The Social Act of Bicycling
Designing Bicycle Facilities to Foster Social Interaction

Peter Cromwell

Acknowledgements

TABLE OF CONTENTS

INDEX OF GRAPHICS

INTRODUCTION: WHO OR WHAT IS THE BICYCLIST?

While sociologists and designers in the last half century have acknowledged that the pedestrian experience is a critical part of the urban landscape, it is time to recognize that the bicyclist, like the pedestrian, is an active agent in shaping the character of the city. Bicyclists have the potential to serve as agents of change in the city, revealing continued privileging of the automobile while contributing to more livable streets and cities.

So, who is the bicyclist and what is it that they need? One answer to this question might be that people who bicycle are the same as pedestrians. More to the point, bicyclists are often described as more like vehicles than pedestrians. And yet like a pedestrian, bicyclists are moving on their own power and are generally closer to the scale of a pedestrian. Bicyclists are clearly not cars, and they are not simply pedestrians. The bicycle is a machine that propels a person at much faster speeds than they would otherwise be able to reach on their own. Because of their increased mobility bicycles are often ridden in the street and characterized as vehicles. Yet, bicyclists are vulnerable to automobiles like pedestrians and share a similar frame of sensory experiences as pedestrians. Indeed, bicyclists – people who ride bicycles – are something of an enigma from a classification perspective: they are neither vehicles nor pedestrians, yet share characteristics with each.

That bicyclists and pedestrians have similar sensory experiences

has been noted by others. In his novel, *Zen and the Art of Motorcycle Maintenance*, Robert Pirsig poetically describes the difference between the experience of riding a motorcycle and that of driving an automobile:

> You see things vacationing on a motorcycle in a way that is completely different than any other. In a car you're always in a compartment, and because you're used to it you don't realize that through car window everything you see is just more TV. You're a passive observer and it as all moving by you boringly in a frame.
>
> **On a cycle** the frame is gone. You're completely in contact with it all. You're *in* the scene, not just watching it anymore, and the sense of presence is overwhelming. That concrete whizzing by five inches **below your foot** is the real thing, **the same stuff you walk on**, it's right there, so blurred you can't focus on it, yet you can put your foot and touch it any time, and the whole thing, the whole experience, is never removed from immediate consciousness. (2006, 4-5: bold text added by author, italics by Prisig).

It is important to note that, while Prisig starts by talking about the experience of being on a motorcycle, by the second paragraph he is simply describing the experience of being on a -cycle, motor or otherwise. Additionally, he makes several allusions to the similarity between the pedestrian and cyclist's experience of the world. Both are fully in the world, engaged with the landscape and other people. Political scientist and bicycle advocate J. Harry Wray, is more succinct in his observations, "Put most simply, people see the world differently on a bicycle than from behind the wheel of a car, and they connect differently to people as well." (2008, 7) Wray's point is important because it goes further in connection bicyclists and pedestrians. During an interview, a man who identified himself only as 'Monster', expounded on the relationship between pedestrians and cyclists in comparison to that of automobilists:

> I like to watch cyclists because they are close by…I can see their faces, I can see their bodies, I can see their attitudes. I don't feel any people riding in cars being present. They're just in a box. People on a bike their present. They're here. They're observing. (Copenhagen, Denmark Sept. 18th, 2012)

His observations reflect that as a pedestrian, he is able to connect with bicyclists observe him sitting and watching. However, he experienced no connection to people in cars. This testimony echoes that of Prisig

and Wray: the sensory experience of being on a bicycle is more similar to that of a pedestrian than the automobilist.

How people interact with their environment is an important question for designers of the city. For example, during the 1960's and 70's, in response to Modernist Architecture and Planning, designers questioned whether organization, efficiency, and function were the best design criteria for public space. In addition, there was an increased awareness that city designs had too often privileged the car over the pedestrian. Several key activists and designers (Jacobs 2011; Whyte 2000; Gehl, 2010) focused increasingly on how the built environment influenced the relationship between people and cities. This led to the more general acknowledgment that the way we design influence one's sense of invitation to use public space, connection to community, and thus, contribute to the vitality of the city (Gehl 2011).

Pedestrians facilities have been the focus of the city revitalization efforts, yet the facilities as architectural objects in space do not create vitality in a city. Rather, public spaces are a medium for social engagement that sustains community (Mehta 2013, Boyer 1994, Hayden 1995, Hester 1993). They do this by fostering the social interaction that strengthen city life: "…more roads invite more traffic. Better conditions for bicyclists invites more people to ride bikes, but by improving conditions for pedestrians, we not only strengthen pedestrian traffic, we also – and most importantly – strengthen city life." (Gehl 2010, 19). This statement limits the role of public space to pedestrian facilities and activity, not bicyclist or automobile. While it has been shown that bicyclists experience the world in a similar fashion to pedestrians it has yet to be demonstrated that they interact with other street users in a manner similar to pedestrians. This begs the question: do bicyclists have a social experience? If this connection can be established then it can be concluded that bicyclists also contribute to the vitality of a city. Moreover, that bicycle facilities, like pedestrian facilities, must be designed to invite and foster social interaction. If done successfully then bicyclists, like pedestrians, will become active agents in shaping the character of the city.

LITERATURE REVIEW

There are two areas of knowledge that must be addressed in order to establish if bicyclists, like pedestrians, can be agents in shaping the character of the city: Whether bicyclists have social interactions, and whether design of bicycle facilities invites and fosters social interactions. Three topic areas might exhibit evidence for a social dynamic in bicycling: sociological literature, bicycling literature, and bicycle community groups. Bicycle design literature will establish whether social interaction in bicycling is being addressed in the built environment. While a complete analysis of each of these fields is beyond the scope of this thesis, a brief and directed examination of each topic should reveal what evidence exists.

