community and convert residents into champions (and even funders) of more permanent interventions in the right-of-way. I had the unique opportunity to meet with Better Block co-founders while interning in Copenhagen, DK, during their public speaking tour. Their enthusiasm and passion are clearly evident when talking about how vital grassroots demonstration projects are to the process of creating livable streets and cities.



Figure 14. Team Better Block’s two-way demonstration protected bicycle lane in Kansas City, MO (Better Block)

protected bicycle lane through the arts district of an underserved community. This project, called “The Hampline” was jumpstarted using a pilot project in 2010 sponsored by Livable Memphis, Historic Broad Business Association and Memphis Regional Design Center. A demonstration cycle track was a key component used by Team Better Block (see sidebar/figure 14), a not-for-profit tactical urbanism consultancy.

Online tools have exploded as a way for people to donate money to projects in which they believe. Crowd-funding is one new multifunctional way to raise money for projects. However, it is a way to close funding gaps, not a way to entirely fund projects. Most people are familiar with kickstarter.com, one of the largest crowd-funding portals. It started as a tool for small businesses and organizations, but has expanded to have a wider variety of users because of its success in quickly generating money, interest and support. The Memphis, TN, project raised over \$75,000 using a different portal called ioby.org, which is geared more towards neighborhood and block scale of built environment improvement projects. This kind of tool should be considered for a bicycle infrastructure project such as the Missing Link.

Real estate developers are also successfully using the crowd-funding model. It is a key new strategy in building enthusiasm and ownership of a project by the local community. There are over twenty companies that exist in this emerging market (Forbes 2014). People would be much more likely to visit or use a building or facility if they “owned” a stake in it. This concept can be applied to bicycle facilities as well, generating more enthusiasm and care for a new project.

It is also worth noting that the bicycle industry-sponsored non-profit organization **People for Bikes** is another new funding source and partner for a variety of bicycle oriented projects. This national organization advocates for safe and convenient bicycle facilities, collaborating with millions of bicyclists and businesses as well as community and elected leaders. Their “**Green Lane Project**” is a major source of financial and technical support for protected bicycle lanes across the country.

Not coincidentally, Memphis, TN, was one of the first six cities to receive financial, strategic and technical assistance from the Green Lane Project to implement protected bicycle lanes or cycle tracks in 2012. Memphis, along with Austin, TX, Chicago, IL, Portland, OR, San Francisco, CA and Washington, DC, constructed half of the 62 miles of new protected bicycle lanes constructed in the U.S. in 2012-2013. The Green Lane Project acts as a catalyst, helping cities on the cusp of creating great bicycle infrastructure networks to realize critical projects.

In March 2014, People for Bikes announced that Seattle, WA, along with Atlanta, GA, Boston, MA, Denver, CO, Indianapolis, IN, and Pittsburgh, PA, would be the next cohort of cities to participate in their comprehensive two-year program to build low-stress bike lanes that people of all ages and abilities feel comfortable using (People for Bikes 2014). Seattle’s selection is both an indicator of the existing bicycle programs and facilities and a sign of great investment and progress to come in the near future. This is further evidence of the local momentum for bicycling, which will be a critical ingredient for completing the Missing Link of the Burke-Gilman Trail.

Another source of support for infrastructure projects is leveraging public/private partnerships.



Figure 15. People for Bikes provides bicycle infrastructure resources such as photos, statistics, reports, and technical assistance (People for Bikes)

This is one strategy that has been adopted for financing major green stormwater infrastructure (GSI) projects and is gaining acceptance and use from municipalities and financial institutions. It is a key way to scale-up the investments in GSI, the benefits of which extend far beyond the environment to support community revitalization and economic stimulation. It is estimated that major public/private partnerships can create thousands of jobs in the green industry. For example, the partnerships currently occurring in Prince George's (PG) County Maryland have reported such an outcome (U.S. EPA Webcast 2014). PG County has been a leader in GSI, and created one of the first Stormwater Manuals to guide the implementation of green stormwater infrastructure.

Federal support for GSI has expanded in recent years through the Environmental Protection Agency's programs as well as through other transportation initiatives. The Transportation Investment Generating Economic Recovery (TIGER) grant program was refunded in 2014, offering over \$600 million in funds for infrastructure investments. ". . . there is an extraordinary amount of language about transportation complimentary green infrastructure . . . So GI [green infrastructure] for groundwater recharge, and all other forms of green water infrastructure are a priority within this \$600 million fund" (U.S. EPA Webcast 2014).

The public/private partnership model is not without its problems. Skeptics might reference Privately Owned Public Open Spaces (POPOS) as a frequent example of where public/private

partnerships can go wrong. There has been misuse of the POPOS typology in many cities that is leveraged by developers to gain additional development rights from municipalities. It ranges from spaces that are very questionable as to how "public" they are to management practices that infringe on equitable use and social justice. Problems arise when owners are not accountable to the public and when they have too much control over how the space can be used. A common issue is the ability of an owner to have loiterers or homeless people removed from a POPOS. Another example of this spatial typology that is not very public is a rooftop-terrace with controlled access through a building lobby. However, it is important to not dismiss this tool as a result of projects that had poor oversight, management or execution. Public/private partnerships are a valuable means in getting larger scale projects constructed with the trade-off that they necessitate more attention to transparency and accountability.

Diversifying the ways in which we generate interest in, and raise funds for, innovative infrastructure projects can jumpstart their successful implementation in our cities. Economies of scale can be achieved through public/private partnerships, while grassroots organizing and fundraising can stimulate public involvement and support. Together these methods for envisioning, funding and supporting infrastructure projects have a greater power to earn public and government backing that is critical for the expansion and upgrade of our urban infrastructure.

PRECEDENTS

Ramping Up: Lessons from Elevated Bicycle and Pedestrian Facilities

As I conducted the site analysis and developed a design framework, I came to the conclusion that one potential solution to address the existing physical and social conditions is to elevate a portion of the trail. In reviewing examples locally and nationally I have highlighted specific elements from each that could be extracted and applied to the context of the Missing Link.

In Seattle, the **West Thomas St Pedestrian and Bicycle Overpass** was completed in 2012. It is a simple structure that works well with the grade to connect the lower Queen Anne neighborhood over a major arterial and railroad tracks

to the waterfront. The overpass is 12' wide, 932' long and cost \$10 million (ABKJ 2014). While it does provide excellent views of Elliot Bay and the Olympic Mountains, its only amenity is a very modest overlook with no additional features of seating or vegetation (figure 18). However, the width of the structure and how it connects into the hillside to work with the grade (figure 16) are key features that can be incorporated into the Missing Link design.

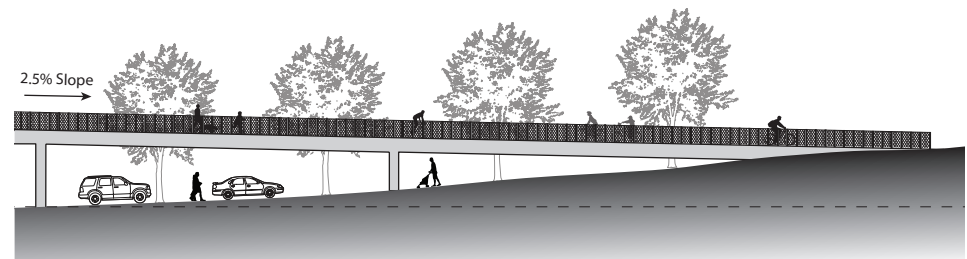


Figure 16. An example of an elevated bicycle and pedestrian trail that works well with the grade (Schwindeller 2014)



Figure 17. West Thomas St Pedestrian and Bicycle Overpass north (Queen Anne) entrance (Schwindeller 2014)



Figure 18. West Thomas St overlook (Schwindeller 2014)



Figure 19. Vancouver Land Bridge, Vancouver, WA
(Creative Commons: Wendy Bumgardner)



Figure 20. The High Line, New York, NY
(Creative Commons: Vilseskogen)

Moving further away from the site and expanding the type of facility, the Vancouver Land Bridge (Vancouver, WA) and the High Line (New York, NY) are examples of elevated walkways that provide significant public space amenities. While these precedents are at an entirely different scale with a different intent—e.g. the High Line does not allow bicycles—they provide a glimpse of the types of spaces that can be created on an elevated structure. My design includes several nodes that are wider and include invitations to stay inspired by these examples.

The **Vancouver Land Bridge** is a unique pedestrian and bicycle highway overpass that spans State Route 14. Opened in 2008 as part of Maya Lin's Confluence Project that traces 450 miles of Lewis and Clark's route West, it is 40' wide and cost \$12.25 million. It was funded through federal, state and private funding. The land bridge connects Fort Vancouver with the Columbia River and was created with the partnership of the National Park Service, the Confluence Project, the City of Vancouver and the Washington State Department of Commerce (Confluence Project).

The **High Line** is a very high profile project located in the lower-west side of Manhattan in New York City that opened in 2009. While bicycles are not allowed, it is a celebrated example of how elevated public space can successfully merge invitations to stay with green stormwater infrastructure and weave them together with a thread of historic interpretation. The High Line is a 1.45 mile converted freight rail line 30' above the street and 30' to 60' wide. It was slated for demolition in 1999, but saved through the use of railbanking. It was designed by the landscape architecture firm, James Corner Field Operations and architecture firm, Diller Scofidio + Renfro (Friends of the High Line 2014, under "About"). The High Line is another example of major infrastructure project, completed through public/private partnerships that provides significant pedestrian and public space amenities from vegetation to seating to stormwater planters.

Other examples of significant bicycle and pedestrian bridge facilities include the **Martin Olav Sabo Bridge** in Minneapolis, MN, and the **Big Dam Bridge** in Little Rock, AK. The Sabo Bridge, completed in 2007, is 2,200' long



Figure 21. The Big Dam Bridge, Little Rock, AK
(Creative Commons: E. Glavin)



Figure 22. The Martin Olav Sabo Bridge, Minneapolis, MN
(Creative Commons: Thirteen of Clubs)

and cost \$5 million, with 82 percent of the cost funded by the federal government and 18 percent by the county. The bridge is part of the “Mid-town Greenway” which was *USA Today’s* top urban bike trail in 2013. The Big Dam Bridge was constructed

in 2006 to complete the Arkansas River Trail. It is 14’ wide, 4,226’ long and cost \$12.8 million. The Big Dam Bridge is the longest pedestrian and bicycle only bridge in the U.S. and connects 15 miles of riverfront trails (Big Dam Bridge 2014).

Cost vs. Benefit of Bicycle Facilities

“There’s been some criticism about the amount of money we spend on these facilities, particularly when they’re off-road facilities and dedicated trails. But when you do the head count and you really do the cost/benefit analysis, and compare that to how much money we put into the transportation infrastructure for cars—and you look at the benefit, in terms of transportation, in terms of connecting communities, in terms of livability, quality of life and just how it makes people feel about where they live—it just can’t even be compared” (Minnesota State Senator S. Scott Dibble, quoted by Eckerson 2011).

Table 2. Comparison of elevated bicycle/pedestrian facilities

Bridge	Length	Width	Cost (millions)	Other Amenities
Big Dam Bridge (AK)	4,226’	14’	\$12.8	Eight observation areas, longest pedestrian/bicycle bridge in U.S.
Sabo Bridge (MN)	2,200’	18-30’	\$5	
Thomas St Overpass (WA)	932’	12’	\$10	Overlook of Elliot Bay and the Olympic Mountains
Vancouver Land Bridge (WA)		40’	\$12.25	Earth-covered, with native plants
High Line (NY)	7,656’	30-60’	\$152 (sections 1 & 2)	Extensive seating and planting

INDIANAPOLIS CULTURAL TRAIL CASE STUDY

This case study is provided to highlight valuable hybrid infrastructure lessons that can be translated to the Missing Link of the Burke-Gilman Trail. The Indianapolis Cultural Trail (ICT) was conceived in 2001 as part of the Indianapolis Cultural Development Commission's economic development strategy. It is an eight-mile off-street trail for bicyclists and pedestrians that was accommodated by converting traffic lanes and parking spaces. The intent was to connect six cultural districts and generate economic growth and investment downtown. They broke ground in 2006 and several trail segments opened during 2010-2012. The trail was completed in May 2013. Lessons can be learned from the Indianapolis Cultural Trail related to both funding and design that can be applied to the Missing Link.

Process

It is important to realize that this project was comprehensive and took more than a decade to complete. One of the primary champions of the trail is Brian Payne, President of the Central Indiana Community Foundation. Mr. Payne cites the importance

of their approach, "We didn't talk about this as an infrastructure project, we talked about it as a quality of life and an economic development project" (Eckerson 2013, under "Video," 2:22).

The trail cost of \$63 million was both publicly and privately funded. Public funding sources included \$20.5 million from the U.S. Department of Transportation's 2010 Transportation Investment Generating Economic Recovery (TIGER) grant program. The Indiana University Center for Urban Policy and the Environment conducted a study in 2008 that estimated the economic impact of the project at \$864.5 million



Figure 23. Stormwater planters with trees on the Indianapolis Cultural Trail
(Credit: Rundell Ernstberger Associates)

and that part of that would include the creation of an estimated 11,372 jobs (ICT 2013).

Design

The design of the trail is strongly based on connections to landmarks, cultural districts and to pieces of the greater network of bicycle infrastructure in the city. The eight miles of trail provides significant connections to other bicycle facilities in the city. It links almost 40 miles of the Indianapolis Parks Greenway Trail system as well as 65 miles of bike lanes (ICT 2013). One feature of the trail that makes it unique is the integration of 25,400 square feet of stormwater planters. That combined area is able to capture and filter 4 million gallons of rainwater per year, which is approximately 40,000 gallons per rain event (ICT 2013). The location and usage of these stormwater planters is a critical design lesson. They are the primary form of separation from traffic, between the trail and the vehicle travel lane. By placing the stormwater planters here there are benefits of both protection from traffic as well as intercepting and treating the polluted stormwater runoff from the road surface.

There are several additional methods that the designers of this project used to calm traffic and improve the safety of trail users. All intersections are raised to meet the level of the trail, and custom crosswalks are made with a product called “duratherm” that provides a durable and iconic intersection treatment (figure 24) (Eckerson 2013).



Figure 24. Duratherm intersection treatment, created with a thermoplastic material inlaid in the asphalt. (Creative Commons: Jun Wang)



Figure 25. Mixing of pedestrians and bicycles separated from traffic with plantings (Credit: Chris Gahl/Visit Indy)

Summary

The Indianapolis Cultural Trail is an innovative bicycle infrastructure and Complete Streets project that prominently features green stormwater infrastructure (GSI) (figure 26). There are several lessons that can be learned by studying their approach from intersection design to planting strategies. Many of these strategies are directly translatable to the design of the Missing Link. Elements such as stormwater planters, intersection treatments, separation from traffic and concepts like the restructuring of parking and travel lanes, connections to the city bicycle network, integration of artwork, and funding from public/private partnerships can inform the design approach to the Missing Link. As enhanced standards for GSI become the new norm, especially in Seattle, designers should consider how to use bioretention cells and other forms of GSI as a new tool to support and separate bicycle facilities.



Figure 26. Stormwater planter showing curb cut
(Credit: Indianapolis Cultural Trail)

CHAPTER 3 DESIGN FRAMEWORK:

Using local research as a foundation for a contextually responsive design

The design framework offered in this thesis is grounded in a selection of research methods including archival research, observational techniques, photo documentation, mapping, and interviews. In developing my design framework, I synthesized the findings from my interviews with the conclusions I drew from the literature review. The result is a framework that reflects stakeholder input, features of previous unrealized designs of the Missing Link and my interpretation of how these meld with current infrastructure and urban design practices implemented successfully elsewhere.

Figure 27. View from the Ballard Bridge looking west at the intersection of Shilshole Ave NW and NW 46th St

Stakeholder Interviews

The interviews that I conducted provided insights from four major groups invested in the project outcome: municipal agency staff and designers, marine industrial interests, bicycle advocates and neighborhood representatives. The recruitment process for the interviews began with identifying key stakeholders from each of the four unique groups with connections to the Missing Link. Initial contact was made via e-mail, explaining the context for the interview and requesting an interview appointment. Additional individuals and connections arose from the early interviews, resulting in a snowball sampling that was more comprehensive.

After evaluating the circumstances, particularly the fact that this project has been the subject of legal action, I decided to offer to protect the identity of the people that I interviewed. I made it explicitly clear that their input was strictly confidential and in service to the development of my design framework and the resulting design proposal (see Appendix p 104: Informed Consent Form). This was a conscious decision in order to elicit the maximum amount of information from the people that I interviewed. As a result, I am only able to share a fraction of the content of the interviews in order to preserve my promise to protect their anonymity. The most critical concepts and quotes are provided in the following pages. I cannot understate the value and influence that these interviews—of people with a combined 121 years experience of working on/

in this corridor—provided in the development of my design approach. There are certain themes and quotes that I will share and explain how they influenced the design.

Key Concepts

Chapter Two outlines some of the concepts and practices used in existing bicycle infrastructure and Complete Street projects. Blending those elements with the feedback from stakeholders and influencers formed the basis for composing a negotiated framework for design. The key concepts that structure the resulting design framework include:

1. Safety of trail users
2. Organization of bicycles, pedestrians, parking
3. Proximity of the trail to high speed traffic
4. Ecological quality and separation created by green stormwater infrastructure (GSI) and planting where possible
5. Access to driveways and loading docks
6. Connections to local businesses for all users

These considerations each have physical manifestations and design moves that address the needs of the community and trail users. The process of formulating a design framework was not linear, but iterative in a way similar to a design process. There is a reciprocal relationship between research investigations and site analysis in this work. This dialogue of research and design is the nexus of the negotiation that grounds this design

in place, history and context as well as other social and economic concerns. The schematic design in Chapter Five is therefore my interpretation of how to resolve the existing conditions, based on previous designs, precedents and stakeholder input as represented in the framework, in a negotiation of the needs of the greatest diversity of users.

Safety of Trail Users

The focus of this thesis is on how to design the trail to facilitate safety in a manner that provides greater amenities and multifunctionality to all. Fortunately, this is one of the few concepts on which practically everyone can agree. The contention mentioned earlier, that has manifest itself in the form of several lawsuits, stems from *how* and *where* the city constructs the Missing Link. I acknowledge that people from the marine industrial interests that I spoke with do not believe that the trail can co-exist with the businesses in the area and still be safe. However, I would argue that in order for a protected or separate bicycle facility to function safely in *any* right-of-way, *all* users require a behavior modification. The design should facilitate this behavior change as part of the safe negotiation of the transformation of space.

The Missing Link section of the Burke-Gilman Trail has a unique juxtaposition of land uses, that is typically not found elsewhere on the trail.* As a result of this unique condition, a portion of all of the stakeholder interviews touched upon land use. When speaking with the marine industrial in-

terests, this was a more substantial portion of the conversation. In the context of land that is zoned “industrial” and has been used that way for more than a century, there are additional challenges to safety. The condition today includes a significant number of vehicles, often large ones with oversized turning radii and blind spots, and an equally large number of driveways and access points. The site analysis in the next chapter further quantifies my observations of the number and concentration of driveways. A marine industrial interest interviewee confirmed some of the sizes and volumes of trucks, stating that there are approximately 300 crossings at one driveway per day (Salmon Bay Sand & Gravel) and that 75-foot tandem fuel trucks are frequently navigating the corridor.

**Some argue that the section just to the east of the Missing Link from 11th Ave NW to 3rd Ave NW (the Fremont neighborhood) has the same condition as the Missing Link. I refute this argument on the basis that the trail crossings are consolidated at city street intersection crossings and there is no loading access, parallel road or turning movements across traffic.*

The safety of vulnerable users of the corridor today is greatly impacted by the existing condition of the ground surface. Currently, poor pavement, harsh transitions and seams and railroad track crossings, are all very significant challenges for a bicyclist trying to navigate the corridor, especially when forced to mix with traffic. Compounding these facts with **confusing wayfinding contributes to the unpredictability of users**. I catalog some of these conditions in my

site analysis in the following chapter.

One of the major concerns vocalized by the marine industrial interests is the potential for pedestrian/bicycle and truck collision incidents and the ramifications that would have for their insurance. Several of the other stakeholders are familiar with this concern and one responded in the following way:

“For them [the industrial interests] the liability is a major issue. I contend that liability exists today, even worse than if you had a trail built. Because now you have pedestrian and cyclists that are in undefined areas. I would think that the uncertainty and risk exists more profoundly today than if you had one space to put all of these people” (Municipal Agency Staff/Designer).

This comment regarding the existing situation and liability informs both the need for safety and the need for organization. The next key concept focuses on organization, overlapping with safety in a way that facilitates a higher diversity of users.

Organization of Bicycles, Pedestrians and Parking

Both the industrial interests and municipal staff and designers highlighted the need for organization of movement and space in the area of the Missing Link. “Part of the problem is that nobody knows where a cyclist is going to be at any given moment” (Marine Industrial Interest). And they reinforce how critical organization is in support of

safety: “The safety comes from everybody knowing where everybody is” (Municipal Agency Staff/Designer).

Part of my rationale for selecting the Rail/Shilshole Ave NW alignment is the existence of significant potential and space to organize the right-of-way. If this change were to take place, all users would benefit from the clarity and hierarchy. This translates to formal space allocation for trail users and vehicles and using design strategies to create increased awareness and reduced speeds at potential conflict points.