Social interaction can happen either privately or publically. Since bicycle facilities in the United States are largely paid for by the public (vis-à-vis the government) and constructed in the public right of way (The American Association of State Highway and Transportation Officials –AASHTO - state that all highways were bicycles are legally permitted should be designed with the assumption that they will be used by a bicyclists. Thus, almost - every road in the US is a bicycle facility) it follows that social interactions for bicyclists are generally a public act. For this reason, this thesis will focus on public social interactions.

Since social interaction can be either non-verbal or verbal (Hall 1990, Mehta 2013) there are a variety of ways two people can interact. American sociologist, Eugene Goffman observed that participation in public social interaction happens either when one is alone or within a

group (1971, 19). He described these two state as "single" and "with". He suggests that because conversations are difficult to maintain while on the move, social interaction on a bicycle is very difficult for those in a 'with'. Mansfield 1976, Gehl 2010, Hall 1990, Mehta 2013, Crowhurst Lennard 1995, and Appleyard 1981 study the role, mechanics, and value of public social interaction in society more deeply, the Goffman reference is the lone mention of social interaction on a bicycle in the sociological literature that could be identified. Thus, one surmises there to be a gap in the current literature supporting the social engagement of bicycling.

Because bicycling is a very specific activity it follows that a study of whether bicyclists have social interactions is more likely to be addressed in bicycle literature. Behavior is an important component of social interaction, but in regards to bicycling it has only been studied from the perspective of route choice (Dill and Glieb 2008,) and factors that influence whether or not to bicycle (Geller, Gerrard Handy and Dill 2012). Wray discusses the impact of cultural values around perceptions of bicycling – how one perceives they will be judged by others – but his observations are at the national scale. In their article, *Hell is Other Cyclists: Rethinking Transport and Identity*, Skinner and Rosen touch on social interaction by discussing the frustration bicyclists have with the behavior of other bicyclists, without actually saying that social interactions were a source of frustration. They do mention that identity is an important concept because it, "enables us to think about the relationship between the individual and their social context." (2007, 85) However, their call is for greater research into the role of identity so that it might facilitate mode shift. Last, in his article *Fear of Cycling*, Horton observes, "It is easy to trivialize someone's fear of feeling embarrassed and humiliated by falling off a bike in public. Importantly, maintaining composure is harder for people perceiving themselves as 'under the watchful eyes of others'." (2007, 135) This at least notes the existence of a non-verbal social interaction. While each of these accounts touches on a social dynamic in bicycling, they do so indirectly. The dearth of data in the literature suggests a need to study the mechanics of social interaction on a bicycle.

For example, one of the largest cycling organizations in Seattle is the

Cascade Bicycle Club whose mission is, "Creating a better community through cycling". Community is inherently a social product, as community does not exist without society. They believe this can be accomplished through the following goals:

• Engagement: To get more people of all communities, backgrounds and ages to cycle regularly and safely for transportation, fitness, and daily activities.

• Community Partnership: To cultivate a community of bicyclists and non-bicyclists who respect each other on the road and trial and a broad-based coalition that supports bicycling as part of a larger vision of healthy, sustainable, and connected living.

• Infrastructure: To significantly expand and improve infrastructure that facilitates safe and convenient cycling.

• Presence: To increase the visibility of the Cascade Bicycle Club to reach a broader audience.

While these goals are valuable they do not address social interaction. It can be could argued that social interaction comes under "connected living" but this is too vague, leaving too broad of a focus to be built upon. The Bicycle Alliance of Washington has the mission of being, "…a statewide voice advocating for legislation, policy, and funding that makes it safer, easier and enjoyable for citizens to ride their bikes." While it can be posited that bicycling community groups such as these intuitively understand the importance of promoting social interaction through planned rides, workshops, and community outreach there is nothing that suggests they explicitly understand the mechanics of how social interaction happens spontaneously in the built environment[1]. Thus, there is some acknowledgement by community groups of the importance of social interaction of bicyclists to become agents that shape the character of the city, but greater understanding is needed if these observations are going to be used to design bicycle facilities that foster social interaction.

There are two categories of literature addressing design of bicycle

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[1] SGoffman might suggest these community groups are promoting bicycling by assembling a temporary 'with' while not understanding the mechanics of how social interaction is happening for a bicycle 'single' in the built environment.

facilities: books and articles, and governmental documents. Published documents in the public sector serve to educate designers about methods of site scale design, but also address larger scale planning issues. For example, the *Time-Saver Standards for Landscape Architecture* (Harris and Dines 1998), is a quick reference guide for practicing professionals. It is a conservative design manual that addresses the most basic issues of bicycle facilities design. A more liberal manual would be Bain et al.'s *Living Streets: Strategies for Crafting Public Space* (2012). Some, such as *Planning and Design for Pedestrians and Cyclists* (2010) by the Vélo Québec Association, are as much about bicycle advocacy as they are design. Yet, of all the reviewed published manuals (including: *Fundamentals of Bicycle Boulevard Planning & Design* 2009, and *Cities for People* 2012) no reference was found to social interaction while bicycling or its relationship to the built environment.

Government produced planning documents serve both to educate state employed designers and planners of government standards, and to educate the public about efforts to design and construct large scale bicycle facility networks. The American Association of State Highways and Transportation Officials (AASHTO) is the standard setting body when it comes to highway and transportation planning. For this reason their guidelines are often the cornerstone for government transportation facilities design in the United States. Their *Guide for the Development of Bicycle Facilities* address the safety and efficiency needs bicyclists expect from facilities (1999, 5) but lacks any reference to how bicyclists relate socially to other street users, or how these interactions inform bicycle facilities design. In addition to the AASHTO guidelines city specific bicycle plans offer guidelines for designing bicycle facilities. Of those cities with a bicycle facilities master plan that were reviewed (Seattle, WA 2007; Portland, OR 2010; San Francisco, CA 2009; Los Angeles, CA 2010; Minneapolis, MN 2011; Chicago, IL 2006; New York City, NY 1997; and Copenhagen, DK 2012) only Minneapolis' bicycle master plan even mentioned cycling as a social act. Several discussed the importance of work with social groups – like those mentioned above – but usually in the context of safety training. All of them presented a hopeful, and at times utopian, vision of the future of cycling, but none of them addressed designing bicycle facilities to foster social interaction.

SOCIAL INTERACTION AND BICYCLING

Current best practices suggest that public facilities design has an important impact on urban quality of life (Mehta 2013, Whyte 2000, Bain et al. 2012). Indeed, for the first time in the history more people live in cities than rural areas. Thus, issues of urban quality of life are at the heart of contemporary urban design. In an effort to make life in cities better, theorists and designers (Gehl 2010, Whyte 2000, Mehta 2013) have sought to redefine interpersonal relationships between urbanites while establishing a symbiotic relationship between humanity and the built environment. This is as true for pedestrian facilities as it is for bicycle facilities. Questions concerning the degradation of community ties[1] have led to efforts to rebuild community and increase vitality in the city. To understand how this can happen a deeper analysis of social interactions and their relationship to the built environment must be explored.

SOCIAL INTERACTION IN THE BUILT ENVIRONMENT

In his pursuit of understanding life between buildings[2], The planner and architect Jan Gehl sought to define people's activities and their

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[1] See, Robert D. Putnam Bowling Alone for an extensive account of the degradation of community in American cities.

[2] For this thesis 'life' is restricted to humanity and human interactions.

relationship to the built environment. He defined three types of daily activities: *necessary*, *optional*, and *social* (Gehl 2011, 9). Necessary activities are those that people must do, like going to work, the grocery store, running errands, etc. These activities will be done regardless of the quality of the built environment. Optional activities are those that people do by choice, like drinking coffee at a café, promenading, sunbathing, or site seeing. These are some of the most important activities for an enriched urban life: "The great majority of the most attractive and popular city activities belong to this group of optional activities, for which good city quality is a prerequisite." (Gehl 2010, 20) He observes that optional activities are something people do only when, "exterior conditions are favorable, and when weather and place foster them." (Gehl 2011, 11) Finally, social activities are something that can only happen when other people are around. Gehl refers to social activities as *resultant* activities as they evolve from either necessary or optional activities. This classification of activities and their relationship to social interaction is important because it clarifies a spectrum of interactions that will only happen if people are present in a landscape that fosters social interaction. Thus, to increase vitality in the city it is important to design invitations in the built environment for both necessary and optional activities. These are the conditions in which social interaction happens.

Social interactions broadly fall under two categories, *direct* social interaction, for example a conversation between two people, and *indirect* social interaction that occurs when people-watching. Indirect social interaction is a key component to increasing the vitality of a city and bolstering community. For the purposes of this thesis[3] vitality of a city will be defined as: *the presence of social interaction in a city's public spaces*. Architect and author Suzanne Crowhurst Lennard corroborates this in her observation of the relationship between social interaction and the built environment:

> Urban public space is the single most important element in establishing a city's livability…When community members frequently pass through a traffic free urban space running errands, going

[3] Since the goal of this thesis is to design bicycle facilities we are only interested in the public right of way.

shopping, going to work or school, they recognize other frequent users of the space, and exchange greetings, which in time develop into conversations. Spontaneous social contacts are the seeds from which sense of community evolves. (1995: 25)

It is the relationship between the affordance of public space for activity and the presence of other people that creates life in a city. More recently, Vikas Mehta, an assistant professor of Architecture and Urban design at the University of Southern Florida, notes that it is the constant opportunities for interaction that enriches life in the city:

The city is unique especially because it is a place of constant encounter. These encounters – the exchange of ideas and information – create innumerable possibilities to make innovation and growth possible. City life and urbanity are distinctive to human civilization because the agglomeration of a large number of heterogeneous people permits limitless permutations for exchanges and interaction, and this constantly creates new possibilities to advance culture. (2013, 7)

The urbanist and author William Whyte's observed that, "What attracts people most in an urban place is other people" (2000, 229) now has more substance to it; people are attracted to other people because they want to have social interactions. Thus, a vibrant city is a public place that fosters social interaction between a heterogeneous population. This is significant for, as Gehl points out, indirect social interaction is the most common form of social interaction and is the foundation from which other forms of interaction develop (2011, 13). In this way, indirect social interaction is a seminal part of creating vitality in a city and bolstering community.

The above definition of vitality in the city consists of two components: *social interaction* and *built environments* that affords and foster them. This first component was studied by Eugene Goffman, a noted sociologist who studied norms of human face-to-face interaction and behavior[4]. Of particular interest to indirect social interaction is his work on social order:

The dealings that any set of actors routinely have with one another and with specified classes of objects seem universally to become

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[4] For the purposes of this thesis, social interaction refers to face-to-face interactions, as opposed to those which might happen on a phone or other device.

subject to ground rules of a restrictive and enabling kind. When persons engage in regulated dealings with each other, they come to employ social routines or practices, namely patterned adaptations to the rules…These variously motivated and variously functioning patterns of actual behavior, these routines associated with ground rules, together constitute what might be called "social order." (Goffman 1971: x)

Goffman observes that societies generally use a set of mutually understood ground rules to negotiate social interactions. Understanding of, and adherence to, these rules leads to social order. As actors in society people externalize their knowledge of and adherence to ground rules through gestures that make these otherwise unavailable facts public. (Goffman 1971: 11) As people move through public spaces they both externalize information about themselves and scan others to confirm adherence to ground rules. Goffman concludes that externalization of intent and adherence to this intent leads to a condition of mutual trust between strangers:

Voluntary coordination of action is achieved in which each of two parties has a conception of how matters ought to be handled between them, the two conceptions agree, each party believes this agreement exists, and each appreciates that this knowledge about the agreement is possessed by the other…As the two parties approach each other, each provides a progressive evidence to the other, a small step at a time, that each is adhering to a proper course and to the one he has been indicating. And since ordinarily the gain to be achieved here by inducing confusion or by outright trickery is not great, trust can be – and is – sustained. (Goffman 1971: 17-18)

Since the majority of social interactions are indirect, Goffman's account means this entire negotiation frequently happens tacitly. Thus, the majority of social interactions for bicyclists happen indirectly. This means bicycle facilities that foster social interaction should be designed for indirect, non-verbal social interactions.