The reorganization would look and function differently than it does today in order to reconcile the needs of the diverse group of users. This would require minor behavior modifications in some of the driving patterns of the marine industrial vehicle operators, but not enough to have a significant impact on business operations. For example, the turning movements may need to occur at tighter angles or new vertical elements many require slightly adjusted routes. The reorganization provides many opportunities to maintain a high level of parking for both employees and customers for both sets of businesses along the corridor, which have been incorporated in the design proposal.

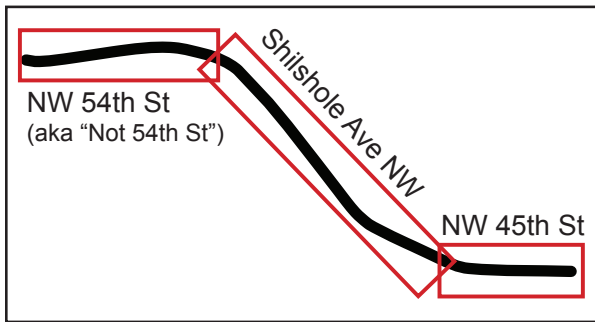
Proximity to High Volume and Moderate Speed Traffic

The location of the trail following Shilshole Ave NW, and to a lesser extent following NW 45th St,

places it adjacent to high volumes of traffic traveling at moderate speeds. This proximity is another concept that is related to safety, and it is part of the justification for different forms of separation between uses by travel mode. Basic analysis of the corridor reveals the differences in character of three unique segments.

As the right-of-way usage and width changes, one strategy for separation may be more appropriate

than another. In order to support some of my other goals of multifunctionality and ecological function, I utilize different methods of separation that are more than just a barrier between bicycles and motor vehicles.



Map 5. The three unique segments of the Missing Link

Ecological Quality and Separation Created by GSI and Planting

One critical theme in this design is the enhancement of the ecological quality of a popular corridor

Table 3. Missing Link segment characteristics

Missing Link Segment	Typical Width	Traffic Volume	Traffic Speed	Turning Movements
NW 45th St (East)	66 feet	Medium	Medium-Low	Medium
Shilshole Ave NW (Central)	100 feet	High	Medium-High	High
NW 54th St (West)	60 feet	Low	Low	Medium-Low

using planting where possible, and more specifically, using green stormwater infrastructure (GSI) as a way to create the separation from traffic at the same time as providing ecosystem services. This multifunctional approach increases the benefits generated by the Missing Link infrastructure project as well as opens up new funding opportunities. The Indianapolis Cultural Trail demonstrated how GSI could successfully be used to create this beautiful and functional buffer from traffic. This technique is used predominately on either end of the Missing Link corridor (NW 45th St and NW 54th St) and other strategies are used to negotiate the separation of vehicles and bicycles in the middle section along Shilshole Ave NW.

Access to Driveways/Loading Docks

In addition to liability, the other central concern for the marine industrial interests is the impact to business access. This is a common consideration any time one is designing a bicycle facility, especially a protected bicycle facility, as it is typically located between the vehicle travel lane and driveway access to properties. In the case of the Missing Link, the difference is the size and frequency of the vehicles moving through the area. Trying to navigate the corridor the way it exists today is inhospitable, and it is challenging to envision how it could work for all parties. By organizing the right-of-way, the reconfiguration begins to address this seemingly impossible situation. Trade-offs and compromises need to be made in locations and ways that have the least

impact to the marine industrial businesses while improving safety, organization, multifunctionality and efficiency.

In some cases, the proposed design provides a low-speed and low-traffic driveway access road to accommodate the loading and unloading activities that are a part of business operations. In other cases, the large vehicle turning radii does not allow for access from the driveway access road. A clearly marked crossing, with green pavement markings, can maintain access for these large trucks. The pavement markings at trail crossings are intended to indicate to both the vehicle operator **and** the bicyclists that there is a need for caution at this potential conflict point. In some cases a raised trail crossing may be appropriate to further calm vehicle speeds and indicate the crossing of the trail.

Connections to Local Businesses

The concept of connections occurs on several levels and with different entities. When considering both the marine industry and the Ballard Avenue Historic/Landmark District, this connection should be supportive of the economic benefits and relationship these businesses have with the community. First, there is a physical and spatial connection. This concept has more significance to the commercial district, providing a flow of active transportation trail users to their door.

The second type of connection is more visual and mental in nature. There is an opportunity to show-

case and celebrate the marine industrial business uniqueness and contribution to the neighborhood and the region. Visitors and neighbors alike can be made aware of the significance of this working waterfront, the shipping and fishing activities it supports as well as its economic and cultural importance to the city. These businesses support millions of dollars of commerce as well as significant tax revenue and blue-collar job creation for Seattle. Through interpretative signage and other more subtle design elements such as art and material selection, the design and completion of the Missing Link could tell the story of the corridor, from filled in wetlands to the lumber industry to the maritime industry of today.

Summary

This chapter identified lessons learned from some of the research techniques applied to the site of the Missing Link through the Ballard neighborhood of Seattle. It builds on the more general concepts and precedents introduced in Chapter Two to create a design framework that is sensitive to the local context and the negotiation with the various stakeholders. Extensive information from interviews was distilled down to key concepts that began to be paired with physical and spatial strategies to achieve design objectives. Chapter Four provides an examination and analysis of the site and its existing conditions, further building the case for the design decisions proposed in this thesis.

Table 4A. Design framework concepts, strategies and examples




Design Concept	Strategies	Examples
<p>Safety of trail users</p>	<ul style="list-style-type: none"> • Protection from vehicle traffic • Protection from train tracks and poor pavement 	
<p>Organization of bicycles, pedestrians and parking</p>	<ul style="list-style-type: none"> • Consolidate bicycle and pedestrian traffic onto one clear pathway • Formalize parking for higher efficiency, use as buffer from traffic 	
<p>Proximity of the trail to high speed traffic</p>	<ul style="list-style-type: none"> • Create a physical buffer from traffic • Use traffic calming techniques to reduce vehicle volumes and speeds 	

Table 4B. Design framework concepts, strategies and examples

Design Concept	Strategies	Examples
<p>Ecological quality and separation created by green stormwater infrastructure (GSI) and planting where possible</p>	<ul style="list-style-type: none"> • Bioretention cells (curbs, grade change, vegetation) • Trees as vertical elements as sight clearances allow 	
<p>Vehicular access to driveways and loading docks</p>	<ul style="list-style-type: none"> • Secondary driveway access roads • Green pavement markings at trail crossings • Raised intersections 	
<p>Connections to the local businesses for all users</p>	<ul style="list-style-type: none"> • Physical access to businesses • Visual and mental connection to businesses from viewpoints and interpretative signage 	

CHAPTER 4 EXISTING CONDITIONS AND SITE ANALYSIS:

Documentation and
evaluation of trail alignment
and neighborhood

This chapter represents an extension of the research methods used to develop the design framework. The primary methods include photo documentation and mapping, building on the understanding of the challenges and opportunities of the corridor.

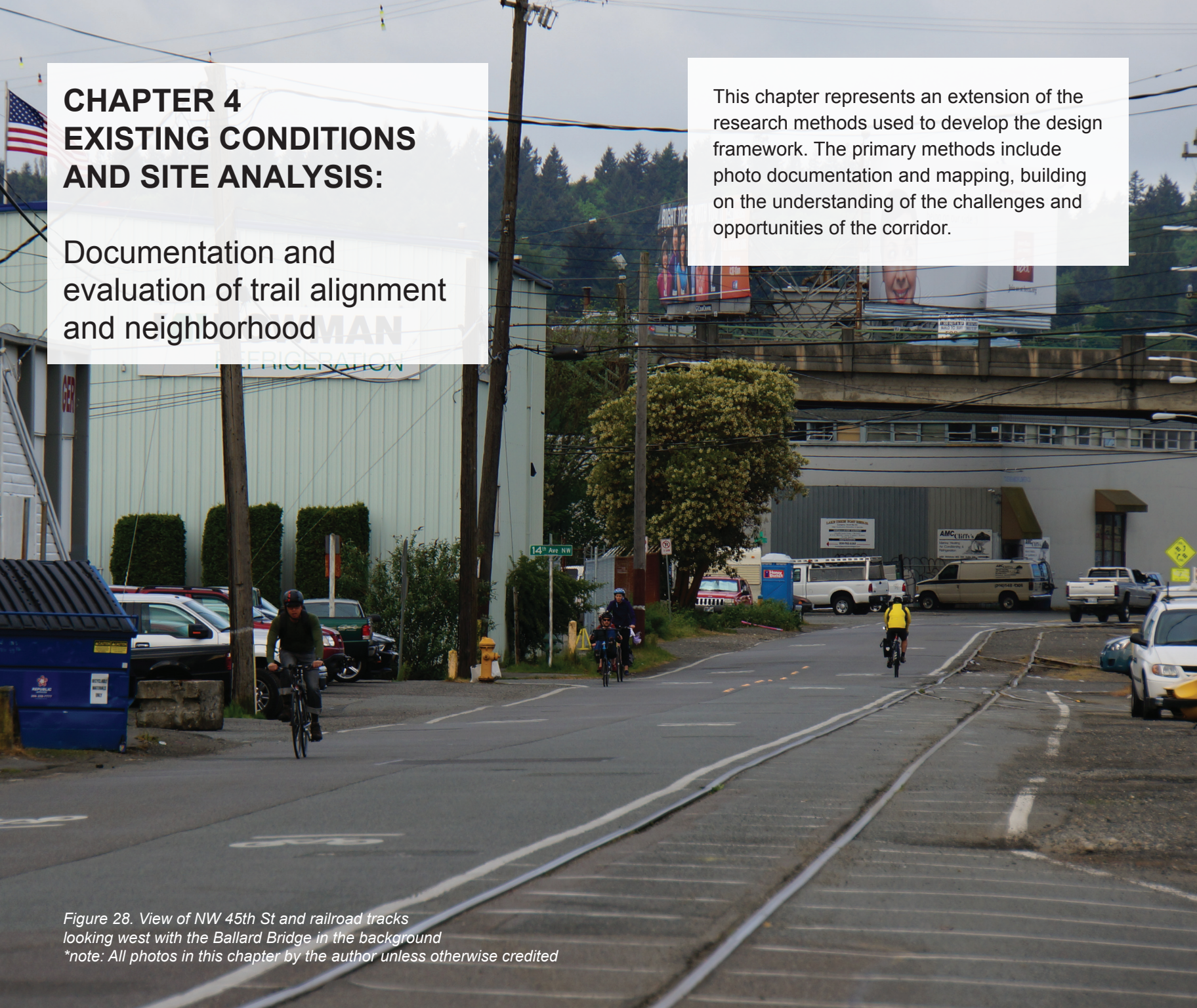
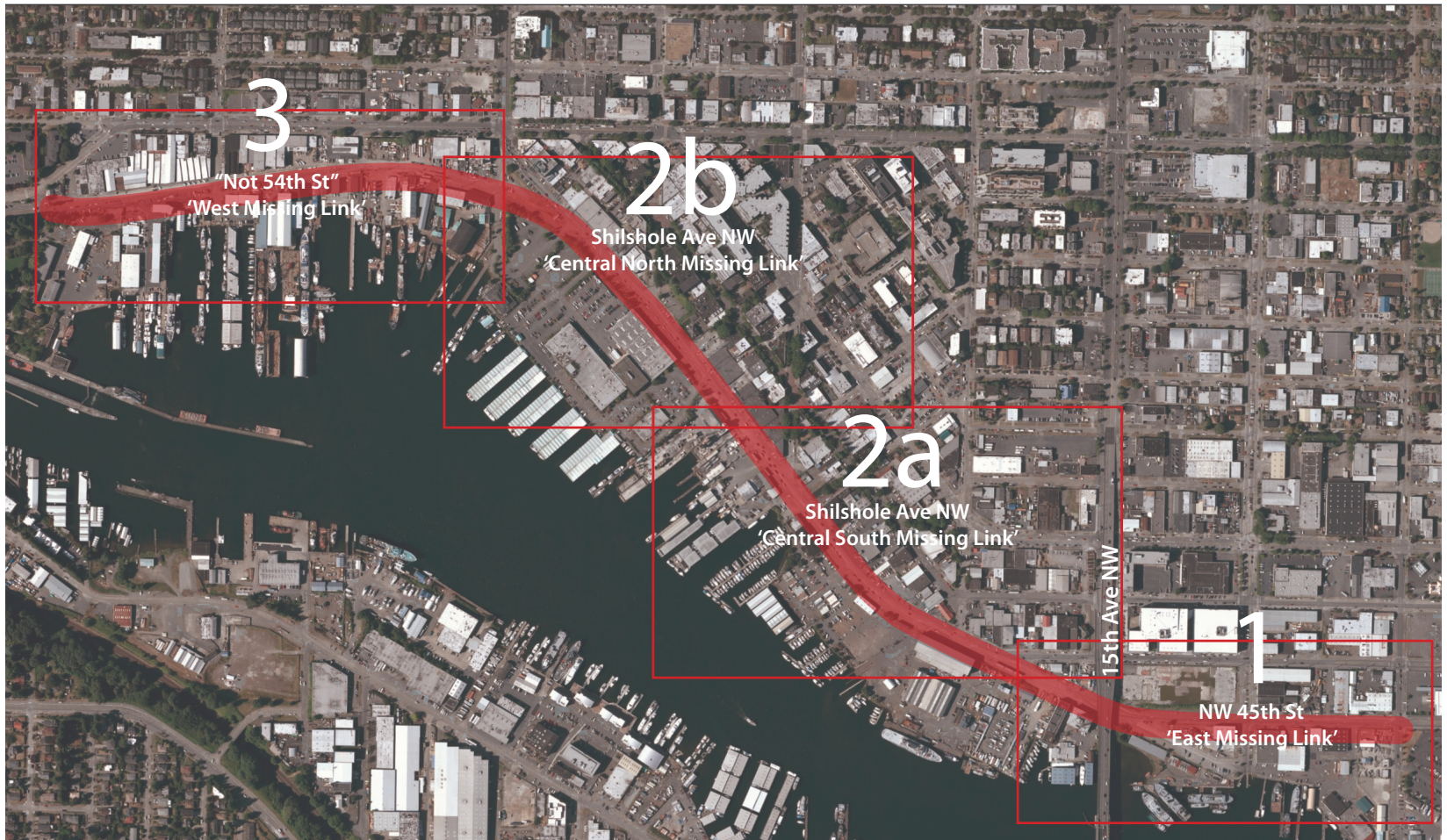


Figure 28. View of NW 45th St and railroad tracks
looking west with the Ballard Bridge in the background
**note: All photos in this chapter by the author unless otherwise credited*

Lessons on the Ground

The corridor of the Missing Link can be subdivided into three different conditions. The previous chapter examined some of the differences in character based on width as well as on traffic volume and speed. When looking at the existing conditions, I captured the differences through

photos that express the nature of NW 45th St (map 6.1), Shilshole Ave NW (map 6.2a/b), and NW 54th St (map 6.3). The cataloguing of these segments augments the other forms of research to further strengthen the foundation for the design presented in Chapter Five.



Map 6. All Missing Link segments shown in Ballard

NW 45th St

The eastern end of the Missing Link follows the railroad tracks on NW 45th St. There is even a sign that states “End Burke-Gilman Trail” (see figure 30d, on the next page) as you travel west from the Fremont neighborhood.

Wayfinding is an issue as walkers, joggers and bikers alike approach the intersection of 11th Ave NW and NW 45th St. There has been no clear option to continue traveling west. Figure 30.1 shows a group of lost bicyclists receiving directions.

Figure 30.2 depicts the initial reconfiguration of NW45th St in December 2013 by the Seattle Department of Transportation (SDOT). The city proposed to convert this segment of the Missing Link to one-way vehicle traffic eastbound, with a two-way bicycle facility in the former westbound traffic lane. This change occurred on NW45th St (from 11th Ave NW to 15th Ave NW) and the

continuation of the road which becomes Shilshole Ave NW from 15th Ave NW to NW 46th St. This proposal was accepted by the marine industrial interests and has reduced the bicycle and vehicle conflicts, especially at the railroad track crossing shown in figure 30.3.

Images taken from the Ballard Bridge (15th Ave NW) capture the feel of the corridor and the railroad tracks that are still active and run parallel to the proposed bicycle facility (figures 30.4-5). Railroad tracks can be a challenge for bicycles to cross, because if they do not cross perpendicularly their tire can get caught and cause them to crash.

Before the SDOT intervention, this particular railroad track crossing was especially treacherous as bicyclists were forced to mix with traffic in order to traverse them at a 90 degree angle. By converting the street to one-way traffic, SDOT removed the requirement for bicycles to mix with vehicles in order to cross at 90 degrees, giving them the room to cross safely. Figures 30a & c show some of the warning signage related to bicycles and the railroad tracks. An interviewee commented on the dangers of this crossing:

“It’s the number one accident location for cyclists in the city, and those are just the ones that are reported. The businesses along there have purchased first aid kits just for the purpose for going out there to help cyclists” (Municipal Agency Staff/Designer).

The empty lot to the north of NW 45th St is scheduled to be developed and will add both additional vehicle traffic and additional bicyclists and pedestrians. This influx of users is an additional reason the Missing Link needs to be completed to safely accommodate all users. Figure 30b shows a natural spring on the southeast corner of this lot.

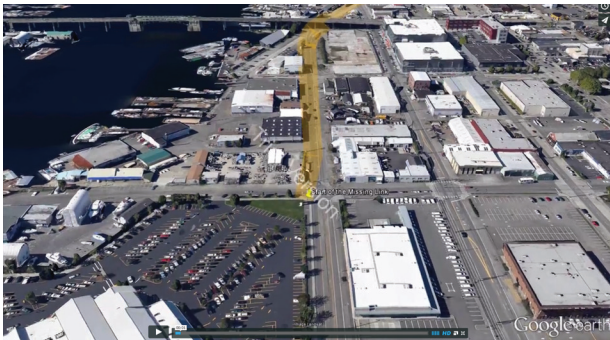
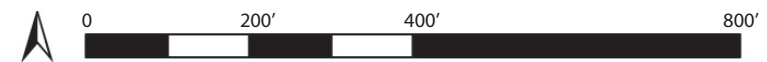


Figure 29. Missing Link bird’s-eye fly-through video (bottom) and QR code link (top) (click image link to video, starts at Fred Meyer parking lot, east end of Missing Link)



**NW 45TH ST
'EAST MISSING LINK'**

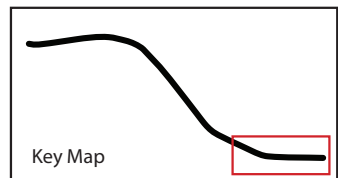


Figure 30. 'East Missing Link' NW 45th St existing conditions

Shilshole Ave NW (South)

The Shilshole Ave NW section of the Missing Link is functionally one condition. However, for the purposes of mapping, it has been subdivided into north and south segments. The beginning of this section starts at an oversized intersection at the corner of NW 46th St and Shilshole Ave NW (figure 31). This location is another confusing wayfinding moment and a dangerous crossing for pedestrians and bicyclists because of the increased speeds (figure 32). A majority of higher speed traffic flows along Shilshole Ave NW and continues on NW 46th St.



Figure 31. Intersection of NW 46th St and Shilshole Ave NW, with initial pavement marking for one-way vehicle traffic and two-way bicycle traffic.



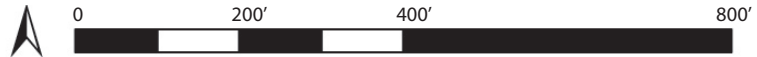
Figure 32. Bicyclists attempting to navigate traffic and poor wayfinding at the intersection of NW 46th St and Shilshole Ave NW

driveway inventory (map 8, page 64) illustrates my observations of the active driveways throughout the entire Missing Link corridor. There are far more unutilized access points, and driveway consolidation might be necessary to minimize turning movements across a bicycle and pedestrian trail.

The pavement and shoulder are in poor condition on the NW 45th St section, and they become even worse along the Shilshole Ave NW section (figure 33a). Drastic material change, from concrete to gravel, as well as a steep dropoff or grade change have also made for challenging conditions for bicyclists on both sides of Shilshole Ave NW. In the spring of 2014 SDOT was in the process of improving some of these conditions by widening and repaving the shoulders.

One constraint in this segment is the oversized loads that CSR Marine brings in through its driveways. This consideration, and others like it, must be taken into account when designing this corridor. Turning radii, sight clearances and height requirements must be further studied in conjunction with the design of pedestrian and bicycle facilities to improve safety and business operations.

It is also important to note that 17th Ave NW is the starting point of access to the Ballard Avenue Historic/Landmark District that parallels Shilshole Ave NW on Ballard Ave NW. There is an opportunity to connect trail users to this business district at 17th Ave NW.



**Shilshole Ave NW
'Central South
Missing Link'**

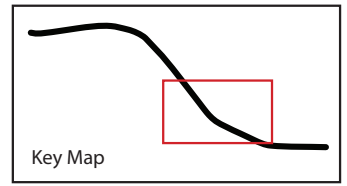


Figure 33. 'Central South Missing Link' Shilshole Ave NW existing conditions

Shilshole Ave NW (North)

This segment is a continuation of the previous southern portion of Shilshole Ave NW. It functions the same with similar medium-high traffic volumes and speeds. There are still a great deal of truck turning movements in this segment.

One of the symbolic images for the Missing Link has become the juxtaposition of Salmon Bay Sand & Gravel concrete trucks and people on bicycles (figure 34). Earlier design proposals for the Missing Link place the trail almost exactly where the cement truck is located in the photo below. In addition to these trucks, forklifts from Salmon Bay Sand & Gravel also cross Shilshole Ave NW.

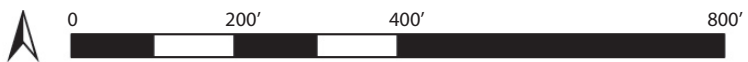
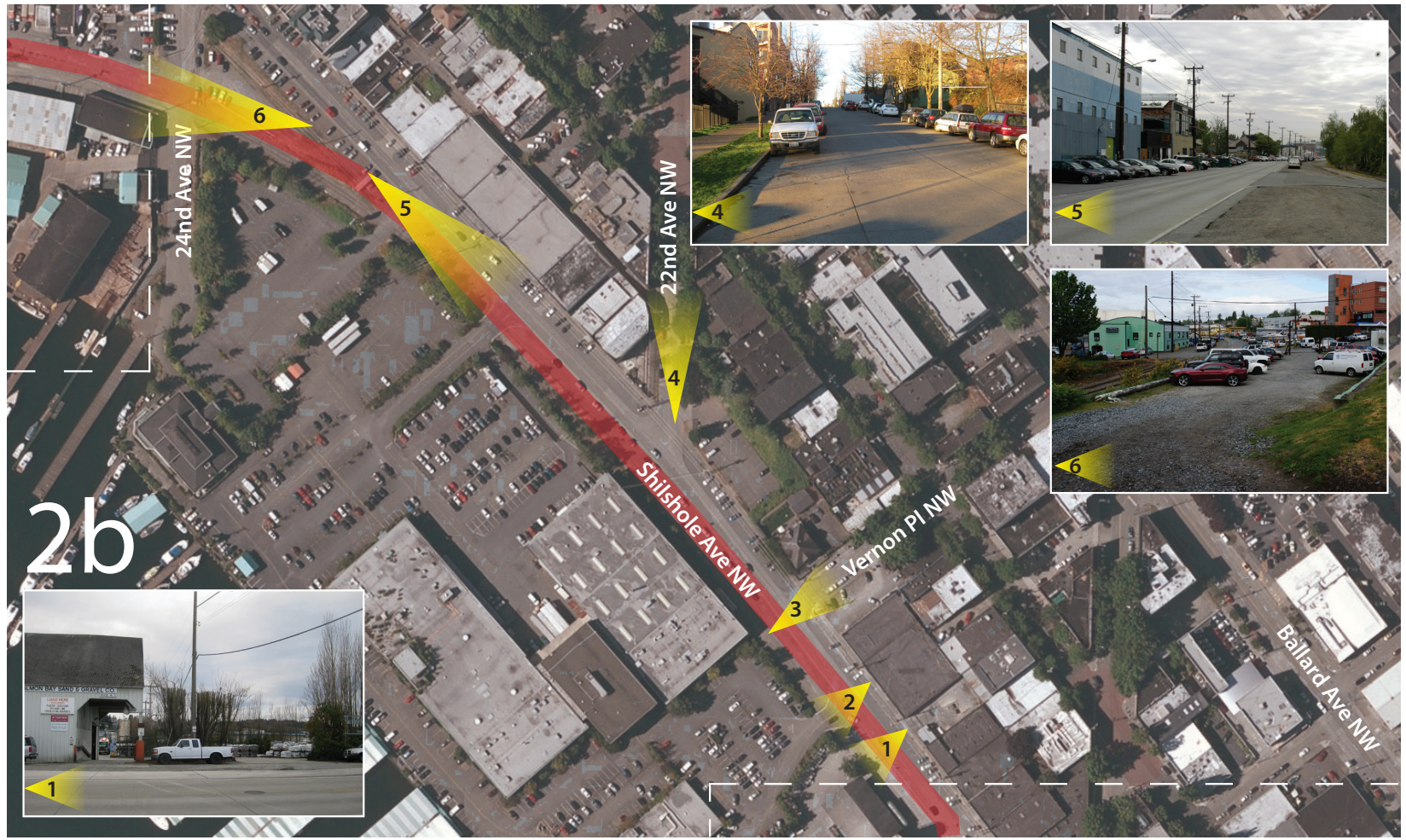


Figure 34. Cement trucks, bicyclists and even pedestrians negotiate Shilshole Ave NW

Understanding the frequency, size and speed of these trucks was something that could only be understood on site and it impacted decisions made in this design proposal. The design of a facility that serves users of all ages and abilities must mitigate the number of locations and speed of any truck crossings. A study of the current truck movements, turning angles and speeds might clarify the behavior modifications that may be necessary as the corridor becomes more structured and organized.

On the northern end of this segment is another opportunity to connect to the Ballard Avenue Historic/Landmark District. As 22nd Ave NW moves north it becomes the primary north/south civic cross axis, crossing NW Market St and connecting to the local library branch and Ballard Commons Park (see figure 35 on the next page).

Figure 35.5 demonstrates how the 100' right-of-way can accommodate new uses before turning to the west and following the railroad. The width for a trail narrows to the west of figure 35.5 and so does the surrounding conditions. Currently, assertive bicyclists continue on Shilshole Ave NW and turn left at the intersection of 24th Ave NW and NW Market St (not pictured). Very few bicycles and vehicles alike continue to the west (figure 35.6) other than employees of the businesses in the area.



**SHILSHOLE AVE NW
'CENTRAL NORTH
MISSING LINK'**

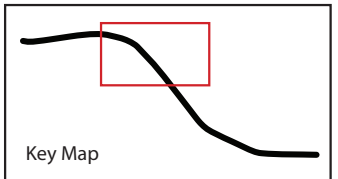


Figure 35. 'Central North Missing Link' Shilshole Ave NW existing conditions

NW 54th St (aka “Not 54th St”)

The westernmost portion of the Missing Link follows NW 54th St and has the most unique existing conditions. It is a combination of railroad right-of-way and land parcels owned by the City of Seattle. Practically no through traffic or vehicles that are not related to the neighboring marine industrial business navigate the corridor, which is in horrible disrepair. Businesses there experience flooding as there is poor drainage infrastructure through this passage (figure 37.2 and 37.4 on the next page).

NW 54th St is also referred to locally as “Not 54th St” as it is not maintained by the City as right-of-way and it is not a continuously connected

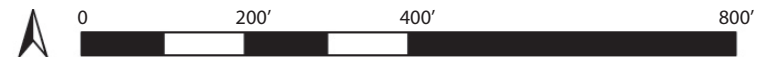
roadway for vehicles. One issue that has brought debate is the use of the public property by the marine industrial businesses for private benefit. This is of concern along NW 54th St—the majority of which is owned by the City for transportation purposes—as well as portions of the public right-of-way on Shilshole Ave NW and NW45th St. Compromise on the allocation of space and the balance of uses will need to be negotiated in order for the corridor to adapt to accommodate bicycles and pedestrians.

There are fewer driveways and access points on the western end of this section. The Burke-Gilman Trail resumes at the Hiram M. Chittenden Locks (aka Ballard Locks). Figure 37.6 shows the connection point adjacent to the Lockspot Cafe and the entrance to the Locks.

An additional consideration through the NW 54th St portion of the Missing Link is the change in grade and how that relates to the railroad tracks, the access to businesses and the trail (figure 36). A more continuous retaining wall will help organize the space into two levels. The introduction of green stormwater infrastructure (GSI) in this area will further help with organization, but more importantly it will address the flooding that currently takes place. GSI will also reduce the contamination of surface runoff by intercepting stormwater from the unimproved roadway before it reaches waterfront businesses.



Figure 36. Six foot grade change between the waterfront businesses and NW 54th St



**NW 54TH ST
AKA 'NOT 54TH ST'
'WEST MISSING LINK'**

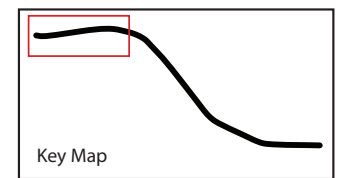
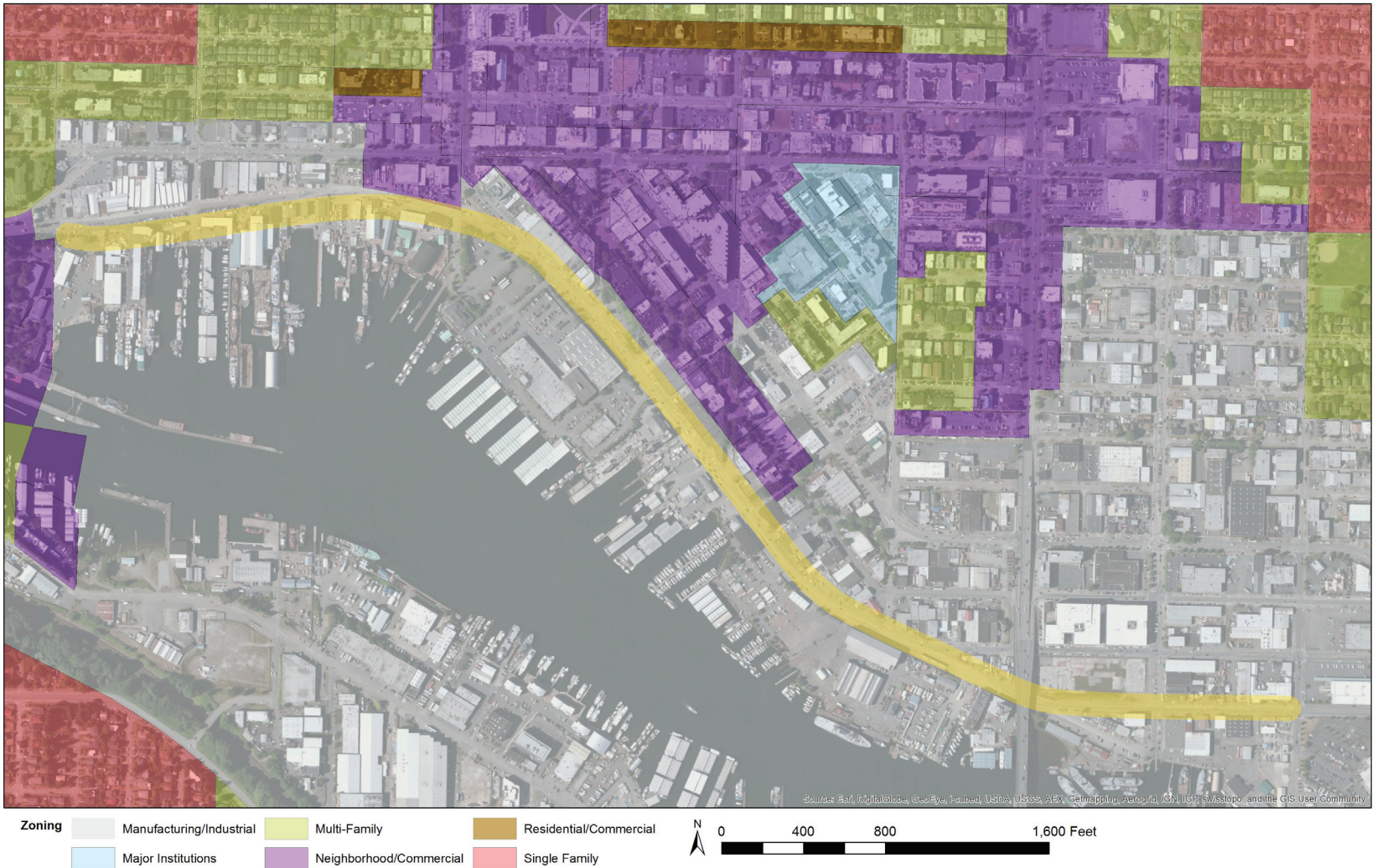


Figure 37. 'West Missing Link' NW 54th St existing conditions

Zoning and Land Use

One of the central themes that drives the delay and opposition to the completion of the Burke-Gilman Trail through Ballard is the proximity of

manufacturing/industrial zoned land to a major neighborhood commercial district. There are additional factors related to the evolving nature of



Map 7. Zoning and Land use in Ballard (Missing Link highlighted in yellow)

the neighborhood and if the marine industrial cluster will remain intact. Several interviewees spoke to the dynamics of the neighborhood and the potential for completing the Missing Link along the Rail/Shilshole Ave NW alignment. A marine industrial representative articulated a more black and white view that businesses and the completed Burke-Gilman Trail could not co-exist. “You could put a bike trail anywhere, but you can’t put a maritime industrial cluster anywhere.” Whereas a neighborhood representative was more optimistic about the relationship, “People are attracted to Ballard because of the fact that it is a living waterfront and they are not looking to destroy that, they are looking to blend the lifestyles.” There is great speculation on both sides on the future of the neighborhood and any positive or negative effects that organizing the right-of-way would have on businesses. One of the most significant perceived negative impacts to marine industrial businesses is the effect that the completed Burke-Gilman Trail would have on access to their businesses.

Driveway Analysis

In order to better understand the vehicle movements and access to businesses, I conducted my own inventory of active driveway access points. There are more potential access points along the corridor, but my intent was to gain a picture of potential conflict points with the goal of finding ways to minimize conflicts and crossings. Sight clearances and turning radii are of critical

importance when designing transportation projects. A detailed analysis is necessary to ensure turning movements in and out of driveways are maintained. However, as part of the negotiation, the consolidation of several driveways that serve the same property would enhance the safety of the corridor. This might be more necessary near the intersection of 17th Ave NW and Shilshole Ave NW in order to accommodate the proposed elevated structure and ramp. The driveway at CSR Marine (map 8.9, p 64) must have a truck clearance of 20’ to allow for boats. Also, there is an additional access point that is not used and not reflected in the driveway inventory (figure 38) that I assume could be removed. Other possible options include hauling oversized loads in from

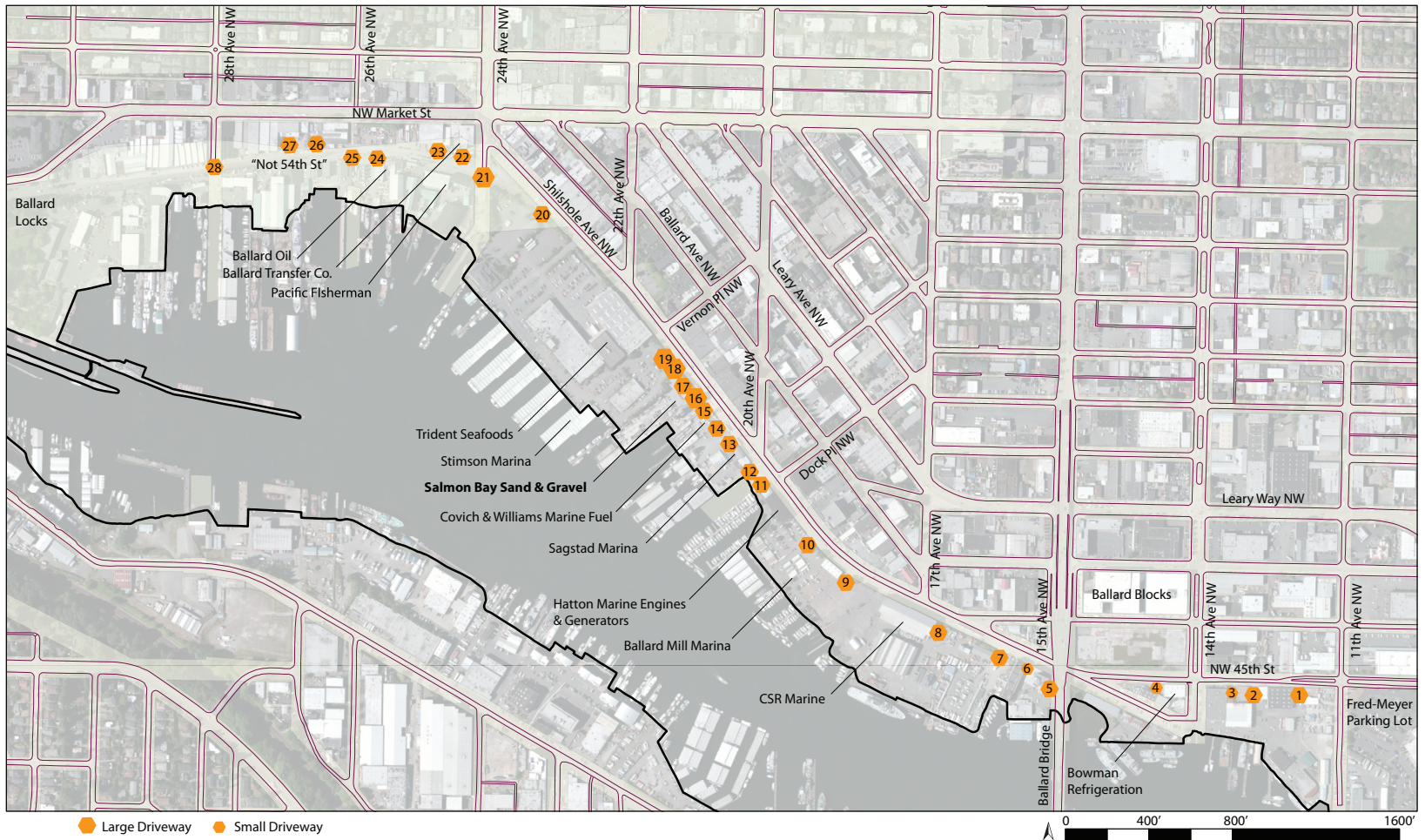


Figure 38. Secondary access at CSR Marine and other locations may need to be consolidated

the driveway on the eastern side of the CSR building (map 8.8) or that a portion of the elevated structure is removable and the elevated portion would be closed for the few times a year that 20' clearance is necessary.

One of the major observations from the examina-

tion of the active driveways was the concentration in the central portion of Shilshole Ave NW. Not only are there nine active driveways in 750' but the number and size of vehicles using these access points is significant. The Salmon Bay Sand & Gravel concrete trucks (figure 39, p 65) are worth



Map 8. Active driveway inventory along proposed Missing Link alignment

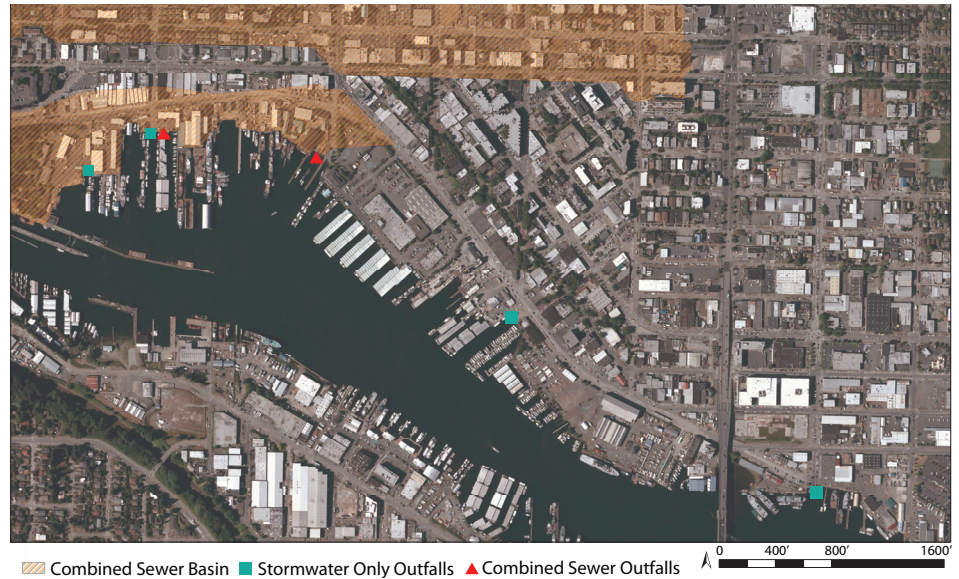
highlighting, especially in light of one marine industrial interviewee estimating they conduct 300 crossings per day. This area is another potential location for consolidation of driveways. However, the proposed elevated portion of this design proposal would eliminate the need for consolidation. Additional study would be required for the sighting of the columns and trees relative to driveways and turning radii for an elevated structure to address impacts to turning movements.



**SALMON BAY SAND & GRAVEL
Concrete Truck Specifications**

Kenworth 10 Yard Concrete Mixer
 Weight: 72,000 lbs Fully Loaded
 Height: 12 feet 3 inches at the hopper
 Width: 9 feet 7 inches at the mirrors
 Width: 8 feet 7 inches at the wheel base
 Length: 35 feet 3 inches

Figure 39. Salmon Bay Sand & Gravel concrete truck size and specifications (Salmon Bay Sand & Gravel, www.sbsg.com/concrete/faqs)



Map 9. Ballard stormwater basin and outfalls

Stormwater Basin and Outfalls

Chapter Two introduced the concept of a combined sewer system versus a separated sewer system. Both types of systems are found in the Missing Link corridor.