While social ground rules are powerful because they allow people to fluidly negotiate social interactions, they are not the whole story. *Territoriality* is another key component in social negotiation. Goffman defines territory as a good that one claims control of and will defend if they feel it is threatened. While territory is often thought of as something that is fixed and has a physical form, like a piece of property, Goffman notes in social interaction there are forms of territory, such

as personal space, that are neither fixed nor having physical form. American anthropologist, Edward Hall took the territory of personal space and categorized it into four zones. Titled Proxemics (1990,1), Hall's theory posits that the proximity one will comfortably allow another to get is determined by their social relationship; the better we know someone, the closer they are allowed[5]. Each zone has cultural and situational ground rules that define comfortable physical proximity and level of social interaction.

Proxemics is a relationship between distance and gathering sensory details about others. At the farthest distances one is not able to determine many details about another; perhaps only visual details. However, as two people get closer they are able to gather increasing detail about each other using many of their different senses. (1990, 115). When people move closer they will instinctively gather more information about each other - sometimes more information than they want. By moving into another's personal space– and, conversely, bringing them into our own personal space – one can trigger a non-verbal social interaction. As Mehta observes,

> Due to its limited space, the street often compels strangers or people who are little known to each other and who may have chosen to be at a public distance, to be at social or personal distances, particularly those using the same side of the street. This creates opportunities, namely to be in the presence of others and to feel the part of a larger community, are crucial in contemporary times when we are able to satisfy most of our needs in our private realms or in an ersatz urban public realm… (2013, 64)

Mehta's statement further corroborates that indirect social interactions can lead to an increased sense of community. Through the negotiation of personal space people share indirect social interactions. Again, whether or not this is intentional or recognize[6], social interactions have

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[5] While Goffman is less forward in defining his observations, Hall makes it clear that proxemics is an elaboration of culture. As cultures vary greatly, so to do their use of space. Thus, the distances used to negotiate relationship are fluid. The distances used here are Hall's approximations for Americans.

[6] This is worth noting as it implies that the majority of social interaction is not easy to detect visually, and with the case of proxemics, may not even be noticed by the people they are happening to. As Hall observes, "Concepts such as these are not always easy to grasp, because most of the distance-

Intimate Distance
0 - 1.5 feet

Personal Distance
1.5 - 4 feet

Social Distance
4 - 12 feet

Public Distance
12 - 25 feet

A Diagram of the four zones of Hall's *Proxemics*..

happened and connections created between the participants.

While recognizing the value of indirect social interaction in its contribution to appreciating life in the city, it is through design that the built environment is constructed to foster indirect social interaction. In order to create good design it is necessary to understand the mechanics of indirect social interaction. In bicycling culture this is critical as indirect social interactions may be the most frequent social interactions.

SPEED, TIME, AND SOCIAL INTERACTION

While social interaction has been described as it happens 'on foot', there is strong evidence to believe it happens in a similar manner on a bicycle. It has been argued that pedestrians and bicyclists experience the world in much the same way. Recall Prisig's observations of how engaged cyclists are with the environment; like pedestrians, they are free to use all their senses. Thus, people on bicycle have social interactions much the same way they do on foot. However, there is an important difference between bicyclists and pedestrians: their speed capabilities. Bicycles have the potential to travel at much greater speeds than pedestrians. As a result, bicyclists have the potential for much greater speed differentials than pedestrians. This, in turn, has an impact on indirect social interactions.

In the case of social interaction, it may well be said that speed, time, and distance have an inextricable interrelationship. In basic algebra one learns the equation:

$$Distance = Speed \times Time$$

As Hall observed, distance is an important component in indirect social interaction. This equation suggests distance can be understood

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sensing process occurs outside awareness…So many things are happening at once it is difficult to sort out the sources of information on which we base our reactions" (Hall1966, 115). If we are not always aware of these stimuli we might not attribute their importance in our decisions and behavior.

as the product of speed and time. In order to be within proximity of a person one must have an appropriate speed over an appropriate amount of time, where 'appropriateness' of speed and time varies by the type of social interaction. Based upon Goffman's observations the smallest unit time in indirect social interaction is that which it takes to scan for externalizations. This can happen at a variety of movement speeds so long as there is enough time to process what is being observed. For this reason it is possible at higher movement speed differentials. By comparison, a more complex social interaction, such as a conversation, can take hours and must therefore happen when the participants have no movement speed differential. In this case relative difference of movement speed is key, as two people can have a social interaction while running together - an example where they are moving at a great speed - but not relative to each other. In a similar fashion, it is a common ground rule in face-to-face social interactions that one person walking away indicates the end of a conversation. The result is an extrication from a shared proximity – and therefore, the social ground rules associated with that proximity. This experience can also be understood as a change in relative movement speed between the two participants; while one person stays in place the other changes their relative speed by moving away. This is important to bicycle culture because it is both possible to be at rest on a bicycle and to move at similar speeds.

The relationship between speed and time becomes more meaningful on bicycle. Since bicyclists can travel at greater speeds than pedestrians their potential for speed differential is higher. As a result, bicyclists may well in general spend less time in proximity to one another and, therefore, gather less detail about each other. From this several important conclusions can be drawn about social interactions while engaged in bicycling:

1. While greater potential for speed differential means there is less chance that bicyclists will remain in proximity to each other, it does not mean that social interactions do not happen. When bicyclists have the same relative speed to each other there is the potential for indirect social interaction.