Map 9 highlights the combined basin—the rest of the area is separated—as well as outfalls and helps to prioritize the function of green stormwater infrastructure (GSI). The majority of the corridor is on a separated system, meaning that the primary goal of GSI is to filter the polluted stormwater runoff in bioretention cells before it gets discharged into Salmon Bay, the receiving body of water. The filtration and treatment of the polluted stormwater runoff is especially important as the stormwater runoff

flows across an industrial area that is also a major truck route.

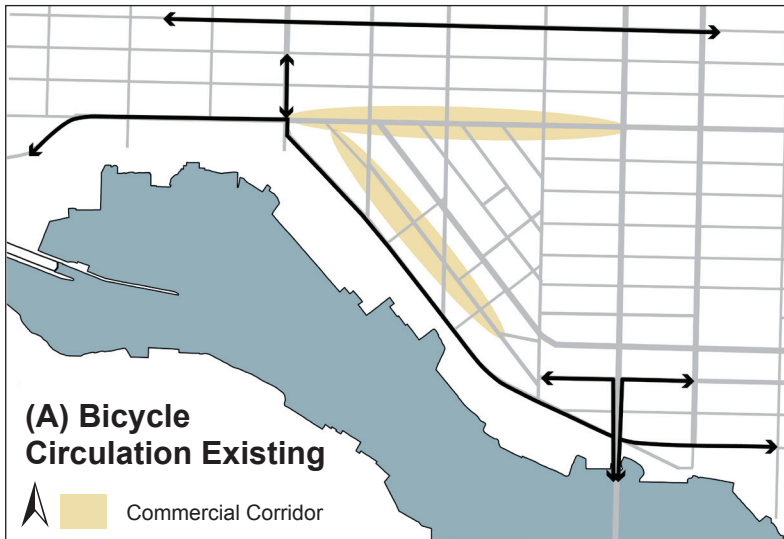


Map 10. Ballard portion of the Bicycle Master Plan, 2013 (SDOT BMP 2013, p 42) (yellow highlight of proposed Missing Link added by author)

In the NW 54th St or western section of the Missing Link, the system is predominately a combined sewer. In this case, filtration is not as necessary because the stormwater is combined with sewage and processed at the wastewater treatment plant. The primary function of green stormwater infrastructure in this corridor would be to detain water during the peak flow of a storm event to reduce the combined volume of sewage and stormwater thereby reducing the likelihood of a combined sewer overflow (CSO).

Bicycle and Freight Circulation

To better understand the flows of bicycles and large vehicles, it helps to understand the Missing Link corridor in the larger context of the Ballard



Map 11A/B. Bicycle circulation existing and proposed

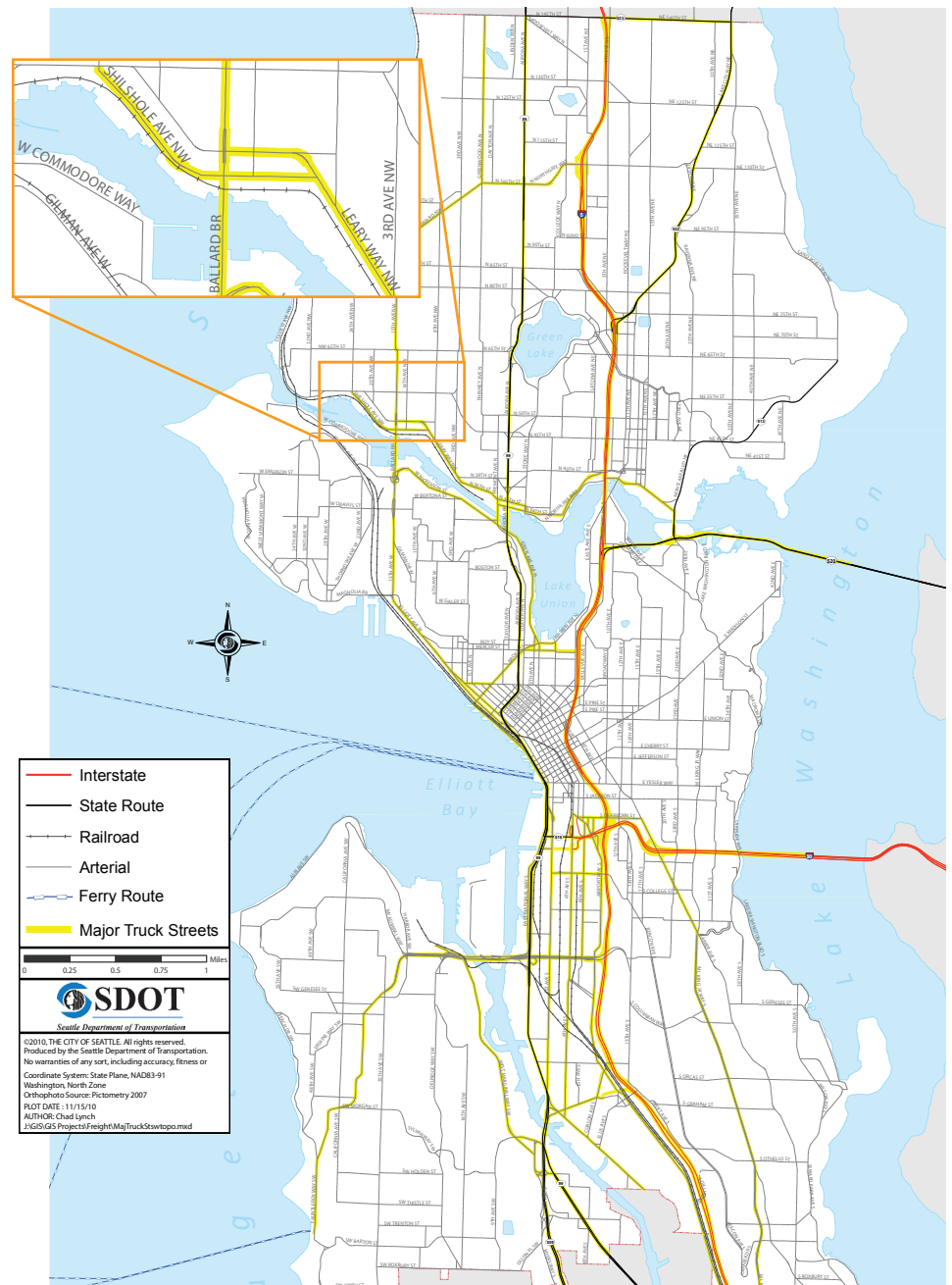
neighborhood and even the city. The new Bicycle Master Plan (BMP) (map 10) was one source that influenced the existing and proposed bicycle circulation diagrams (map 11A/B). The BMP was supplemented by findings from observational and interview research. The proposed bicycle circulation diagrams the potential flows and connections from the design and how it works with the network outlined by the Bicycle Master Plan.

Earlier in this chapter, the industrial and manufacturing land use along the Missing Link was highlighted. Frequently land with this zoning has the need for shipping goods with large vehicles. As a result, Shilshole Ave NW and NW 46th St have been designated **Major Truck Streets*** by the Seattle Department of Transportation (SDOT) (map 12, indicated by yellow highlight).

Both the circulation of bicycles and freight has been examined and the overlaps considered as part of the design proposal in this thesis. They contributed to the understanding of the existing conditions and informed the design negotiation.

* **SDOT defines Major Truck Streets as:**

“an arterial street that accommodates significant freight movement through the city, and to and from major freight traffic generators. The street is typically a designated principal arterial. Major Truck Streets generally carry heavier loads and higher truck volumes than other streets in the City. SDOT uses the designation of Major Truck Street on an on-going basis as an important criterion for street design, traffic management decisions and pavement design and repair” (SDOT 2014, under “Truck Classification Legend Definitions”).



Map 12. SDOT Major Truck Streets, with Ballard portion enlarged

CHAPTER 5 DESIGN:

Synthesizing Lessons in a Schematic Design Proposal



The culmination of the research and compromise presented in this thesis is a schematic design that highlights five major areas that address different conditions over the course of the 1.3 mile Missing Link. This design builds on previous ideas for the corridor, adding new combinations without some of the real world constraints. Perhaps it may expand the thinking and dialogue regarding the future design solution.

Figure 40. Enlargement of vignette for the design proposal along NW 45th St

Design Proposal Introduction

This design proposal is presented by zooming in on five different areas that have unique challenges. My original three examples highlight the different width and characteristics of the three distinct segments, starting with NW 45th St (map 13.1) to the east, NW 54th St (map 13.2) to the west and

two iterations on Shilshole Ave NW (map 13.3). After receiving feedback on these three example design treatments and the potential for an elevated segment of the trail, I carefully selected the ramp locations for the elevated portion. The proposal for how the elevated segment connects to the community are presented at 17th Ave NW (map 13.4) and 22nd Ave NW (map 13.5)



Map 13. Missing Link design proposal alignment (yellow), elevated section (orange) and example areas (red boxes)

The overall approach to each segment was derived from merging my design framework (Chapter Three) with the existing conditions and site analysis (Chapter Four). The proposed NW 45th St section continues the Burke-Gilman Trail on the south side of the primary vehicle travel lanes, building on the December 2013 SDOT conversion of NW

45th St to one-way eastbound. A bioretention cell provides separation between trail users and vehicles as well as provides ecological quality. The NW 54th St section also uses bioretention cells, but primarily for ecosystem services, to detain the stormwater, and the grade change provides the separation from traffic and a new

access road improves waterfront business access. The Shilshole Ave NW section is shown with both a surface and elevated example alternative. The elevated portion was a critical strategy to address the size and volume of vehicles crossing the trail. Moving forward with the elevated alternative, I present how and where the ramps could connect to the community. First, at 17th Ave NW, where a signalized intersection and left turn lane are added. And second, at 22nd Ave NW where the ramp forks to both continue the Burke-Gilman Trail to the west and connect into the heart of Ballard.



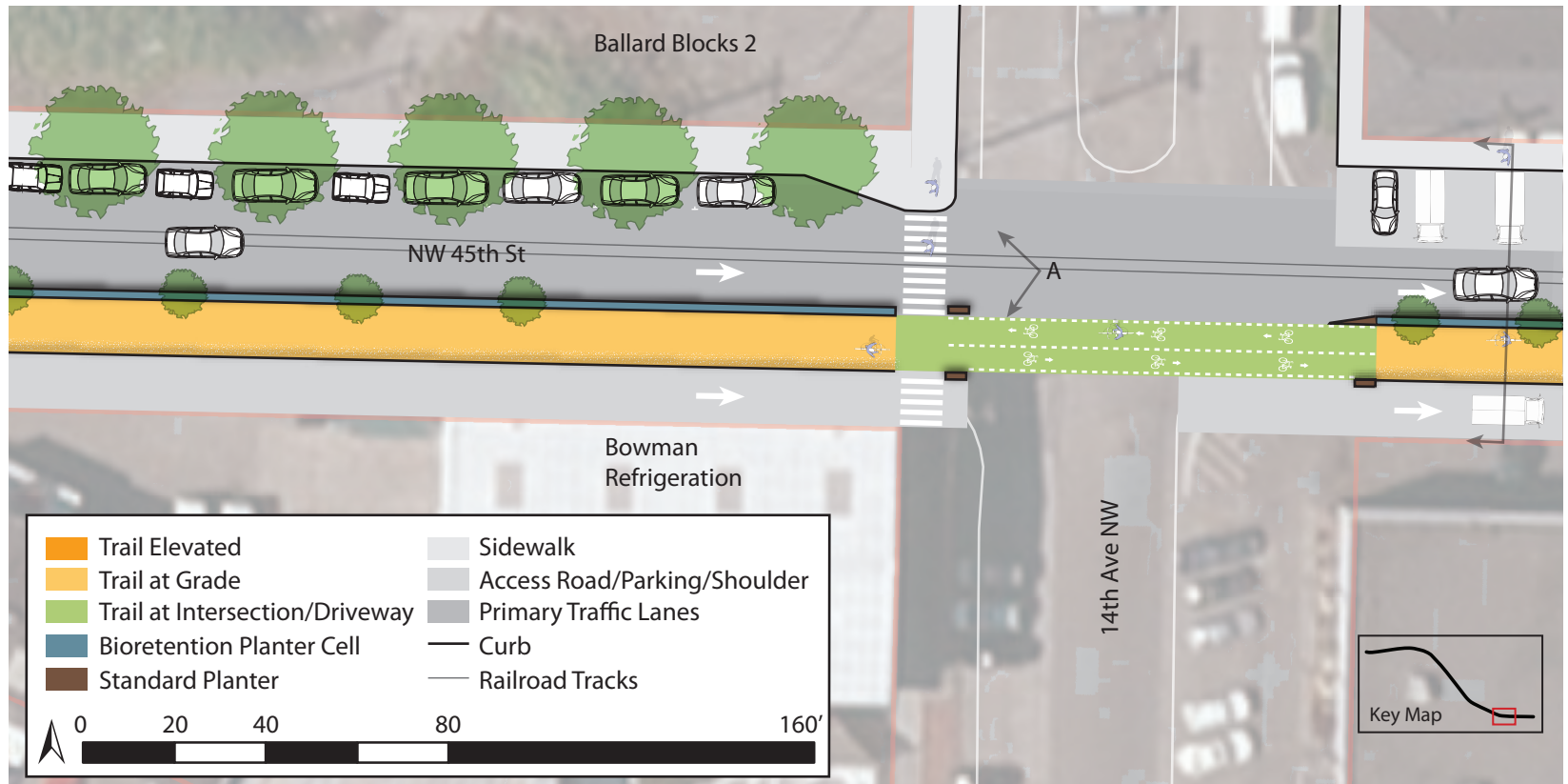
Figure 41. Vignette of design proposal featuring green stormwater infrastructure along NW 45th St (see map 14A, p 71)



Figure 42. Vignette base image, shows the first phase of the SDOT December 2013 reconfiguration

NW 45th St

The eastern portion of the Missing Link has probably changed more than any other. With the introduction of Fred Meyer in the 1990s and the Ballard Blocks development in the 2000s, the look and feel are quite different than when there was a steel mill on the 12 acre Fred Meyer site. The vignette to the far left (figure 41, p 70) anticipates the proposed development of the vacant lot at NW 45th St and 14th Ave NW, called Ballard Blocks 2.



Map 14. Design plan example for NW 45th St (east Missing Link), highlights pavement markings and separation between users, at intersection with 14th Ave NW

My proposed design of the NW 45th St section of the Missing Link builds on the reconfiguration of the right-of-way made by SDOT in December 2013. The City's original move was to convert the westbound vehicle traffic lane into a two-way bicycle facility. While this was a fantastic first step, it has two significant challenges. The first is the added complication of having bicycles and pedestrians cross diagonally from the existing Burke-Gilman Trail (in front of Fred Meyer on the south side of NW 45th St). At 11th Ave NW trail

users must navigate from the southeast corner to the northwest corner to access the new bicycle facility. The other challenge is that the new two-way bicycle facility is on the north side, directly next to the railroad tracks. In spite of these challenges, this modification has begun to change behavior through the corridor and with one less traffic lane there is more space to work with in order to accommodate all users.

This design proposes an evolution of the reconfiguration, by moving the two-way bicycle facility to the south and creating a shared vehicle traffic and railroad lane to the north (maintaining the one-way eastbound traffic). Green stormwater infrastructure (GSI) in the form of bioretention cells provide ecological function as well as separation from traffic located in the center. They are a multifunction alternative to the more basic curbs and bollards.

Maintaining and enhancing business access is a priority outlined in the design framework and is accomplished by providing a 12' wide driveway access lane on the south side of NW 45th St and more formal back-in parking and loading access on the north side. The driveway access lane is intended to also be one-way eastbound and would

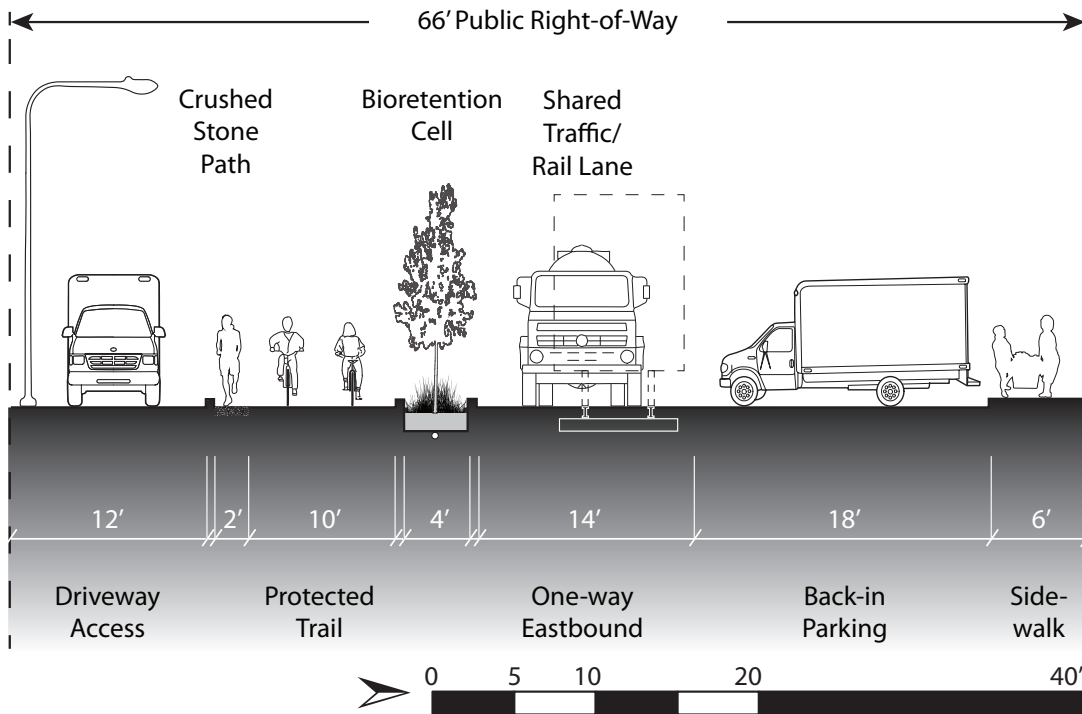


Figure 43. Design section cut for NW 45th St (eastern Missing Link) allocates the right-of way to make it multifunctional and provide hierarchy while maintaining access, shown east of intersection with 14th Ave NW

have very low traffic volumes and speeds. If the vehicles attempting access have turning radii not capable of navigating the tight turns, and there is no other access alternative, a trail crossing can be incorporated into the design that allows for vehicle access. Minimizing these crossings will be a priority in the negotiation in order to reduce potential conflict points. These driveway crossings would look similar to the major crossing at the intersection of 12th Ave NW and NW 45th St (map 14, p 71). The proposed green and white pavement markings are the current standard to clearly indicate to both bicycles and vehicles that

they need to reduce speed and heighten awareness because the potential exists for crossing each other's path. Figure 44 is from the National Association of City Transportation Officials (NACTO) *Urban Bikeway Design Guide*. It is an important reference for all bicycle facilities and the design guidance for two-way cycle tracks is appropriate for this section because it essentially functions in that manner, similar to the Broadway (Seattle) cycle track.

In this design, the continuation of the Burke-Gilman Trail through the NW 45th section is

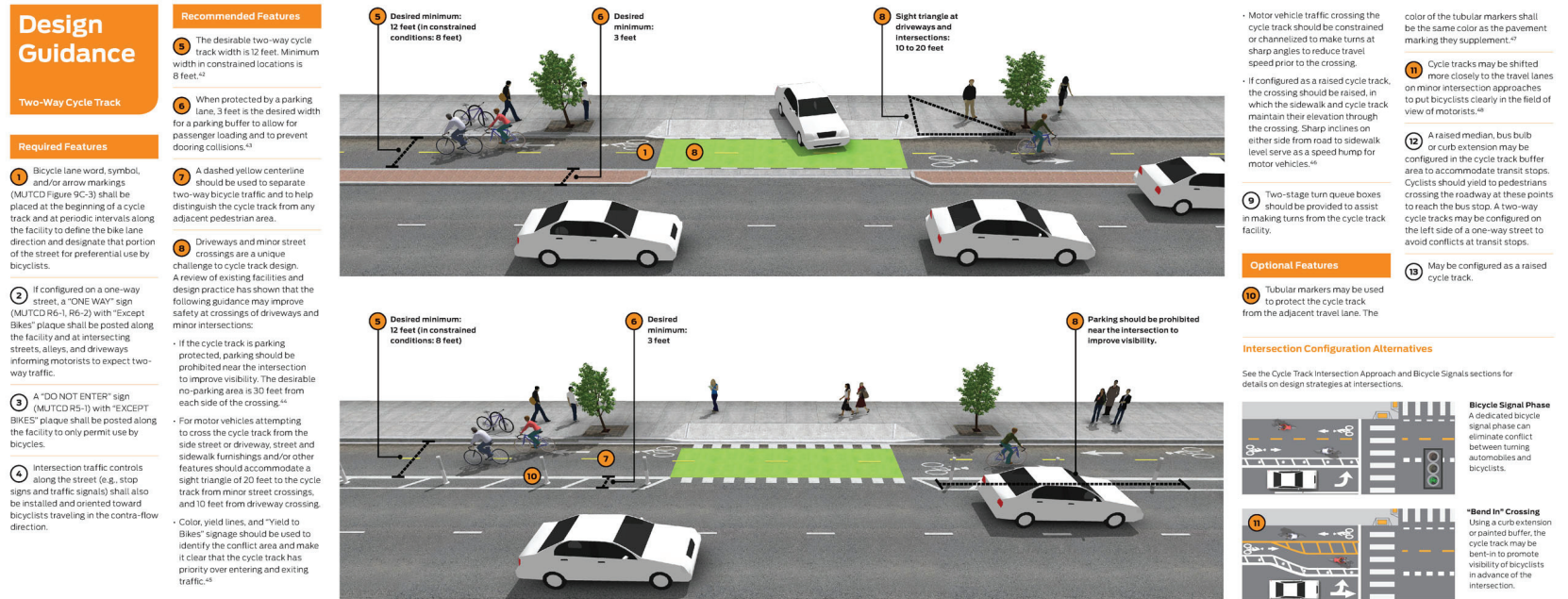


Figure 44. NACTO Urban Bikeway Design Guidance for two-way cycle tracks (NACTO 2012, p63)

protected from the driveway access lane (to the south) by a 6" curb, and a 2' crushed stone path is provided to accommodate pedestrians and runners. The protected trail is 10' wide, similar to the two-way bicycle facility SDOT created in December 2013. The crushed stone path feature could be considered optional. However, it does help create some hierarchy on the trail and reduce impact for walkers and joggers.

NW 54th St (aka "Not 54th St")

The western portion of the Missing Link starts at the Ballard Locks and follows the railroad tracks through city owned property, portions of which are known as NW 54th St or "Not 54th St." There is a 6' grade change from the existing railroad tracks down to the shoreline businesses. This design consolidates driveways by providing a formal lower access road. On the upper portion, a planting strip with trees borders the north side of the trail. GSI is used to the south of the trail, helping to detain stormwater (as this area is connected to the combined sewer system) and reduce flooding of the businesses.

The initial iteration of the design for this section maintained parking and a westbound travel/railroad lane south of the trail and an eastbound access road north of the trail, both on the upper portion of the corridor. However, this option was deemed redundant, too tight of a fit and also missed opportunities to capture and detain additional stormwater on the lower portion. The lower access road would serve all waterfront businesses and connect to the street network at the primary access point at 24th Ave NW as well as a secondary access at 28th Ave NW. Parking and bioretention cells with a lining could be interspersed on the lower access road as space allows.

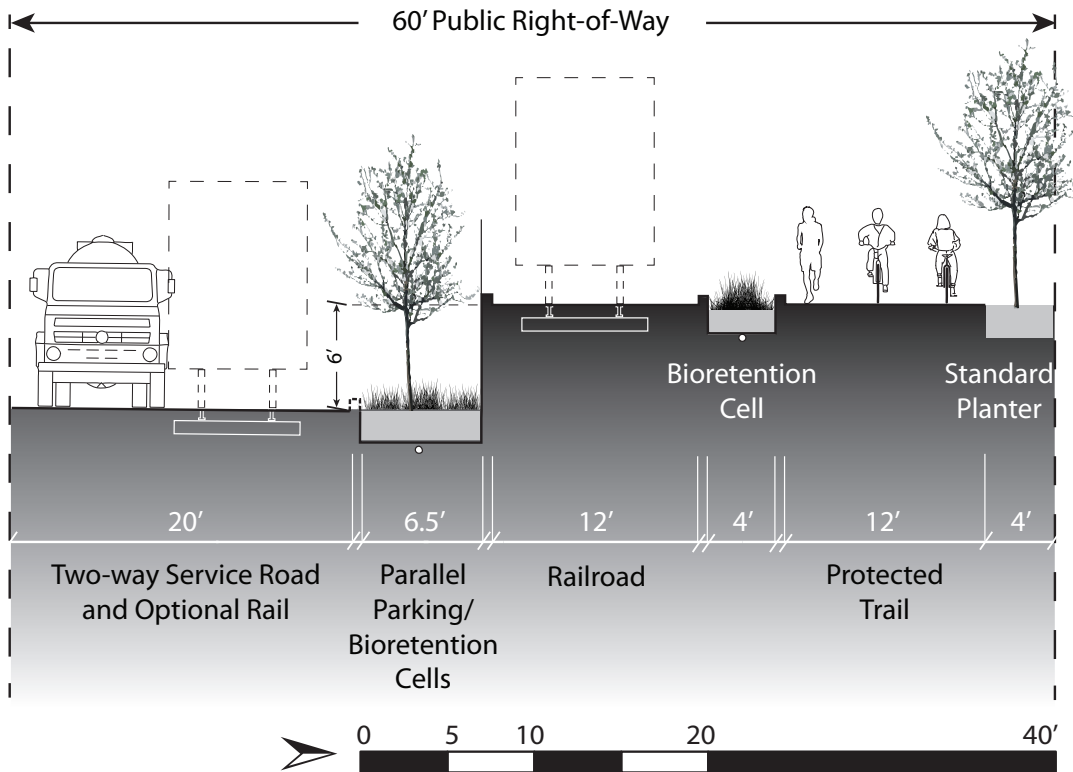
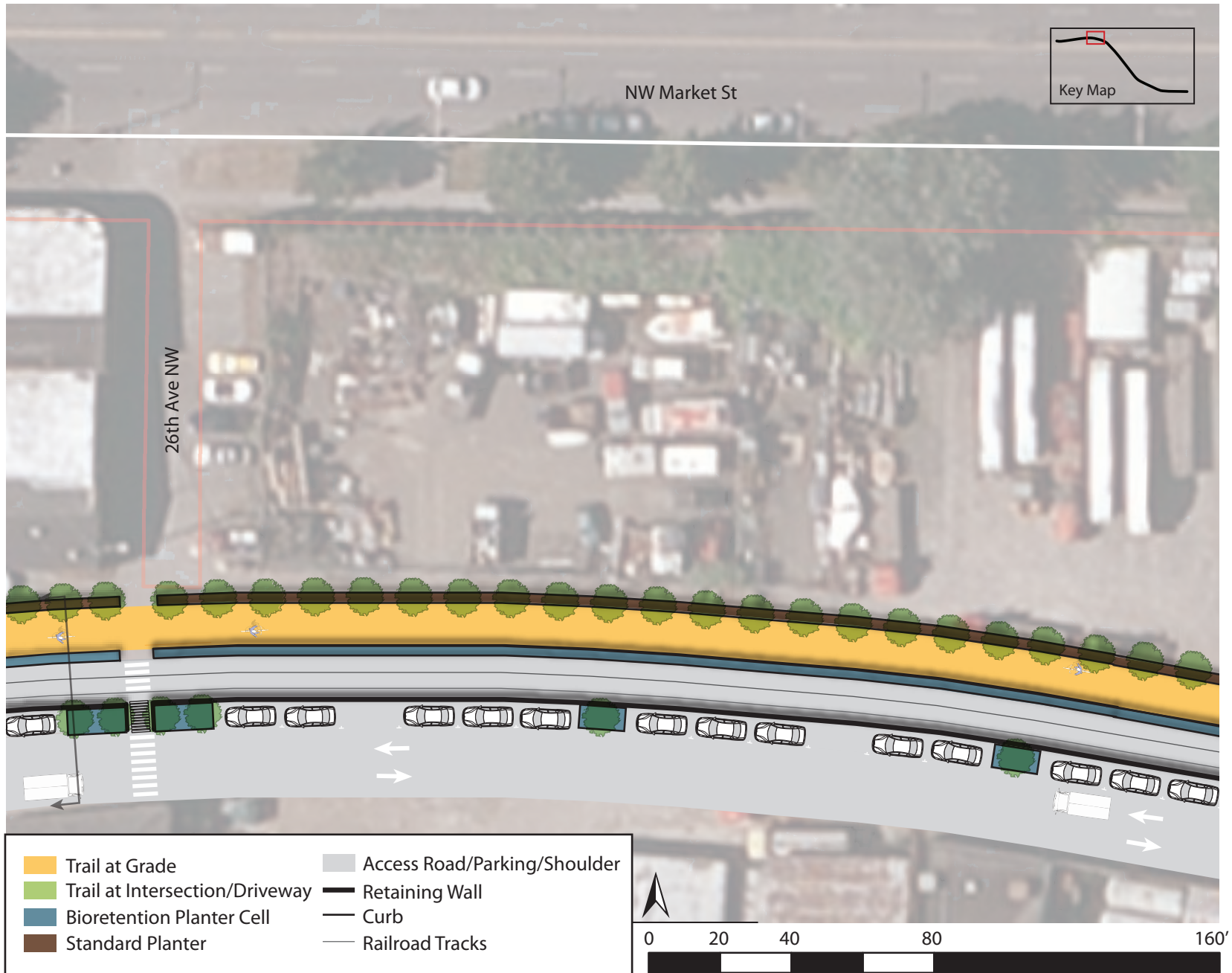


Figure 45. Section cut for NW 54th St (western Missing Link) illustrates the grade change, GSI using bioretention cells and creation of a lower access road, shown at intersection with 26th Ave NW



Map 15. Plan example for NW 54th St (west Missing Link) provides ecological quality can creates a lower access road, shown at intersection with 26th Ave NW

Shilshole Ave NW (Surface Option)

The central portion of the Missing Link has some of the most significant loading/unloading and large vehicle movements primarily resulting from Salmon Bay Sand & Gravel as well as Covich & Williams Marine Fuel. These businesses are located just north of the intersection of Shilshole Ave NW and 20th Ave NW. The initial design scheme considered a surface option, which required frequent active driveway crossings. The evolution of the design is reflected in the elevated trail segment shown on the following pages.

The combination of a design exercise to navigate the traffic and driveways (represented by figures 46 and map 16) with the research documentation and site analysis of this portion of the Missing Link made proceeding with the elevated alternative a clear decision. It was helpful to visualize the frequency of crossings. Analyzing this information led me to believe that without significant driveway consolidation, it would be extremely difficult to create a bicycle and pedestrian facility that could be considered an all ages and abilities route.

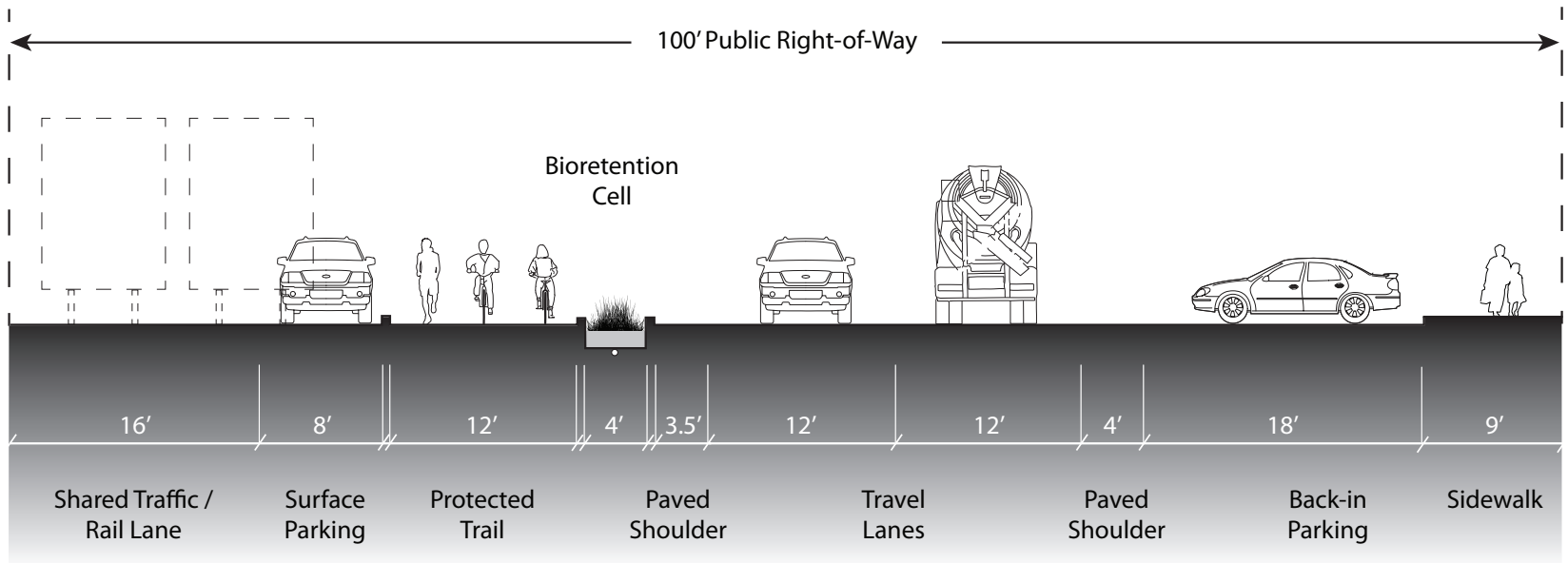
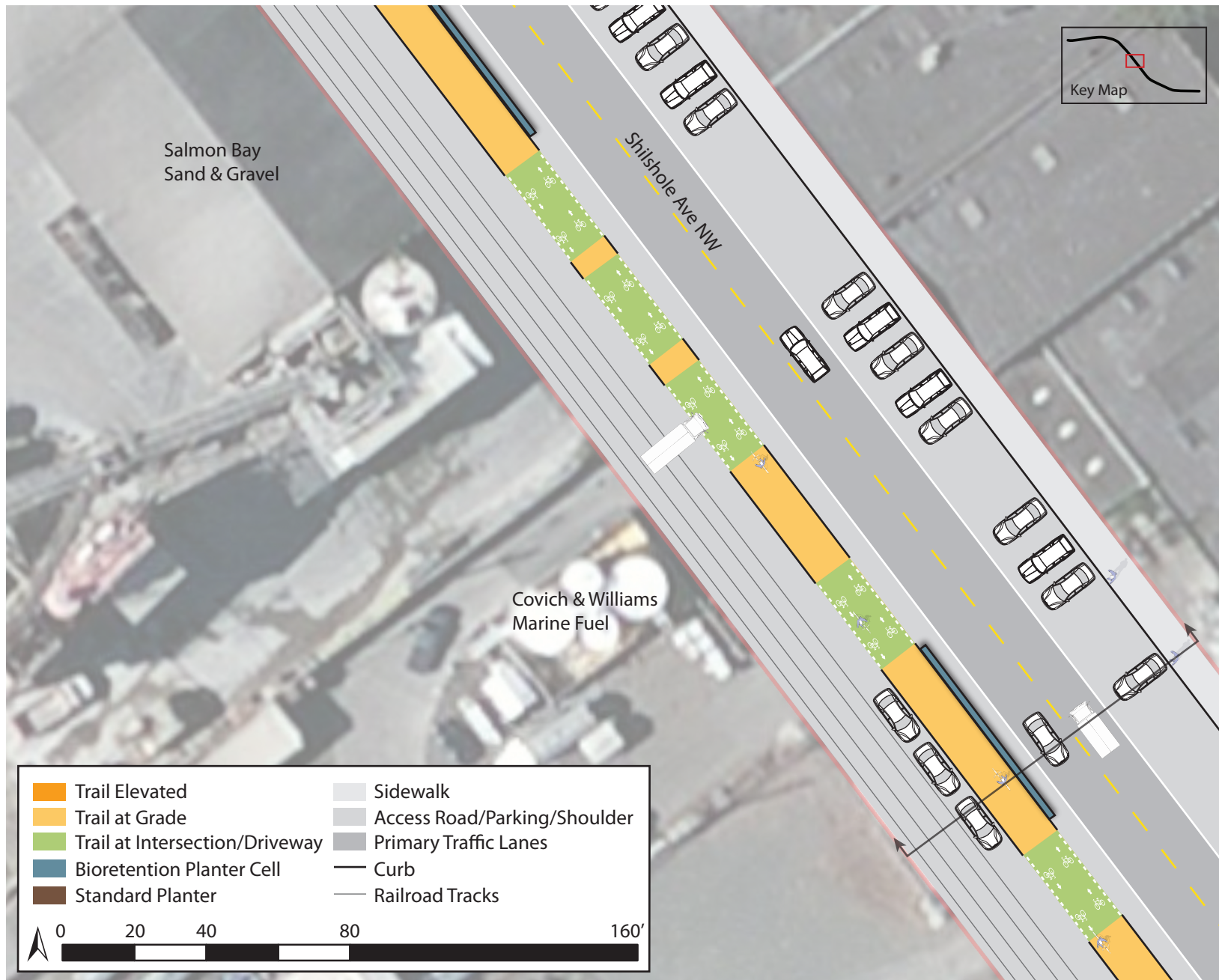


Figure 46. Surface design section cut for Shilshole Ave NW (central Missing Link) shown north of intersection with 20th Ave NW



Map 16. Surface plan example for Shilshole Ave NW (central Missing Link) illustrates frequent trail crossings, shown north of intersection with 20th Ave NW

Shilshole Ave NW (Elevated Option)

Arriving at the elevated option was not taken lightly. It has been explored in the past and dismissed, primarily because of cost. Yet, an elevated portion of the trail through the highest traffic volume and speed section of the Missing Link has wide support from the vast majority of stakeholders interviewed.

A major consideration for the elevated option is the ground clearance for large vehicles and special oversized vehicles such as ones that carry boats. As part of the driveway inventory, CSR Marine (near 17th Ave NW) is one limiting factor, as is the portion of the elevated structure that crosses over Shilshole Ave NW at 22nd Ave NW.

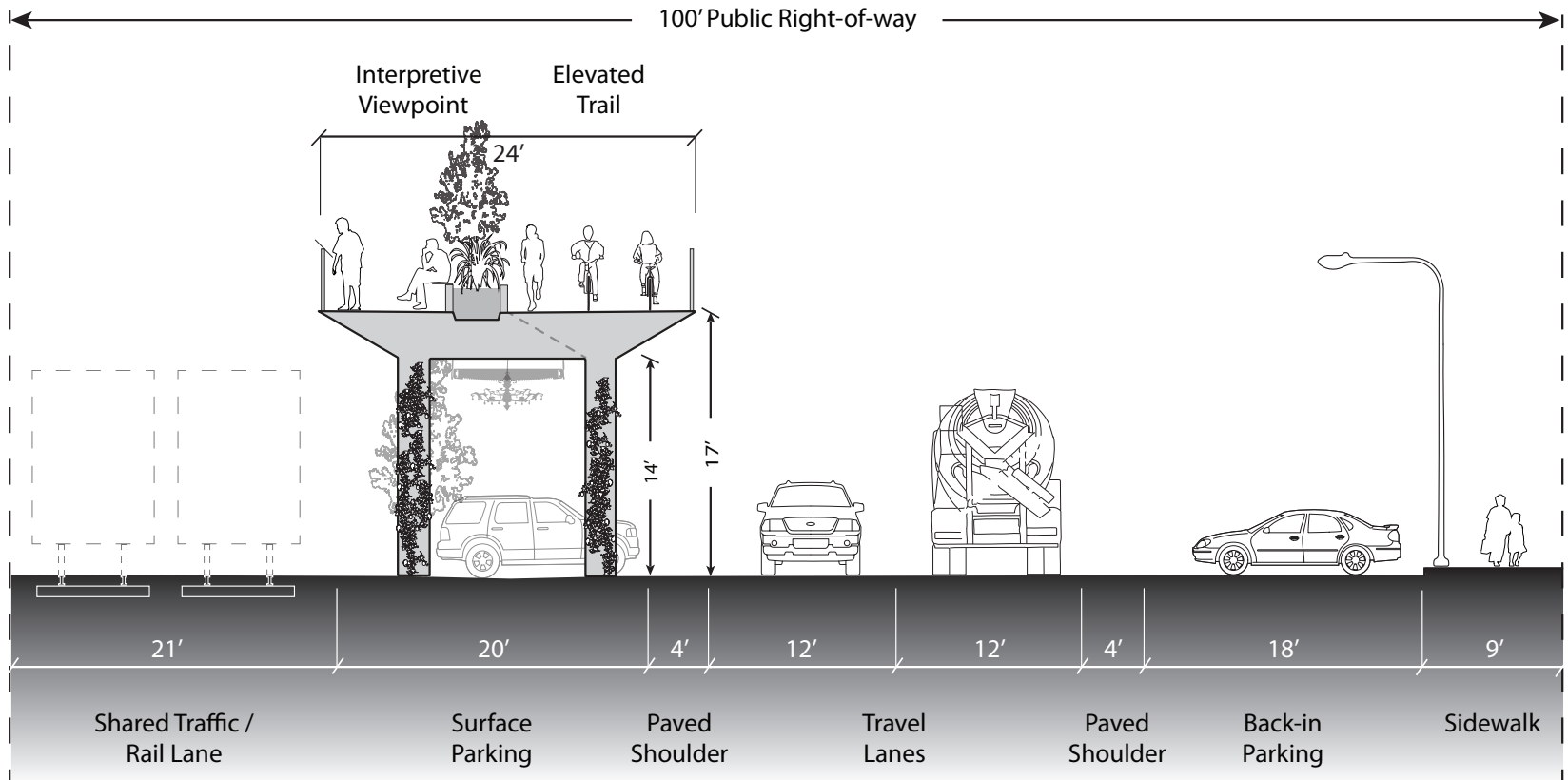
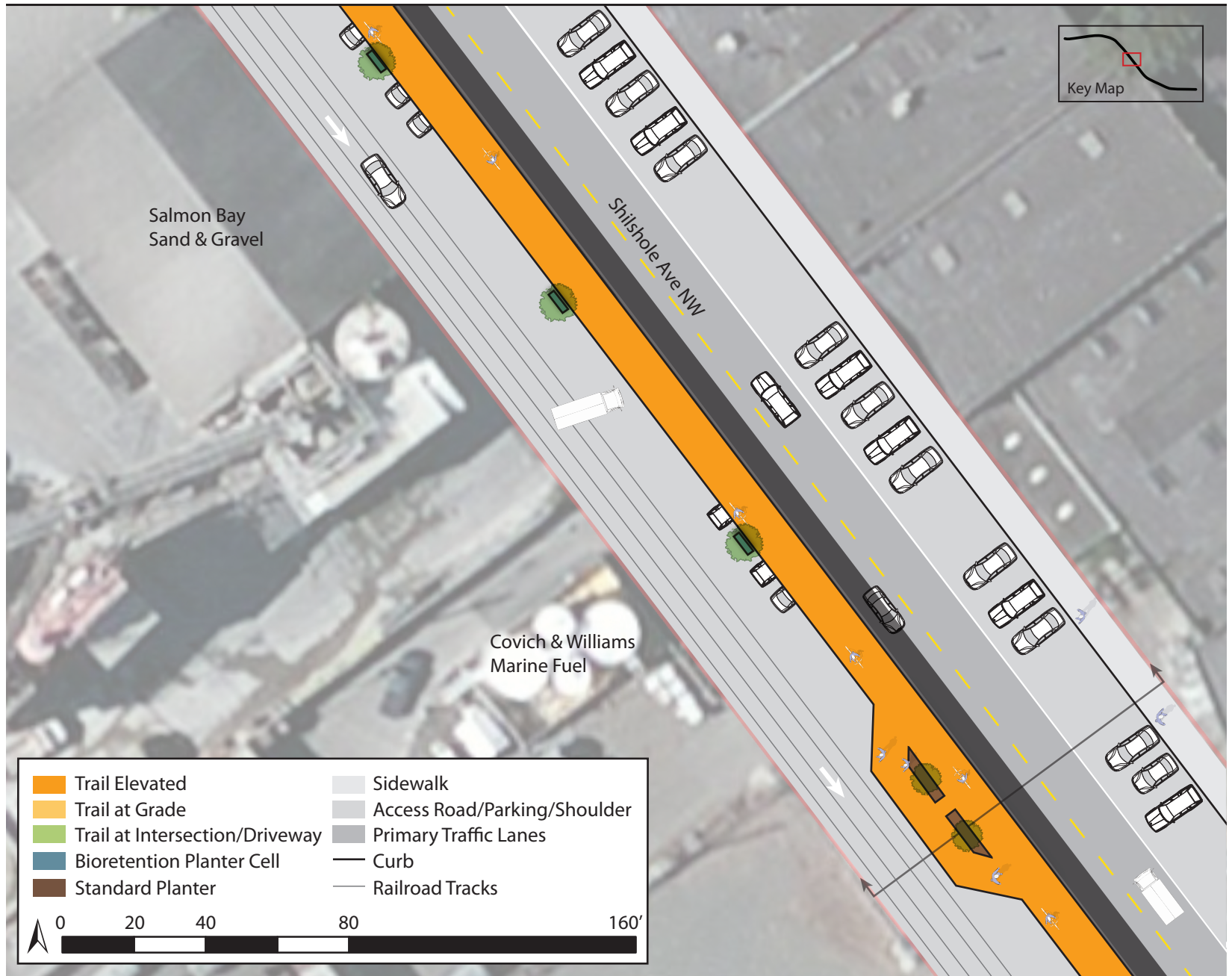