2. Bicycle facilities that promote lower speed differentials create greater opportunity for social interaction.

3. People watching (scanning and acknowledgement) is the form of social interaction that bicyclists are most likely to engage in since it takes the least amount of time and does not require close proximity.

4. Dense urban areas where there are lots of necessary and optional activities occurring provide the most chances for people watching.

5. Negotiations are less likely to happen while bicyclists are in motion since there is seldom enough time for effective communication.

6. However, places of pause, such as stoplights, provide the greatest opportunities for negotiation since bicyclists are at rest, and therefore have no speed differential.

7. Conversations are the form of social interaction that bicyclists are least likely to engage since they require the most amount of time and proximity[7].

8. Topography is an interesting ingredient to the speed, time, and distance equation of social interaction. Facilities on a downhill gradient are less likely to afford social interaction due to increased speed and speed differentials between people, while those on an uphill gradient are more likely to afford social interaction[8] due to decreased speed differentials.

Because of the potential for increased speed differential while bicycling, bicyclists are most likely to have indirect social interactions since they take the least time. As indirect social interactions are already the most common form of interaction, bicycle facilities should be designed to foster such experiences. In another interpretation one can argue that bicycle facilities that successfully foster social interaction are those that reduce speeds and increase time in proximity to each other, or are near lively pedestrian environments that allow abundant opportunities for scanning. Another way of saying this is, bicycle facilities that

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[7] This is really only a problem because most urban bicycle facilities do not provide enough space for bicyclists to ride in a way that allows a conversation. Interestingly, in response to this, the city of Copenhagen has installed what have been dubbed "lover's lanes", which allow enough room for two people to ride while holding hands, and allow someone to pass. This, in turn, has given rise to the demand for bicycle facilities that are wide enough for two people to hold a conversation while allowing others to pass.

[8] This is an interesting twist on hills since many people see them as a barrier to bicyclists. However, if properly designed to invite social interaction, they could be one of the best opportunities for indirect social interaction.

foster social interaction are those that provide ample time for social interaction. This affords adherence to societal ground rules and results in a positive social experiences[9]. With pedestrian interactions it was observed that these positive social experiences increase vitality in the city and bolster community. In light of the evidence presented, it can be said that bicyclists also increase quality of life in the city and encourage community[10].

SUMMARY

This section has briefly described the who, what, when, where, how, and why of indirect social interaction:

Who: Pedestrians and, most importantly to this thesis, bicyclists.

What: Non-verbal communication between people

When: During both necessary and optional activities

Where: In public built environments

How: Both through visual acknowledgement (Goffman called this scanning) and negotiation of personal territory as regulated by societal ground rules. As well, indirect social interactions can be understood not just as a relationship of distance, but also speed and time.

Why: Because indirect social interaction is the foundation for other social interactions, creates vitality in the city, and bolsters community.

There is an important link between the quality of the built environment and whether people will participate in optional activities. If the built environment is not designed to foster these activities then opportunities for social interactions are greatly reduced, resulting in less

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[10] Inversely, bicycle facilities that do not enable adherence to societal ground rules creates negative social experiences. Thus, in some cases, ameliorating an existing facility that is creating negative social interactions can be as important as creating positive social interactions.

[11] These are previously unrecognized benefits of bicycling.

life in the city, a decline in community, and a lower quality of life for all. Thus, good city design is vital for livable cities. While the importance of social interaction has been acknowledged for pedestrians and used to improve pedestrian facilities, it has gone unacknowledged for bicyclists, nor used to improve bicycle facility designs. This section has shown that bicyclists have the capacity for social interaction if facilities are designed to foster it. With that in mind, the following chapters will take a closer look at existing bicycle facilities to see whether they afford and foster social interaction.

BICYCLE FACILITIES PRECEDENTS

The last section discussed the connection between social interaction and the built environment. Gehl's observation that necessary and optional activities are the basis for social interaction, and, though people will do necessary activities regardless of the quality of the built environment, optional activities will only occur when a quality built environment invites them. In this way there is a critical relationship between social interaction and the built environment. While the last chapter briefly deconstructed the mechanics and benefits of social interaction on a bicycle, this section will look at what makes quality bicycle facilities. As well, several bicycle facility precedents will be examined to determine their quality. Last, these facilities will be analyzed to see how well each precedent affords social interaction.

There are several factors that contribute to quality bicycle facilities in the built environment. Much like Maslow's hierarchy of needs for people, bicycle facilities are comprised of a range of characteristics. The previous review of the bicycle facility design literature revealed that safety and efficiency are the two most influential characteristics in facility design. Yet, the last chapter has argued that social interaction is an important dynamic for making livable cities. That bicycle facilities have not included invitations for social interaction means they are missing opportunities to contribute to the vitality of cities. This does not negate that safety and efficiency need to be recognized as important preconditions for bicycle facilities that invite social interaction.

It is difficult to come up with a metric for how safe a bicycle route

actually is, as it is significantly dependent on a rider's confidence and skill level. While actual safety is important, perceived safety is a measurable metric. Perceived safety – whether a person feels safe – can be measure through questionnaires. In preparation for updating the Seattle Bicycle Master Plan polls were conducted to hear Seattle residents' greatest concerns about bicycling in Seattle. The overwhelming #1 concern was safety[1]. Nor is this issues isolated to Seattle. Rodger Geller, a bicycle coordinator for the Portland Office of Transportation, has come up with a categorization of bicyclists based upon perceived safety. In a paper titled Four Types of Cyclists Geller splits bicyclists into 4 groups:

1.   Strong and Fearless   <1%

2.   Enthusiastic and Confident   7%

3.   Interested but Concerned   60%

4.   No Way, No How   33%

Geller's numbers illustrate that a large section of the population will bicycle only if they perceive cycling facilities as safe. Thus, perceived safety is an important issue when talking about bicycle facilities, not only because it has to do with the actual safety of bicyclists, but because it represents the willingness of large portions of the population to get on a bicycle[2]. Moreover, as Maslow's hierarchy of needs suggests, until our need for safety is met we cannot begin to address the need for social interaction. Thus, unless bicycle facilities create the perception of safety bicyclists will not be open to social interactions.