Figure 47. Elevated design section cut for Shilshole Ave NW (central Missing Link) shown north of intersection with 20th Ave NW



Map 17. Elevated plan example for Shilshole Ave NW (central Missing Link) includes interpretive viewpoint, shown north of intersection with 20th Ave NW

Designers who provided feedback on this design recommended several different heights. These discrepancies, and the changing conditions throughout the corridor, suggest the possibility of an elevated structure that is not perfectly flat. An undulating design could be more responsive to existing conditions and provide a more interesting user experience. The grade change, once at a minimum clearance height, could vary slightly (1-3% grade change). However, this option is not shown in the trail profile (figure 49, p 82-83).

The minimum height suggested by the American Association of State Highway and Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets* is the following: “In highly urbanized areas, a minimum clearance of 14ft may be provided if there is an alternative route with 16ft clearance” (AASHTO 2011, p 7/38). However, in light of recommendations for 16.5’ and 18’ ground clearance, it has become clear that the design to 14’ should be augmented with segments that have more clearance. Table 5 shows the distance required for an elevated structure with a 5% slope to attain a desired

clearance, however this does not take into account the thickness of the structure. In the estimate that was used in this proposal, an additional three feet of height at 5% would increase the distance by 60’ for the ramp to attain 14’ clearance, with the elevated

trail surface 17’ above grade, for a total distance of 340’. All distances and clearances should be studied further in order to safely satisfy the height requirements for all vehicles that need to move through this corridor.

This design proposes that the elevated portion provide two interpretive viewpoints that showcase the history of the waterfront and the economic benefits of the marine industry with art and signage. These 40’ long viewpoints are designed to be twice as wide (24’) as the trail (12’) and feature vegetated public spaces and seating as resting points and viewing areas. Green stormwater infrastructure could still be incorporated into this section with a light touch. The intent along Shilshole Ave NW is to convey stormwater to bioretention cells that are in line with each of the columns that support the elevated structure.

From the perspective of the elevated trail user, connections to the Ballard Avenue Historic/Landmark District and the greater Ballard neighborhood are extremely important, and were carefully considered. The initial proposal called for a connection to the Ballard Bridge on the east end and Vernon Pl NW on the west end. While facilitating the connection to the Ballard Bridge would strengthen north/south movement to and from downtown Seattle, it would increase the length of the elevated structure and miss the opportunity at 17th Ave NW to tie into the Ballard Avenue Historic/Landmark District and future neighborhood greenway. The length of the

Table 5. Elevated trail clearance height and ramp distances

Clearance Height	Slope	Ramp Distance
14’	5%	280’
16.5’	5%	330’
18’	5%	360’
20’	5%	400’

elevated trail was also considered and a stairway is recommended at the intersection with Dock Pl NW. This location services the middle of the Ballard Avenue Historic/Landmark District and is also the site of a city owned public shoreline

street end. The overall profile of the trail (figure 49, p 82-83) helps to envision how the elevated portion links with the neighborhood context. The goal has been to make appropriate connections to Ballard, while at the same time make people feel



Figure 48. Vignette of elevated trail design proposal with interpretive viewpoint (right) along Shilshole Ave NW

Burke-Gilman Trail Missing Link Profile

This profile of the trail showcases the elevated portion of this design for the Missing Link. The total span is less than a ½ mile with a staircase provided at one of the two interpretative viewpoints, leading to the shoreline street end and to the Ballard Avenue Historic/Landmark District via Dock PI or 20th Ave NW. Strong connections to the commercial center of Ballard are also made at the ends of the elevated segment at 17th Ave NW (future neighborhood greenway route) and 22nd Ave NW (primary civic cross axis).

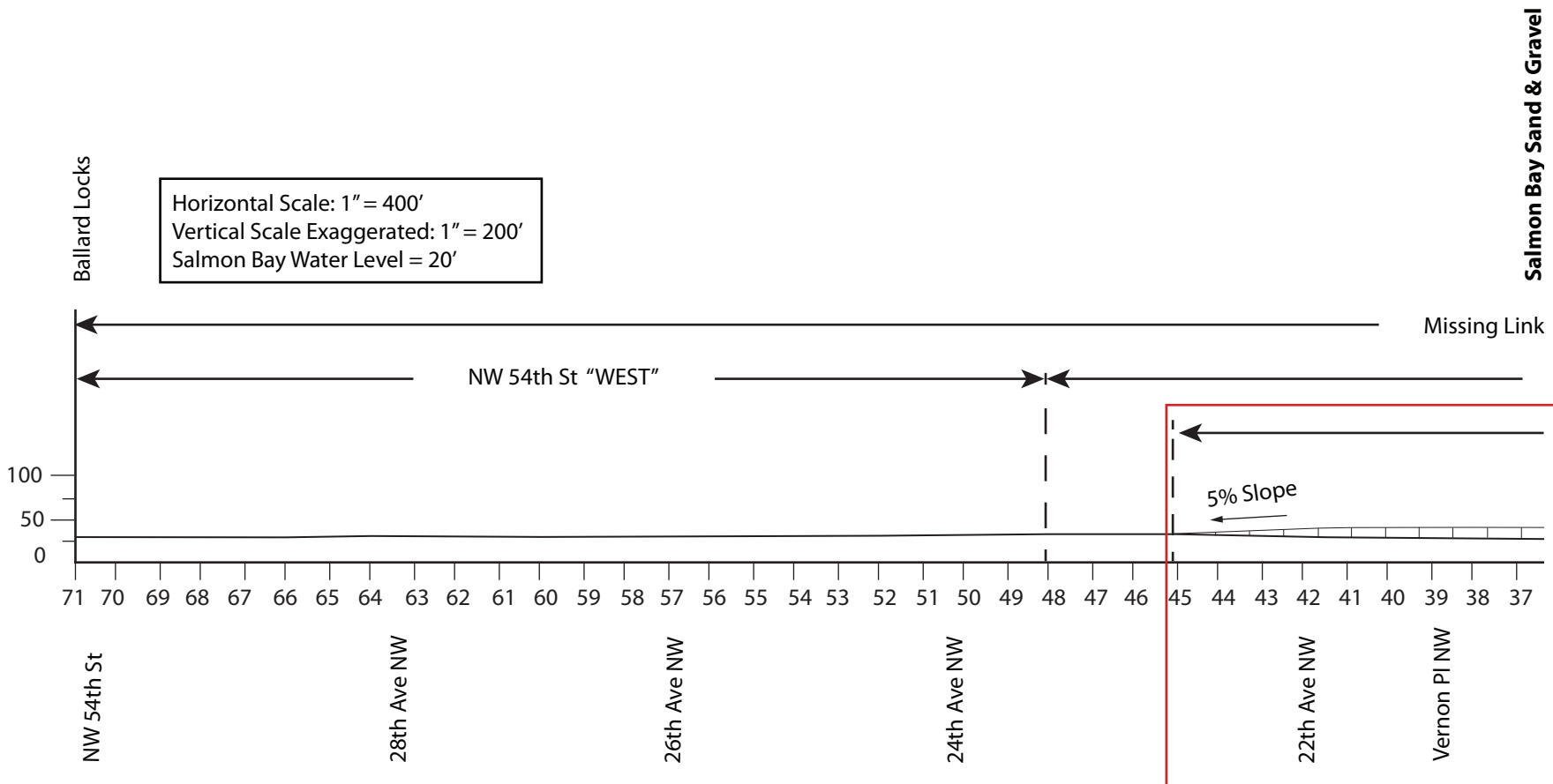
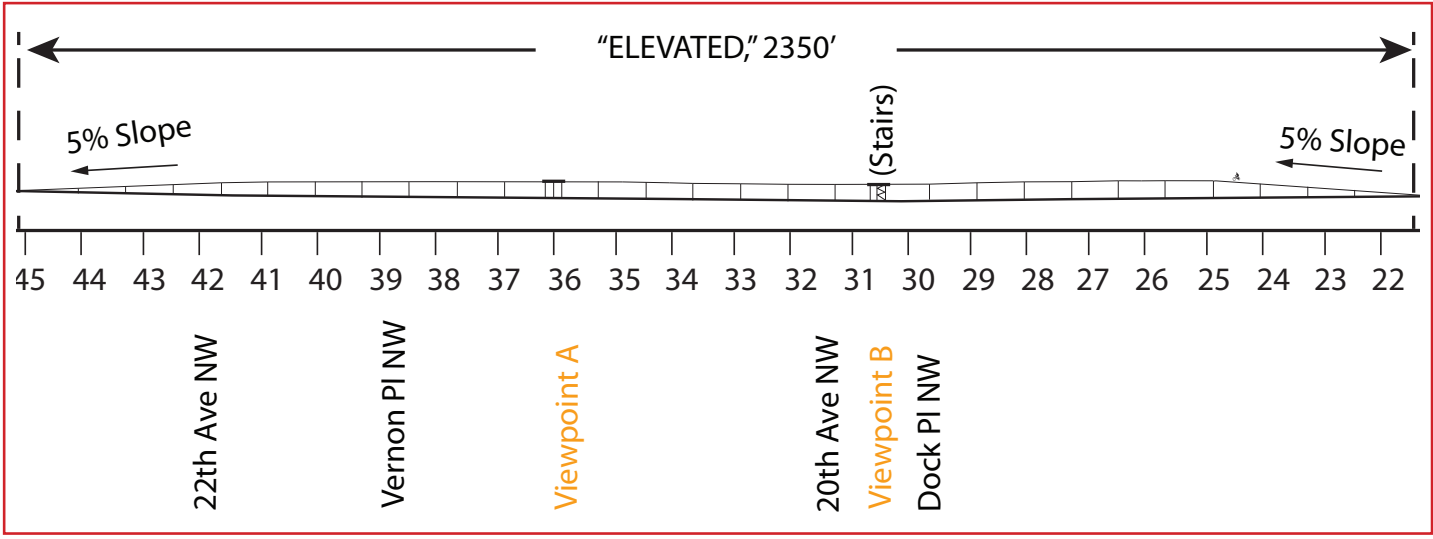


Figure 49. Burke-Gilman Trail Missing Link Profile (p 82-83)

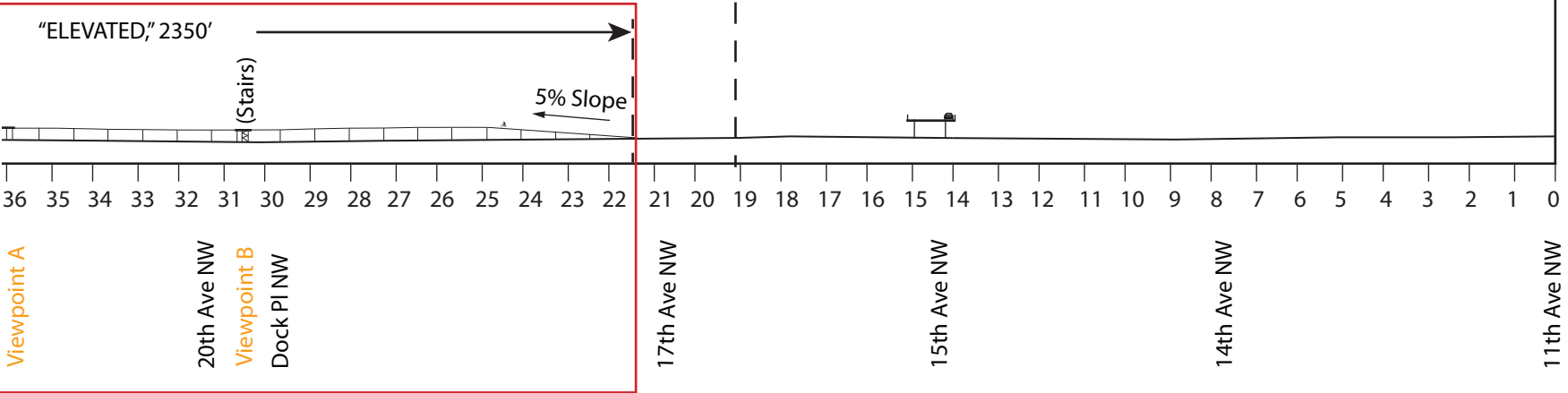
Covich & Williams Marine Fuel



1.3 Miles, 7100'

Shilshole Ave NW

NW 45th St "EAST"



Fred Meyer Parking Lot

comfortable and safe when walking or biking on the elevated trail. If it is too long, people might feel trapped and isolated. On the other hand, if it is too short, people might not feel like it is worth using. A more detailed evaluation of Crime Prevention Through Environmental Design (CEPTED) practices and criteria should be performed to ensure that the experience would be safe and comfortable. Lighting is one feature that could enhance the user experience at night and add to the artistic quality of the elevated structure.

17th Ave NW (South Ramp)

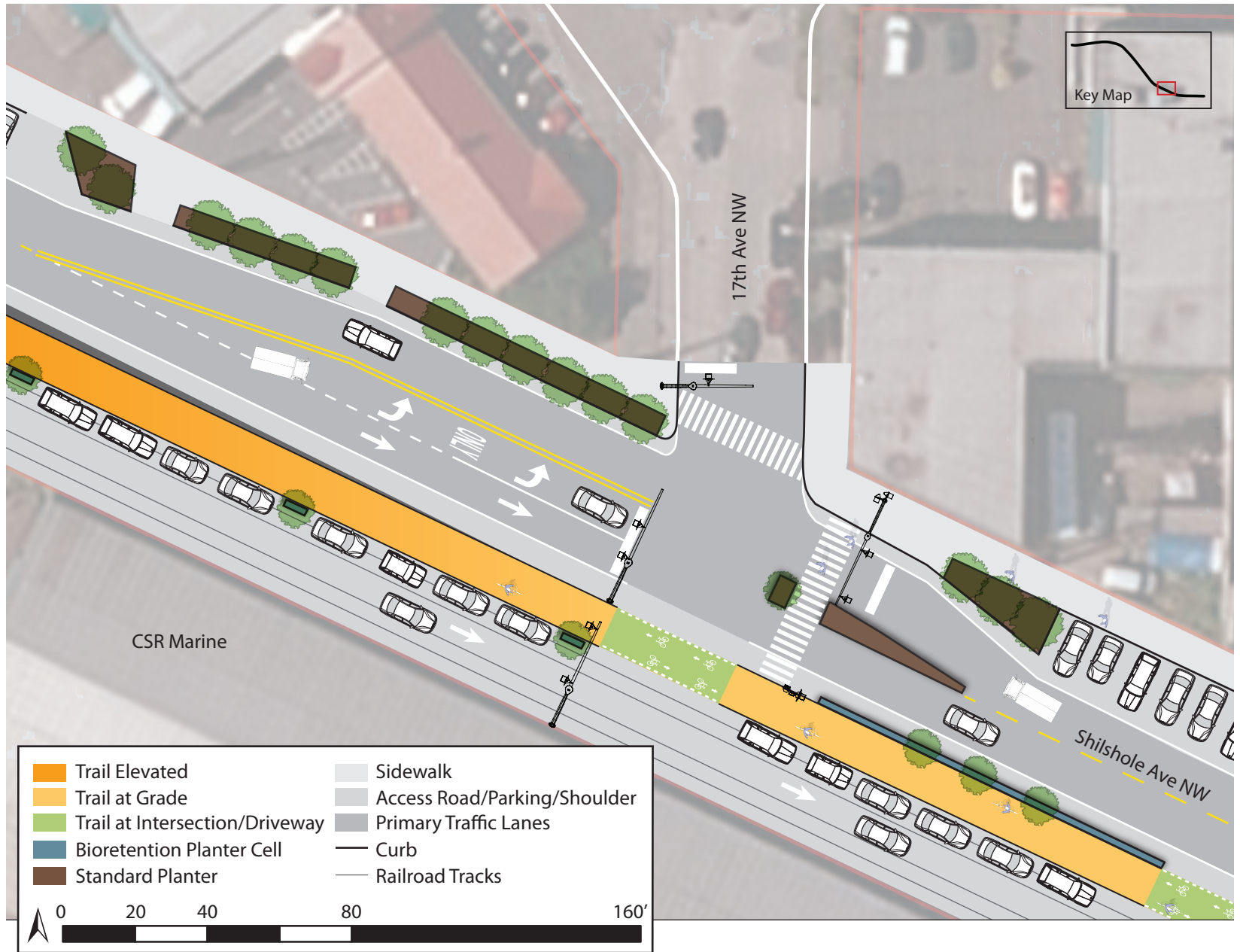
The “take-off” and “landing” locations were both revised to design a strong connection to the Ballard neighborhood. On the eastern end of the Missing Link at 17th Ave NW, a new signalized intersection uses elements of green stormwater infrastructure and Complete Streets to facilitate the safe and efficient movement of all people and vehicles. These include bioretention cells, pavement markings, raised intersection crossings, shortened crosswalks, vertical elements (art/trees) and other plantings.

This improvement benefits larger truck traffic that is attempting to turn left on 17th Ave NW to reach the Ballard Bridge southbound via Leary Ave NW. It also organizes the pedestrian and bicycle access to the Ballard Avenue Historic/Landmark District providing a safe crossing.

The cross section of this segment is similar to the arrangement proposed for the typical elevated segment but without the wider viewpoint. A shared business access and railroad lane and parallel parking maintain business operations on the southwest or waterfront side of the 100’ wide public right-of-way. The trail crossing at 17th Ave NW would need to be signalized for bicycles as well to allow for turning movements to and from the business access road. Again, as with all driveway access and trail crossings, the turning radii and crossing width should be studied further to conform to appropriate vehicle and corresponding roadway specifications.