Bicyclists, like all people, go out for both necessary and optional activities. Anything that happens while they are out on a bicycle

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[1] http://www.seattle.gov/transportation/docs/bmp/919Public%20Engagement%20Summary%20Report2.pdf

[2] It is worth noting that perceived safety increases with riding skill – the better and more confident one becomes, the more likely they are to perceive a route as safe (Joshi and Senior, 1998 - as cited in Rosen, Cox, and Horton 2007). This suggests that if a well-designed network of facilities is implemented then confidence levels will increase and people will be more likely to ride.

happens within the context of the activity. As such, there is still a need for efficiency around the undertaking of bicycle activities. People engaging in necessary activities are likely to want to use a direct route that allows them to efficiently negotiate the city. For this reason, if designing to invite social interaction, it is important for bicycle facilities to be efficient.

Clearly, safety and efficiency are important characteristics of bicycle facility design. Yet, when it comes to safety and efficiency not all bicycle facilities are created equal. Following are a range of select bicycle facilities. While they are not comprehensive to the collection of bicycle facilities options, they do provide a representative cross-section of facilities[3].

FACILITIES FOR MOVING

The most basic bicycle facilities allow people to bicycle. Quality facilities allow people to bicycle safely and efficiently. Following are several facilities that serve bicyclists in motion.

Public Streets: The street is the most basic medium of transportation. Since the 1920's the road has been designed for, and dominated by, the automobile. However, the AASHTO report points out that, "The majority of bicycling will take place on ordinary roads with no dedicated space for bicyclists." (1999, 1) Depending greatly on the speed limit and road width, riding on the road can present challenges for bicyclists. Especially in areas where bicycling is less frequent, drivers do not expect to see bicyclists. This is compounded by the mentality that roads are for automobile. Streets with high speeds, narrow lanes, high flows of traffic, or large transport vehicles – like busses – contribute to a low perception of safety on streets. As well, if separate room is

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[3] For a comprehensive list of bicycle facilities see the Velo Quebec guide to pedestrian and bicycle facilities, the AASHTO guide to bicycle facilities, or many of the bicycle master plan documents from from some of the major cities around the United States – New York, Chicago, Seattle, Portland, San Francisco, or Minneapolis.

Sharrow

not afforded to bicyclists then they are forced to move at the speed of traffic during congestion, resulting in greatly reduced efficiency[4].

Sharrows: In response to the perception that streets are for automobiles, sharrows consist of a double chevron painted onto the ground plane to let drivers know they need to share the road with bicyclists. No space is actually given to bicyclists; instead sharrows represent a reminder of ground rules of negotiation for both users as well as a reminder to drivers of the potential presence of bicyclists. Since bicyclists are still vulnerable they tend to have a low perception of safety in sharrows. And, since sharrows do not actually provide space for bicyclists, they do nothing to increase efficiency for bicyclists.

While sharrows have the benefit of increasing the perception of safety, they have several problems. Through communicate that both bicyclists and automobiles have an equal right to the road, sharrows create conflict. Neither the driver nor bicyclists is sure who has priority. For example, if a car wants to pass a bicyclists they should to go partly into another lane to get room. In reality, this does not always happen, especially when streets are busy[5]. This problem becomes exacerbated when larger vehicles – like busses - try to pass bicyclists. More problematic is the use of sharrows as a stopgap in places that are completely inappropriate. According to the Velo Québec guide to designing bicycle facilities (2010), shared roadways (sharrows) should not be used on urban streets that exceed 3,000 vehicles/day (2010,

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[4] Observations were carried out on one street that was dominated by gridlock automobile traffic and provided no separate room for bicyclists. Three coping mechanisms were adopted by bicyclists in response to the conditions: some bicyclists rode between the stopped flow of traffic; others moved with the flow of traffic in pockets between automobiles; while a few rode their bicycle on the sidewalk past the congestion. None of these behaviors were both safe and efficient.

[5] A study recent conducted in Baltimore tested whether automobiles were giving the legally required three feet when passing bicyclists. Observations show that for streets without bicycle lanes, automobiles gave the legally required three feet less than a quarter of the time – 17% of the time in a standard street and 23% of the time on a shared street (sharrow). However, observations of bicyclists travelling on streets with bicycle lanes provided no instances where the required distances was not given – 100% of the time for bicycle lanes. The study concludes that bicyclists' safety may be compromised by using streets that do not provide bicycle lanes (Love et al 2012, 1)

76). However, in one of the most egregious examples, the City of Seattle has put sharrows on a street that exceeds 38,000 vehicles/day[6].

Bicycle Lanes: Bicycle Lanes provide several feet of separated space in the road for bicyclists. According to the Velo Quebec bicycle facilities guide, the suggested space provided is four to eight feet, with five to six feet being recommended for streets without parking adjacent to the bicycle lane (2010, 78). An additional two-and-a-half feet is recommended for bicycle lanes adjacent to parking (70). The guide warns that bicycle lanes over seven feet should be used with caution as they can be mistaken by automobilists as another vehicle lane. (70)

Bicycle lanes are an important improvement over sharrows. The space provided to bicyclists physically separates them from automobiles, increasing the perception of safety. As well, the separated space allows bicycle traffic to flow smoothly regardless of the condition of automobile traffic. In this way bicycle lanes increase perceived safety and efficiency[7].