Table 6. Elevated trail proposal benefits and trade-offs for marine industrial interests

BENEFITS	TRADE-OFFS
<ol style="list-style-type: none"> 1. Bicycles diverted off Shilshole Ave NW 2. Signalized intersection at 17th Ave NW facilitates truck movements 3. Improved surfaces reduce vehicle maintenance 4. Likely the best offer from the city, having the least impacts to businesses 5. Opportunity to showcase economic benefits the businesses provide 6. New amenity for employees that preserves substantial parking 7. Less flooding and contaminated stormwater on business properties 8. Rail upgrades and improvements, split cost with city 9. Improve industry public relations by accepting a compromise 	<ul style="list-style-type: none"> • Inconvenience of construction • Truck behavior modification necessary, but less impact than surface option • Structural columns need to be avoided



Map 18. Design plan of Shilshole Ave NW (elevated ramp south) adds a turning lane and plantings shown at intersection with 17th Ave NW

22nd Ave NW (North Ramps)

The plan (map 19, p 87) and the vignette (figure 51, p 88) showcase the northwestern end of the elevated section where the trail splits. One fork continues west along the rail alignment and on towards the Ballard Locks and the Burke-Gilman Trail terminus at Golden Gardens Park. The other fork turns north onto 22nd Ave NW, which is the primary civic cross-axis of Ballard, connecting to the middle of the commercial district and the library. The section (figure 50) illustrates how this fork of the trail works well with the topography. Even if the clearance over Shilshole Ave NW needed to be increased from 14' to 18' the ramp could still make the connection into Ballard at 22nd Ave NW and have a slope less than 5%. This is the benefit of the 12' grade change, which decreases the vertical distance the ramp must

travel, thus it works well with the topography.

The change that may be required, if the height clearance is increased, is that the fork in the elevated trail may need to be moved further south. This may be necessary in order to reach grade before the driveway crossing shown in the northwest portion of map 19.

The intersection of 22nd Ave NW and Shilshole Ave NW meet at a sharp angle. This creates a wide intersection and crossing that is not ideal for pedestrians. However, an opportunity exists to add additional elements of Complete Streets and GSI by making bulbouts that decrease crossing distances, calm traffic, enhance ecological quality and also filter stormwater. These elements are also shown in the following vignette (figure 51, p 88).

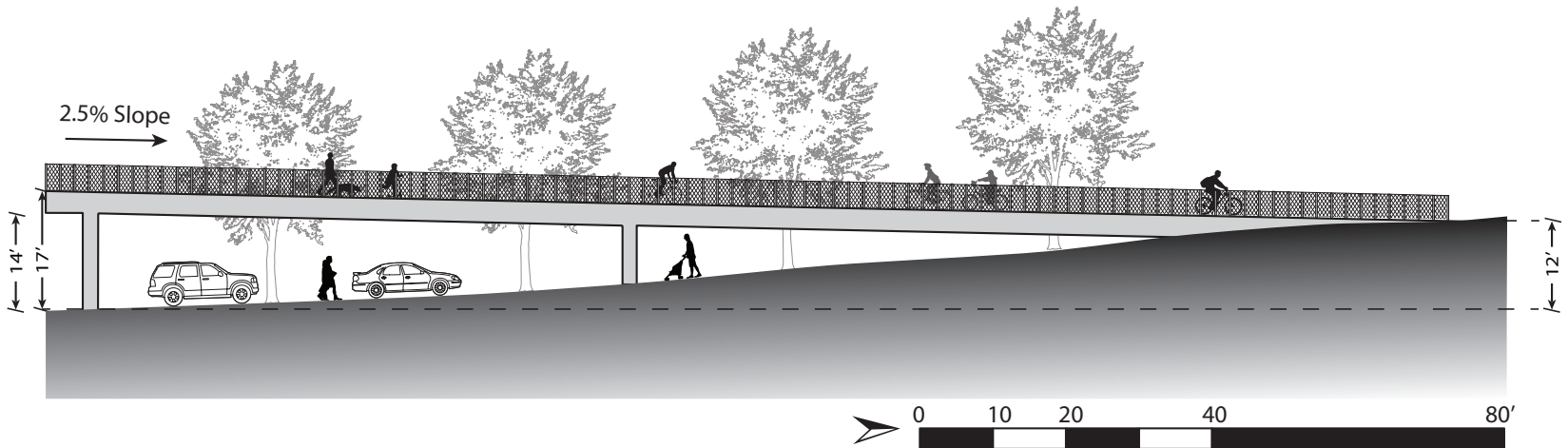
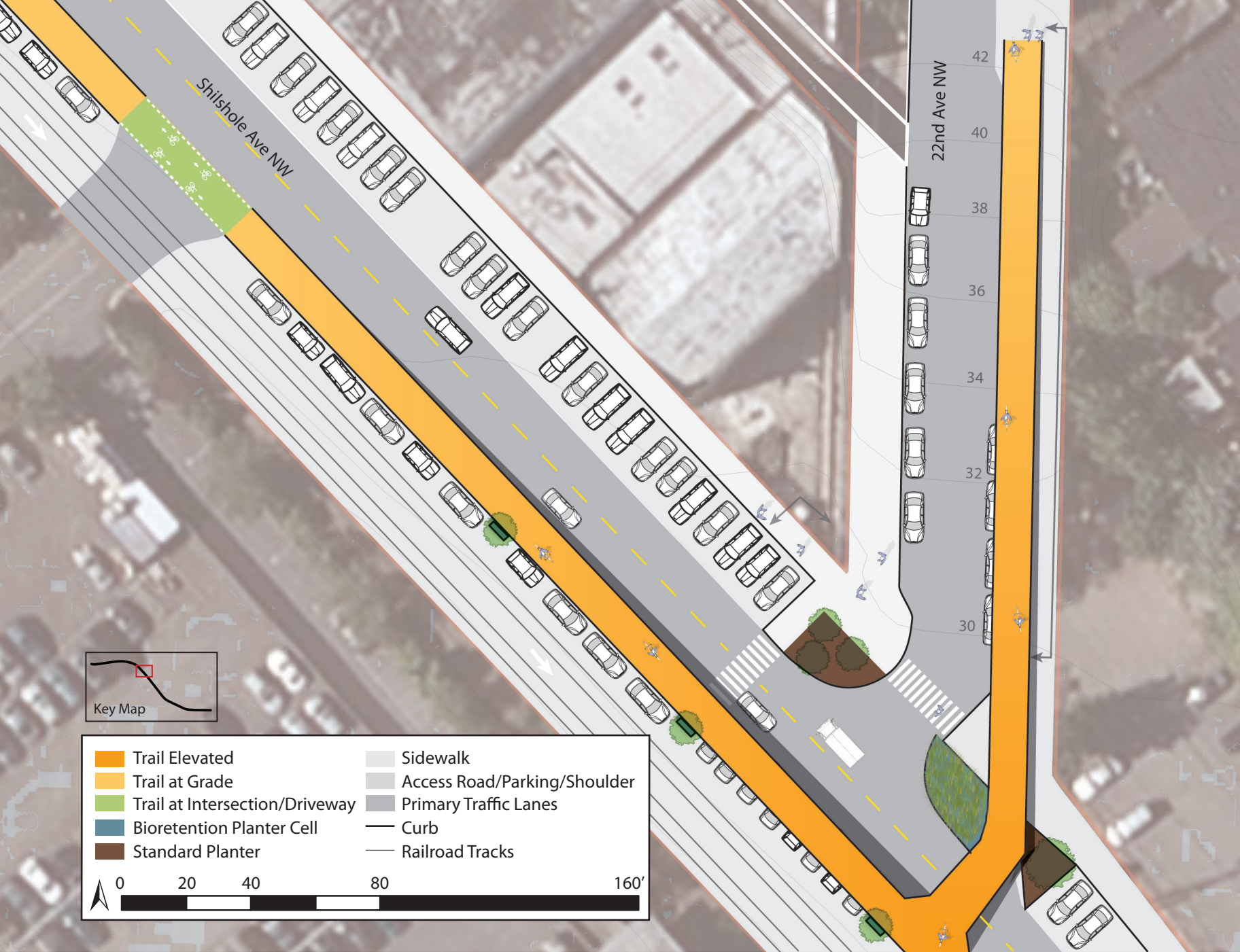


Figure 50. Section cut of elevated ramp working well with the topography on 22nd Ave NW connecting to the heart of Ballard



Map 19. Design plan of Shilshole Ave NW (elevated ramps north) with large bioretention cell and curb bulbs at intersection with 22nd Ave NW



Figure 51. Vignette illustrating the fork of the elevated trail, with abioretention cell and planted curb bulbs looking southeast at the intersection of Shilshole Ave NW and 22nd Ave NW

CHAPTER 6 REFLECTION:

Drawing conclusions on the thesis and design process and outcomes



Figure 52. Participants discuss Missing Link alternatives at the Burke-Gilman Missing Link Open House and Environmental Impact Statement (EIS) meeting on August 8, 2013

The initial investigations for this thesis began in April 2013, over a year before it was completed in June 2014. The broad goals of this thesis have been consistent: to gain experience utilizing a spectrum of research methods and applying them in the design of a real-world project. Hopefully this work can contribute to the Missing Link dialogue in the same productive manner that it has contributed to my education.

Project Goals and Intentions

This research and design thesis begins with the goal of completing the Missing Link. The anticipated outcome was to facilitate the efficient flows of people and vehicles as well as increase safety, by merging contemporary urban design practices with principles of landscape architecture that create more resilient and livable cities by enhancing ecological function.

Applying these concepts and strategies in an area that has been heavily industrialized for over a century is controversial. If it can be accomplished in a manner that provides ecosystem services with minimal impacts to existing land uses, it could allow industrial and manufacturing property owners to adapt and be more responsive to the changing needs of the community. In this scenario, the proposed design intervention can not only benefit the city and environment, but it can also make businesses more resilient to changing conditions instead of being displaced. One lesson resulting from this thesis is that design cannot occur in a vacuum. Instead it must engage with local stakeholders and community members who are willing to find ways to compromise.

Framework for Negotiation and Design

It was not until I started interviewing key stakeholders in January 2014 that I began to internalize the significance and need for an approach using design as a form of mediation. I was aware of the

history, conflicts and lawsuits but was still in the process of formulating my approach to the design challenge. Chapter One of this thesis framed the situation and my understanding of the Missing Link, as well as why and how I would present my interpretation and design.

I did not anticipate the influence that resulted from the interactions with the stakeholders I interviewed. My design framework blended highlights and inspiration from my interview process with existing knowledge and precedents regarding green stormwater infrastructure, bicycle infrastructure and Complete Streets examined in the literature review. The resulting design framework seems to capture the essence of the priorities from key stakeholders, merging it with my perspective and priorities as an aspiring landscape architect and urban designer.

The translation of the design framework to a schematic design for the Missing Link created a personal tension between my desire to be practical, to propose solutions that could be accepted by all stakeholders, and to push the limits of ecological function in an industrial area. Reconciling those ideologies was a challenging but productive exercise, which involved soliciting feedback from other designers and mentors and adjusting the design along the way. The resulting proposal is likely something that will be seen as a compromise to some and as biased by others. Perhaps I should take it as the mark of an effective negotiation if everyone feels like their

top priorities were met but they are still unhappy with the trade-offs required.

A more complete negotiation might have included soliciting and integrating feedback from maritime industrial interests into the later stages of the design process. The design framework and the design itself place a high demand on the findings from interviews, which were challenging to document and share given my dedication to protecting interviewee identities. In spite of this, the design framework served well as a bridge between my literature/precedent review and my design as well as between interviews/site analysis and design.

Evolving Infrastructure

Observations of trends in urban and bicycle culture forecast massive investments in new infrastructure facilities. As urban residents' perception of what mobility means and the function of the right-of-way evolves to include a diversity of users and purposes, the approach to infrastructure and transportation projects also needs to change.

Landscape architects are uniquely positioned as interdisciplinary leaders and generalists to help blend the new potential functions of our right-of-way. While any of the individual strategies presented in this thesis are in the early stages of general use and acceptance, the combinations into a hybrid form of infrastructure are rare.

This thesis proposes a mutually beneficial relationship between bicycle infrastructure, green

stormwater infrastructure and other aspects of Complete Street policies. The Missing Link was an extremely challenging test case for implementing this hybridized infrastructure. It required a more robust supportive strategy of an elevated trail segment in order to reconcile the top priorities of the key stakeholders. In spite of this decisive design decision, the framework and design proposal share a glimpse of how a hybrid bicycle and green stormwater infrastructure can work together to create a multifunctional transportation network.

Conclusion

The completion of the Burke-Gilman Trail's Missing Link has been elusive for the last two decades. As the process continues, perhaps the dialogue can de-escalate and start to find more compromises that satisfy the top priorities of all involved. This thesis might contribute to the dialogue in a way that highlights an alternative that was previously eliminated and reframes it with a higher level of ecological function.

The process of formulating and realizing this thesis has been instrumental to my development as a designer. Perhaps some of the rawness and lack of constraints that are permitted in an academic thesis have served as an asset, allowing for a design proposal that pushes the realm of possibility. If in the end this thesis does not positively contribute to the real-world Missing Link dialogue, it was still extremely valuable to practice the process of research and its dialogue with design.

BIBLIOGRAPHY

AASHTO (American Association of State Highway and Transportation Officials). 2012. *Guide for the Development of Bicycle Facilities*. Washington, D.C.: American Association of State Highway and Transportation Officials.

AASHTO (American Association of State Highway and Transportation Officials) 2011; 2012. *Policy on Geometric Design of Highways and Streets (6th Edition) with 2012 Errata*. Online version available at: <http://app.knovel.com/hotlink/toc/id:kpPGDHSE01/policy-geometric-design>

ABJK. Engineering Firm (accessed March 31, 2014) www.abkj.com/projects/11/bridges-pedestrian

American Rivers, the Water Environment Federation, the American Society of Landscape Architects and ECONorthwest. 2012. *Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide*. (accessed October 18, 2013) www.asla.org/uploadedFiles/CMS/Government_Affairs/Federal_Government_Affairs/Banking%20on%20Green%20HighRes.pdf

Bailey Jr., Thomas. 2010. "Broad Smiles: Organizers Revel in Success of Bikable, Walkable Demonstration Event." (accessed March 14, 2014) www.commercialappeal.com/news/2010/nov/23/broad-smiles

Bain, Lesley, Barbara Gray, and Dave Rodgers. 2012. *Living Streets: Strategies for Crafting Public Space*. Hoboken, N.J.: John Wiley & Sons.

Ballard Historical Society (accessed May 15, 2013) www.ballardhistory.org/search/show_photo.asp?id=757

Berger, Knute, Crosscut, "The Car that Broke the Back of Seattle's Bike Craze" (accessed October 11, 2013) <http://crosscut.com/2013/09/26/roots-of-tomorrow/116398/bike-paths-seattle-history>

Better Block. (accessed March 14, 2014) www.betterblock.org/about

Big Dam Bridge. (accessed February 12, 2014) www.bigdambridge.com

Cascade Bicycle Club, 2012 "Seattle Bicycle Report Card: A Comparison Among U.S. Bicycle Friendly Cities Moving Seattle to the Next Level." (accessed October 13, 2013) www.cascade.org/pdf/Seattle_Bicycle_Report_Card_2012_web.pdf

Cascade Bicycle Club. 2013. "Missing Link EIS Scoping Letter." (accessed October 10, 2013) <http://blog.cascade.org/wp-content/2013/10/Missing-Link-EIS-Scoping-Comment-Letter-Final-2013-08-16.pdf>

City of Northfield. "Complete Streets Policy." (accessed, May 7, 2014) www.ci.northfield.mn.us/index.aspx?NID=732 (p17)

City of Seattle. 2007. Legislative Information Service. "Seattle's Complete Streets Policy." (accessed October 18, 2013) <http://clerk.seattle.gov/~scripts/nph-brs.exe?d=CBOR&s1=115861.cbn.&Sect6=HITOFF&l=20&p=1&u=~public/cbor2.htm&r=1&f=G>

City of Seattle. 2009. Legislative Information Service. "Stormwater, Grading, and Drainage Control Code." (accessed May 8, 2014) <http://clerk.ci.seattle.wa.us/~scripts/nph-brs.e?s1=&s3=&s4=123105&s2=&s5=&Sect4=AND&l=20&Sect2=THESON&Sect3=PLURON&Sect5=CBORY&Sect6=HITOFF&d=ORDF&p=1&u=%2F~public%2Fcbor1.htm&r=1&f=G>

City of Seattle. 2014. Seattle Public Utilities. "March 2014 Combined Sewer Overflow Discharge Monitoring Report." (accessed May 13, 2014) www.seattle.gov/util/groups/public/@spu/@drainsew/documents/webcontent/01_029937.pdf

Clifton, Kelly, Sara Morrissey, and Chloe Ritter. 2012. "Business Cycles: Catering to the Bicycling Market," & "Exploring the Relationship Between Consumer Behavior and Mode Choice," TR News 280 May–June, 2012. (accessed October 17, 2013) http://kellyjclifton.com/Research/EconImpactsofBicycling/TRN_280_CliftonMorrissey&Ritter_pp26-32.pdf

Confluence Project, Vancouver Land Bridge. (accessed, February 12, 2014) www.confluenceproject.org/project-sites/vancouver-land-bridge

Copenhagen, Denmark. 2013. *Copenhagen City of Cyclists: Bicycle Account 2012*. (accessed September 5, 2013) http://subsite.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/LivingInCopenhagen/CityAndTraffic/~/_media/4ADB52810C484064B5085F2A900CB8FB.ashx

Cradock, A. L., Troped, P. J., Fields, B., Melly, S. J., Simms, S. V., Gimmler, F., & Fowler, M. (January 01, 2009). "Factors Associated with Federal Transportation Funding for Local Pedestrian and Bicycle Programming and Facilities." *Journal of Public Health Policy*, 30, pp. 38-72.

- Cycling Embassy of Denmark, *Collection of Cycle Concepts 2012*, (accessed September 20, 2013) www.cycling-embassy.dk/2013/08/01/cycle-concepts2012
- Dannenberg, Andrew L., Howard Frumkin, and Richard Jackson. 2011. *Making Healthy Places: Designing and Building for Health, Well-being, and Sustainability*. Washington, D.C.: Island Press.
- Dill, J. (January 01, 2009). "Bicycling for Transportation and Health: the Role of Infrastructure." *Journal of Public Health Policy*, 30, pp. 95-110.
- DPD (Seattle Department of Planning and Development). Seattle Green Factor (accessed December 5, 2013) www.seattle.gov/dpd/cityplanning/completeprojectslist/greenfactor/whatwhy/
- Eckerson, Clarence Jr. 2011. "Breathtaking Bike Infrastructure: Minnesota's Martin Olav Sabo Bridge" (accessed February 12, 2014) www.streetfilms.org/breathtaking-bike-infrastructure-minnesotas-martin-olav-sabo-bridge/
- Eckerson, Clarence Jr. 2013. "The Indianapolis Cultural Trail: The Next-Gen in U.S. Protected Bike Lanes" (accessed December 4, 2013) www.streetfilms.org/the-indianapolis-cultural-trail
- Emerson, Pam, and Nancy Rottle. 2012. *The Social Feasibility of Roadside Raingardens: A Compendium of Siting, Design and Engagement Tools*. Thesis (M. Landsc. Arch.)—University of Washington, <http://hdl.handle.net/1773/20512>
- Forbes. "2014 Crowdfund Trends: Top 20 Wall-Breakers of Real Estate Investing" (accessed March 15, 2014) www.forbes.com/sites/groupthink/2014/02/28/2014-crowdfund-trends-top-20-wall-breakers-of-real-estate-investing/
- Forester, John. 1994. *Bicycle Transportation: A Handbook for Cycling Transportation Engineers*. Cambridge, Mass: MIT Press.
- Francis, Sarah. 2010. Green Economy Task Force. *Gray to Green: Jumpstarting Private Investment in Green Stormwater Infrastructure* (accessed February 12, 2014) www.sbnphiladelphia.org/images/uploads/02-17-10_EIP_stormwater.pdf
- Friends of the High Line. (accessed March 30, 2014) www.thehighline.org/about/faq
- Fucoloro, Tom. *Seattle Bike Blog*. (accessed April 21, 2013) www.seattlebikeblog.com/tag/missing-link/

Gaber, J., & Gaber, S. L. (January 01, 2004). "If You Could See What I Know: Moving Planners' Use of Photographic Images from Illustrations to Empirical Data." *Journal of Architectural and Planning Research*, 21, 3, p 222.

Gehl, Jan. 2010. *Cities for People*. Washington, DC: Island Press. Gehl, Jan. 2011. *Life Between Buildings: Using Public Space*. New York: Van Nostrand Reinhold.

Gotschi, Thomas. 2011. "Costs and Benefits of Bicycling Investments in Portland, Oregon." *Journal of Physical Activity and Health*, 2011, 8(Suppl 1), S49-S58.

Green Cities Research Alliance. 2012. *Seattle's Forest Ecosystem Values: Analysis of the Structure, Function and Economic Benefits*. (accessed May 8, 2014) www.seattle.gov/trees/ecoservices.htm

Greenworks. "North Denver Avenue Green Street." In *Works/Green Streets*. (accessed March 17, 2013) <http://greenworkspc.com/works/green-streets/north-denver-avenue-green-street/>

Hurd, A-P., and Al Hurd. 2012. *The Carbon Efficient City*. Seattle: University of Washington Press.