Cycle Tracks: Cycle tracks provide space for bicycling like a lane, but are often a few feet wider. What makes them unique is that they are raised several inches above the road surface, though slightly below pedestrian facilities. This provides a visual differentiation between automotive and bicycle lanes as well as pedestrian areas, while also creating a physical barrier between them. The physical differentiation in height goes a long way to increasing the perception of safety for bicyclists and pedestrians.

Because cycle tracks are raised from the height of the street they are placed between the road and sidewalk. This is usually not a problem on narrower streets where there is no on-street parking. However,

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[6] www.seattle.gov/transportation/docs/2011%20Traffic%20Report%20final.pdf

[7] According to Eli Goldberg's report from the 2012 Velo City Bicycling Conference, most experts now view separated bicycle lanes as the bare minimum facility for modern cities: http://seattlegreenways.org/wp-content/uploads/Velo-City-2012-notes-from-Eli-Goldberg.pdf.

Bicycle Lane

Cycle Track

Multi-Use Trail

there are some places where there are both on-street parking and cycle tracks. In these conditions it is best if the cycle track is placed on the right hand side of parked vehicles. This system is known as the "Copenhagen-style bicycle lanes" (Gehl 2010, 190). The Copenhagen bicycle lane organization of the street puts bicyclists closer to pedestrians and building facades, and further from moving vehicles. There are several benefits to this system: parked cars shield bicyclists from the moving cars, increasing perceived safety. As well, he lanes can be wider since the height indicates to automobiles that it is not a vehicle lane. In turn, this allows room for one bicyclist to ride at a comfortable pace while others can pass without needing to enter the flow of automobile traffic.

Multi-Use Trail: So far all of the facilities mentioned have been on or adjacent to the street. Multi-use trails are lanes completely separated from the roadway, often running through parks and green corridors. Within the city they are generally restricted to non-motorized vehicles. Though they vary in width, they are generally between ten and twenty feet. This is wider than any of the previous facilities because the trail must account for flows in both directions.

The isolated and protected nature of multi-use trails makes them particularly safe from vehicle traffic. As well, speeds and numbers of users are generally low enough that there are few regulatory interventions, such as stop signs or traffic lights. This allows for uninterrupted travel while on the trail. The greatest potential for danger occurs only where there is an intersection between the trail and vehicular traffic. In these places automobiles may not recognize a free flowing lane of non-vehicular traffic and so not expect to see bicyclists.

FACILITIES FOR STOPPING

In addition to bicycle facilities for movement are those designed for when bicyclists are at rest. This can occur at traffic intersections when bicyclists are waiting for a traffic signal to change.

Bicycle Box: As the name implies, this is a large green box painted into the ground plane at intersections. It is placed in front of vehicular lanes but behind the cross walk. Bicycle boxes give priority to bicyclists over automobiles as they wait for the light to change. They do so by preventing right-turning automobiles from turning into bicyclists as well as allowing bicyclists to be the first to go when the light changes.

The large space provided to bicyclists by the bicycle box means large groups can stack both vertically and horizontally while waiting for a light. Yet, some have observed that bicyclists in the United States often do not use the full space afforded by the bicycle box, particularly the horizontal width of the box. Moving in front of vehicles for a few seconds to stack at the light is easily perceived as unsafe or rude to automobilists. The use of the whole bicycle box can increase efficiency by providing room for faster bicyclists negotiate into the box around slower bicyclists. When the light turns they have the opportunity to jump out ahead of others. In this way bicycle boxes increase efficiency and the perception of safety at traffic signals.

Bicycle Signal: Like automobile traffic signals, bicycle signals change to let bicyclists know when to move through the intersection. One use for these is where multi-use trails intersect with roads. Another use is in conjunction with bicycle boxes. These signals change for bicyclists six seconds before the automobile traffic signal, allowing bicyclists to safely move through the intersection and out of the way of automobiles. The addition of a bicycle signal to a bicycle box allows bicyclists using the whole of the box without feeling as though they are being rude to automobiles or endangering themselves. In this way bicycle signals increase the perception of safety in bicycle boxes as well as efficiency.

AFFORDANCE OF SOCIAL INTERACTION

The vast majority of people need safe and efficient facilities before they will use a bicycle for necessary and optional activities. As has been shown, some facilities provide these characteristics better than others.

http://www.flickr.com/photos/cherylandrich/2609888772/
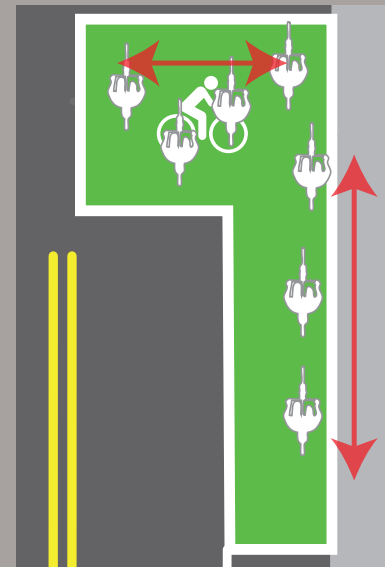
(Left) Diagram illustrating how bicycle boxes invite bicyclists to stack horizontally and vertically. (Top) An Image of a bicycle box. (Middle) Image of a bicycle signal.

The same can be said of affording opportunities for social interaction; some facilities are better than others. Geller observed that safety is an important prerequisite for a majority of the population to even get on a bicycle. From this it can be concluded that the majority of people will not use public streets and sharrow let alone have social interaction on them. However, bicycle lanes, cycle tracks, multi-use trails, and bicycle boxes – particularly when coupled with a bicycle signal – afford social interactions. They do this to different extents.