Ioby. Hampline Project. (accessed March 14, 2014) www.ioby.org/project/hampline

ICT (Indianapolis Cultural Trail) Inc. 2013. "Indianapolis Cultural Trail Fact Sheet" (accessed December 4, 2013) www.indyculturaltrail.org

Jacobson, B. & Richter, J. 2012. *Seattle's Neighborhood Greenways: Seattle Toolkit 2012*. Seattle, WA: Green Futures Lab.

JRA Bike Shop (accessed April 21, 2013) <http://jrabikeshop.com/files/1972BikePlan.pdf>

Karvonen, A. (2011). *Politics of Urban Runoff: Nature, Technology, and the Sustainable City*. Cambridge, Mass: MIT Press.

Kasperzyk, Davidya; Warsinske, Chuck; Wesman, Susan. 2001. *The Missing Link Study: A Design Visualization of a Completed Burke-Gilman Trail Through the Ballard Marine Industrial District*.

King, Jason A. and Kummer, Shawn. 2009. "Green Streets Pave the Way to Greener Communities." *Urban Design Newsletter*. (accessed March 18, 2013) www.asla.org/ppn/Article.aspx?id=23622

Krueger, Richard A., and Mary Anne Casey. 2000. *Focus Groups: A Practical Guide for Applied Research*. Thousand Oaks, Calif: Sage Publications.

League of American Bicyclists. 2009. "The Economic Benefits of Bicycle Infrastructure Investments." (accessed March 25, 2014) http://issuu.com/bikeleague/docs/economic_benefits_bicycle_infrastructure_report

Lebetkin, Mark. 2013 "Best Urban Bike Paths Across the USA." *USA Today* (accessed December 6, 2013) www.usatoday.com/story/travel/destinations/2013/07/23/best-urban-bike-paths-across-the-usa/2576801/

Luoni, Stephen et al. 2010. *Low Impact Development: A Design Manual for Urban Areas*. Fayetteville: University of Arkansas Press.

NACTO (National Association of City Transportation Officials (U.S.)) 2012. *Urban Bikeway Design Guide*. Washington, D.C.: NACTO, National Association of City Transportation Officials.

NACTO (National Association of City Transportation Officials). 2013. *Urban Street Design Guide*. New York: NACTO, National Association of City Transportation Officials.

National Resources Defense Council (NRDC). 2013. *The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value*. (accessed March 26, 2014) www.nrdc.org/water/commercial-value-green-infrastructure.asp

NOAA (National Oceanic and Atmospheric Administration). "Habitat—What's it Worth?" (accessed December 5, 2013) www.habitat.noaa.gov/about/habitat/ecosystemservices.html

NYCDDC (New York City Department of Design and Construction) & Design Trust for Public Space. 2005. *High Performance Infrastructure Guidelines*. New York, NY: New York City Department of Design and Construction & Design Trust for Public Space.

NYCDOT (New York City Department of Transportation). 2012. *Measuring the Street: New Metrics for 21st Century Streets*. NYC (accessed December 10, 2013) www.nyc.gov/html/dot/downloads/pdf/2012-10-measuring-the-street.pdf

Partnership for Sustainable Communities. 2013. "Indianapolis Cultural Trail: Improving Livability" (accessed December 4, 2013) www.sustainablecommunities.gov/pdf/studies/2013_5_23_indianapolis_case_study.pdf

PBOT (Portland Bureau of Transportation) 2012 Portland Bicycle Count Report (accessed September 27, 2013) www.portlandoregon.gov/transportation/article/448401

People for Bikes. October 13, 2013. "Memphis Is About to Build the Country's First Crowdfunded Bike Lane" (accessed March 14, 2014) www.peopleforbikes.org/blog/entry/memphis-is-about-to-build-the-countrys-first-crowdfunded-bike-lane

People for Bikes, March 10, 2014. "People for Bikes Selects New Green Lane Project Cities." (accessed March 14, 2014) www.peopleforbikes.org/blog/entry/peopleforbikes-selects-new-green-lane-project-cities

Phillips, Bianca. February 23, 2014. "City Breaks Ground on Hampline Bike Path." *Memphis Flyer*. (accessed March 24, 2014) www.memphisflyer.com/NewsBlog/archives/2014/02/23/city-breaks-ground-on-hampline-bike-path

Pucher, John R., and Ralph Buehler. 2012. *City Cycling*. Cambridge, Mass: MIT Press.

Rails-to-Trails Conservancy. Railbanking (accessed March 26, 2014) www.railstotrails.org/ourwork/trailbuilding/toolbox/informationsummaries/railbanking_whatandwhy.html

Robson, Colin. 2002. *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. Oxford, UK: Blackwell Publishers.

Rottle, N. & Maryman, B. (2012). "Green Infrastructure for Community Livability." In Fritz Wagner & Roger Caves (Eds.), *Community Livability: Issues and Approaches to Sustaining the Well-Being of People and Communities* (pp. 198-222) New York, NY: Routledge Press.

SDOT (Seattle Department of Transportation). 2011. "Traffic Flow Data and Maps." (accessed October 12, 2013) www.seattle.gov/transportation/tfdmaps.htm

SDOT (Seattle Department of Transportation). 2013. *Bicycle Master Plan (BMP)* (accessed December 5, 2013) www.seattle.gov/transportation/bikemaster.htm

SDOT (Seattle Department of Transportation). "Burke-Gilman Trail Extension Projects" (accessed April 21, 2013) www.seattle.gov/transportation/missinglink.htm

SDOT (Seattle Department of Transportation). 2014 "Truck Classification Legend Definitions." (accessed May 22, 2014) www.seattle.gov/transportation/streetclassmaps/trucklegend.pdf

Seattle City Council. "Privately Owned Public Open Spaces" (POPS) (accessed March 14, 2014) www.seattle.gov/council/licata/public_space.htm

Seattle Times, "A Turf War Over the Burke-Gilman Trail's Missing Link Becomes a Standoff" (accessed April 21, 2013) http://seattletimes.com/html/pacificnw/2012187424_pacificpburke11.html

Seattle Times, "Seattle Bicycle Accidents, 2007-2011"(accessed May 12, 2013) <http://seattletimes.com/flatpages/local/bicyclecollisionsinseattle.html>

- SF Bicycle Coalition. 2012. "The Power of Pilot Projects." (accessed November 14, 2013) www.sfbike.org/main/the-power-of-pilot-projects/
- Smart Growth America. 2012. *The Best Complete Street Policies of 2012*. (accessed December 8, 2013) www.smartgrowthamerica.org/documents/cs/resources/cs-policyanalysis.pdf
- Speck, Jeff. 2012. *Walkable City: How Downtown Can Save America, One Step at a Time*. New York: Farrar, Straus and Giroux.
- South Snohomish County Bicycle Survey, (accessed June 12, 2013) www.surveymonkey.com/s.aspx?sm=c2qrCThFEW2m692S8DowYA%3d%3d
- State of Washington Department of Ecology, State Environmental Policy Act (SEPA), (accessed February 3, 2014) www.ecy.wa.gov/programs/sea/sepa/overview.html
- Stiles, Marc. August 29, 2012. "City Must Study Alternatives for Burke-Gilman 'Missing Link'" Puget Sound Business Journal. (accessed April 21, 2013) www.bizjournals.com/seattle/news/2012/08/29/city-must-study-alternatives-for.html?page=all
- Streets Plan Collaborative. 2012. *Tactical Urbanism Vol. 1*. (accessed June 6, 2014) http://issuu.com/streetsplancollaborative/docs/tactical_urbanism_vol.1
- Transportation Alternatives. 2012. *East Village Shoppers Study: A Snapshot of Travel and Spending Patterns of Residents and Visitors in the East Village*. (accessed December 10, 2013) http://transalt.org/files/news/reports/2012/EVSS_Final.pdf
- U.S. Department of Transportation Federal Highway Administration. 2009. *National Household Travel Survey*. (accessed April 16, 2014) <http://nhts.ornl.gov/2009/pub/stt.pdf>
- U.S. EPA Webcast. "Financing Perspectives on Using Public Private Partnerships (P3s) for Green Infrastructure, Wealth, and Community Resiliency." (accessed March 18, 2014) <http://mp118885.cdnmediaplatform.com/118885/ml/mp/4000/5345/5417/33755/Lobby/default.htm>
- Wiss, Janney, Elstner Associates, Inc. (2012) "Martin Olav Sabo Pedestrian Bridge Cable Diaphragm Plate Fracture Investigation." (accessed, May 13, 2014) www.minneapolismn.gov/www/groups/public/@publicworks/documents/webcontent/sabo-bridge-rpt.pdf
- Zeisel, John. 1984. *Inquiry by Design: Tools for Environment-Behavior Research*. Cambridge [Cambridgeshire]: Cambridge University Press.

August 16, 2013

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Seattle, WA 98124-4996

RE: Cascade Bicycle Club's comments regarding the EIS Scoping of the Burke-Gilman Trail "Missing Link" Completion Project

Dear Peter Hahn,

On behalf of Cascade Bicycle Club (Cascade) and our more than 15,000 members, we are grateful for the opportunity to provide feedback on Seattle Department of Transportation's (SDOT) environmental impact statement (EIS) scoping of the Burke-Gilman Trail "Missing Link" Completion Project.

Cascade requests that SDOT scopes the EIS to the historic vision and intended function of the Burke-Gilman Trail. In addition, Cascade raises several specific environmental issues to consider in evaluating the efficacy of each route in achieving that vision and function.

The Vision of the Burke-Gilman Trail

The vision of the Burke-Gilman Trail has been a single, seamless multi-use trail from Bothell to Golden Gardens Park along the historic rail line of Judge Thomas Burke and Daniel Gilman. For more than 40 years, Seattleites and the Seattle City Council have embraced this plan. As such, in studying route and design alternatives through Ballard to complete the "Missing Link" of the Burke-Gilman Trail, the EIS should consider the immediate impacts to bicyclists, pedestrians, and other potentially trail users who currently already use the historic route along the rail line on NW 45th Street, Shilshole Avenue NW and NW 54th Street.

In 1885, Judge Thomas Burke, Daniel Gilman, and ten other investors set-out to construct a rail line, eventually constructing their "Seattle, Lake Shore and Eastern Railroad" from Ballard to Arlington, Washington. The rail line would later be owned and operated by Northern Pacific and then Burlington Northern.

In the 1960s, rail use decreased substantially on the line. In seeing that the rail from Gas Works Park to Kenmore would be abandoned, a Burke-Gilman Trail Park Committee formed in 1968 to secure the rail right-of-way from Burlington Northern and donate it to the City of Seattle and King County for a multi-use trail. In stating the vision of the Burke-Gilman Trail, a 1968 pamphlet of the Burke-Gilman Trail Park Committee stated:

*"If firm future plans for the region are considered, then **this track is an indispensable piece of a pattern to provide eventual trails from Golden Gardens, around Lake Union, north on Lake Washington to connections with the Eastside trail system, the imminent Lake Sammamish circuit, and routes into the Cascades.**"*

(bold added to emphasize original vision along rail line from Golden Gardens to Bothell)

Burlington Northern applied to abandon the line in 1971 and, in 1978, the Gas Works to Kenmore portion of the Burke-Gilman Trail was completed. In 1993, the trail was connected with the Sammamish River Trail, completing the vision of a route to the Eastside trail system and Lake Sammamish. Now, following a decision by the federal Surface Transportation Board and the passage of the 2013 King County Parks Levy, efforts are underway to further strengthen the Eastside trail system along the Eastside Rail Corridor and Mountains-to-Sound Greenway.

Here in Seattle, from the 1970s to today, residents and public officials have continued to move the vision forward for the Burke-Gilman Trail forward. In 1989, Burlington Northern agreed to give the City of Seattle rights to any "railbanked" rail corridor when it ended service on the line.

In the mid-1990s, Burlington Northern classified the Ballard shortline for probable abandonment and then they sold the line to Sea Lion Railroad, a non-profit organization that railbanked the line under the National Trails Act.

The completion of the Burke-Gilman Trail from Gas Works Park to Golden Gardens Park felt imminent when Seattle city staff obtained federal funding to complete the Burke-Gilman Trail from Gas Works Park to Golden Gardens Park and in 1996 Seattle City Council directed staff to study how to complete the trail using the funds. With strong support from the public, in 1996 the Seattle Engineering Department recommended completion of the route, including an on-street design on NW 45th Street.

But instead, in 1996 the City adopted Resolution 29474, stating their preferred alternative to complete only the Burke-Gilman Trail from the east to 11th Avenue NW and from Golden Gardens Park to the Chittenden Locks. In October of the same year, the City granted a franchise to the Ballard Terminal Railroad Company (Ballard Railroad), and then in 1997 the City approved a franchise to Ballard Railroad to operate a short-line railroad on the Ballard Spur line.

As a result, today the vision of a seamless multi-use trail from Golden Gardens to Bothell along the historic rail lines of Burke and Gilman remains incomplete in a single segment along NW 45th Street, Shilshole Avenue NW and NW 54th Street.

In 2003, the Seattle City Council's adopted Resolution 30583, making it once again clear that the preferred permanent route is the historic vision of the Burke-Gilman Trail along NW 45th Street and Shilshole Avenue NW and that the top priority along this new transportation facility is safety.

Today, the Burke-Gilman Trail, even with its "Missing Link," serves thousands of bicyclists and pedestrians who use it to get to work, shop, and play. This summer the Trail was named one of

America's best urban bike paths by *USA Today*. Ballard has become a thriving neighborhood of development, local retail shops, nightlife activity, and a wonderful Sunday Farmers Market.

Despite the dangers, many of the bicyclists who use the Burke-Gilman Trail also continue to use the Missing Link on NW 45th Street and Shilshole Avenue NW for the route's obvious benefits. NW 45th Street is the quickest and easiest way past the Ballard Bridge, and Shilshole Avenue NW lacks the bricked pavement, many intersections, slower car traffic, increased pedestrian traffic, and Sunday Farmers Market that make travel on Ballard Avenue difficult. In addition, Shilshole Avenue NW is a more direct route to the end of the Burke-Gilman Trail from the Chittendon Locks to Golden Gardens Park.

The dangers to bicyclists are significant. In a recent four year period, emergency vehicles responded to 45 bicycle crashes along NW 45th Street and Shilshole Avenue NW. That is nearly one severe crash every single month, and many other crashes go unreported. Many of the crashes are due to crossing the railroad tracks under the Ballard Bridge and the small shoulders and loose gravel. The speeding cars add to the danger as well.

Recommendations for Scoping the EIS

The EIS Scoping Statement should be clear that:

- The Burke-Gilman Trail should be completed as a multi-use trail for bicyclists, pedestrians, and other non-motorized trail users, as was the historic vision and as the completed portion is currently designed.
- The Burke-Gilman Trail is a trail that exists in the historic rail right-of-way. The creation of the Burke-Gilman Trail was a vision that started more than four decades ago of converting rail right-of-way from Golden Gardens Park to Bothell and the Eastside trail system, and to-date the construction of the entire Burke-Gilman Trail has followed that vision exclusively within and adjacent to former rail right-of-ways.
- The completion of the Burke-Gilman Trail should address the safety problems on the route of the historic vision of the Burke-Gilman Trail along NW 45th Street, Shilshole Avenue NW and NW 54th Street.

Recommendations for Drafting the EIS

In drafting the environmental impact statement, SDOT should recognize or consider:

- The preferred alignment of the Burke-Gilman Trail is along NW 45th Street, Shilshole Avenue NW and NW 54th Street. Reasons include:
 - This is the alignment specified as preferred by Seattle City Council's 2003 Resolution 30583.
 - The alignment would address the safety concerns on NW 45th Street and Shilshole Avenue NW, where there is a bicycle crash nearly once a month that requires an emergency vehicle to respond, on average.
 - The City entered into a rail banking agreement with Sea Lion Railroad, then a franchise agreement with Ballard Terminal Railroad Company, that specified that the rail banked right-of-way was to be used for rail and trail use. The City has a legal obligation to use the rail banked right-of-way for the trail, and the Ballard Railroad management agreed to the trail when they signed the franchise agreement.
 - The rail-trail right-of-way is the shortest distance in the Missing Link segment.

- The alignment is a “flat” grade of the current trail, which is preferred by trail users.
- The alignment has the least number of driveway and street crossings of any possible alternative route, resulting in less conflict with non-trail users.
- The alignment avoids Ballard Avenue, which has more cross-street pedestrian traffic and a Sunday farmers market the block or impede traffic, and that
- Other alignments could not be practically designed as multi-use trails.
- Other alignments would not address the safety problems on the historic vision for the route of the Burke-Gilman Trail along NW45th Street and Shilshole Avenue NW, and trail users are likely to continue to use these streets anyways.
- Because the route along Shilshole Avenue NW is the most direct connection through the Missing Link, it would continue to be used by bicyclists even if another, less direct route were selected. Even in its present degraded and hazardous condition, current volumes in the Missing Link have been measured in the range of 80 to 100 bicyclists during the peak hour and 800 to 1,000 bicyclists per day.
- A “No Build” alternative is unacceptable. The absence of a trail connection in the study area is dangerous for bicyclists and pedestrians and fails to achieve the objective of the Burke-Gilman Trail to connect Golden Gardens Park to Bothell with a single multi-use trail on the historic rail line.
- Multiple design alternatives should be considered to address the safety problems on NW 45th Street, Shilshole Avenue NW, and 54th Street NW.
- In evaluating the transportation impacts, SDOT should:
 - Describe how each route and design will address the safety problems on NW 45th Street, Shilshole Avenue NW and 54th Street NW.
 - Describe the distance and elevation gains for each design and route alternative.
 - Describe the number of turns and crossings of arterial and non-arterial streets for each route.
 - Describe the sight lines for users of the trail and those who cross the trail for each alternative route.
 - Describe the number of arterial stops the trail users would encounter.
 - Estimate the safety impacts due to the drivers crossing the trail from the side streets across or onto arterials.
 - Estimate the number of users that would continue to use NW 45th Street and Shilshole Avenue NW if the multi-use trail is built along a different route.
 - Estimate the number of users that would use the trail instead of driving to popular neighborhood destinations such as the Chittendon Locks and Golden Gardens Park and estimate the beneficial health and environmental outcomes.
- In evaluating the impacts to Earth, plants, and animals:
 - Describe the improvements to water quality due to improved drainage and decreased runoff with the trail design, in consideration of the proximity to Salmon Bay, possible green infrastructure improvements, and trail design.
- In evaluating the impacts to historic and cultural resources
 - Describe the benefit of completing the historic vision of the Burke-Gilman Trail along the intended route.
 - Describe the improvement to neighborhood aesthetics and pride with a well-designed NW 45th Street and Shilshole Avenue NW compared to the dusty, gravelly, dangerous situation that exists today.

- Describe the regional pride of completing the Burke-Gilman Trail, a seamless connection from Golden Gardens to Bothell and the Eastside trail system along the historic rail lines.
- Estimate the changes in commuter transportation choices with an improved, safer route to and from Ballard and how that will yield household savings.
- Estimate the marking impact for Ballard and regional businesses of the increased visibility and new bicycle traffic.
- Estimate the economic impact of new retail businesses that would meet the needs of the trail users.
- Estimate the health cost savings of more people walking and bicycling as a result of the completion of the Burke-Gilman Trail.

We have waited long enough. Recently more than 800 people sent public comments into SDOT calling for the completion of the Missing Link on NW 45th Street and Shilshole Avenue. Cascade requests that SDOT conducts a comprehensive and thorough evaluation of all alternatives for completing the Missing Link. However, Cascade strongly believes that ultimately the Missing Link should be --- and must be --- completed along the route of the historic vision for the Burke-Gilman Trail of NW 45th Street, Shilshole Avenue NW and NW 54th Street. No other route is as direct and no other route will address the dangerous bicycling environment on that historic route.

Sincerely,

Brock Howell
Policy & Government Affairs Manager
Cascade Bicycle Club

Cc: Seattle Mayor Mike McGinn
Tom Rasmussen, Transportation Committee Chair, Seattle City Council
Members of the Seattle City Council
Goran Sparman, Deputy Director, SDOT

Consent for Participation in Interview Research

I volunteer to participate in an interview conducted by Mike Schwindeller, a graduate student enrolled at the University of Washington Department of Landscape Architecture. I understand that the conversation is designed to gather information about the “Missing Link” of Burke-Gilman Trail in the Ballard neighborhood of Seattle. I will be one of approximately six people being interviewed by the student for the sole purpose of developing his design framework for his thesis project.

1. My participation in this project is voluntary. I may withdraw and discontinue participation at any time. If I decline to participate or withdraw from the interview, no one will be told.
2. If I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.
3. Participation involves being interviewed by the graduate student. The interview will last approximately 45-60 minutes. Notes will be written during the interview. The student requests that a digital recording of the interview be made strictly to insure the accuracy and detail of the interview. The recording will be kept on a secure device, and will be destroyed upon the completion of the interviewer’s report, no latter than May 31, 2014.
4. I understand that the student will not identify me by name in any reports using information obtained from this interview, and that my anonymity as a participant will be protected. Any reference made by the student to this conversation will be generalized as made by City of Seattle employees or design professionals with relevant local site knowledge.
5. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this interview.
6. I have been given a copy of this consent form.

My Signature Date

My Signature

My Printed Name

Signature of the Interviewer

For further information, please contact:

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