Bicycle lanes have the potential to afford social interaction. They meet basic needs for safety and efficiency. As a result bicyclists in a bicycle lane will be able to comfortably *scan* pedestrians and make eye-contact with other bicyclists and pedestrians. Yet, bicycle lanes are characterized only as having the potential to afford social interaction because lane widths vary. Potential problems arise in regards to ground rules of negotiating territory. The Velo Quebec guide defines the space needed by a bicyclist to maneuver as their "dynamic envelope" (2012, 15). A dynamic envelope that allows a bicyclist to comfortably maneuver and maintain balance is between three and five feet – thus the recommended bicycle lane width of five to six feet. However, if one bicyclist wants to pass another – because the potential for speed differentials is much greater on a bicycle passing happens frequently – then the passer is forced either to ride into the street or pass too close to the person being passed. In the first case the passing bicyclist will experience a reduction in perceived safety, and perhaps resentment towards the person they are passing. In the second case the person being passed may feel the passer is being too aggressive[8]. Thus, bicycle lanes that are too narrow have the potential to afford social interaction, but can also result in conflicts between bicyclists.

It is difficult to conclude whether multi-use trails afford greater

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[8] One bicyclists, a young woman who worked at a coffee shop at the bottom of a hill, related that she gave up riding her bike home from work. She expressed that it was not the challenge of the hill that made her stop riding, but other bicyclists. The hill had a narrow bicycle lane, resulting in frustrated and aggressive passes. These negative interactions persuaded her to drive or ride the bus. This is similar to reports that a segment of the elderly do not ride no matter the quality of bicycle facilities because they feel they are an inconvenience to others.

opportunity for social interaction than bicycle lanes. Certainly they are safe like cycle tracks but more efficient. However, with regard to social interaction, multi-use trails have a number of issues. Their biggest barrier is that they are often separated from other facilities –economic and automotive facilities. Gehl observed that there are several steps cities can take to become more livable. One of them is: "To integrate, not segregate" (1971, 101). Integration puts activities near each other while segregating pulls them apart. Complete segregation of modes of transit reduces vitality in a city:

> When those in transit are further dispersed through a differentiated road system, in which each type of traffic has its own route, the separation is complete. It becomes duller to drive, duller to walk, and duller to live along the roads as and streets because a significant number of the people in transit are now segregated from other city activities. (Gehl 1971, 108)

Economic facilities – stores and other vendors - are important because they provide a greater spectrum of optional activities, and therefore, more people with whom to interact. Without economic facilities multi-use trails are restricted to recreational optional activities, such as working out, sun bathing, or site-seeing. Likewise, when completely segregated from automobiles, necessary and optional activities become less interesting for both drivers and bicyclists. This is because there are fewer opportunities for scanning others at any speed.

Another issue for multi-use trails is their high level of efficiency[9]. Increased speeds inhibits social interaction (Gehl 2011, 62) since higher speeds can result in higher speed differentials between bicyclists. Because of the speed/time/distance relationship to proxemics, multi-use trails offer diminished opportunities for negotiation. Thus, while multi-use trails afford some opportunities for social interaction they are found wanting.

Cycle tracks are better than bicycle lanes at affording social interaction

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[6] It is recognized that the efficiency of multi-use trails is one of their greatest assets. Not all bicyclists need the same qualities from their facilities; some may cherish opportunities for social interaction, while other may just need to get to work on time. Still, with regard to social interaction, the efficiency and high speeds of multi-use trails is problematic.

while stopped. They create efficient travel while their raised elevation increases perceptions of safety. Like bicycle lanes they allow scanning of pedestrians. However, their increased widths allows one bicyclist to pass comfortably, reducing potential points of conflict. As a result cycle tracks afford the greatest opportunity for social interactions of all the facilities for moving.

Bicycle boxes and bicycle signals afford many opportunities for social interaction. They meet the prerequisite conditions of increasing efficiency and perceptions of safety by providing time and space to bicyclists. Maneuvering into the bicycle box provides opportunities for negotiation while waiting for the signal to change affords opportunities for scanning. It is during this pause that bicyclists are most like pedestrians; when speed differentials are at their lowest. In this way both facilities afford social interactions of some scale.

Summary

This section has considered bicycle facility precedents and a few selected psychological factors that influence people's willingness to use them. The perception of safety and route efficiency are critical characteristic that affect participation rates. As well, the perception of safety is a preconditions for social interaction. When met, bicycle facilities can afford opportunities for social interaction. This section has carefully used the word afford as none of these facilities invites or fosters social interaction. A review of the literature has shown that bicycle facilities do not presently foster social interaction because persistent theory continues to characterize bicyclists as transport. Thus, bicycle facility design optimizes A-to-B transportation and not social interaction.

The following section will look at how bicycle facilities form a network. The quality of this network gives a sense of well-designed cities look like and how not so well designed cities can improve. This analysis creates a foundation from which bicycle facilities can be designed to foster social interaction.

SEATTLE, PORTLAND, AND COPENHAGEN:

NETWORKS AND SITES

So far this thesis has looked at social interaction and its relationship to bicycle facilities in the built environment. While several types of bicycle facilities have been introduced and analyzed for their safety, efficiency, and potential to invite social interaction, they have not been demonstrated in the built environment. Comparison between three cities will show how these facilities succeed and fail as a network at the city scale. As well, a series of site scale analysis and design will demonstrate how these facilities can be used to upgrade one struggling city district. This will show what a well-designed bicycling facilities network looks lie, and how a not so well-designed city can improve.

NETWORKS: SEATTLE, PORTLAND, & COPENHAGEN

Seattle, Washington; Portland, Oregon; and Copenhagen, Denmark are the three cities that will be examined in this section. Each of these cities is unique in character and is in different stages of implementing a bicycle facilities network. According to the US Census Bureau's *Quick Facts* webpage, the city of Seattle has 635,000 people and covers 84 miles^2. Seattle is a city with many challenges to overcome before it's bicycle facilities network can be considered successful. According to the US Census Bureau (2012) shows that the city of Portland has

600,000 people and covers 133.43 miles^2. Portland has been working to improve their network since the early 1970's when legislation was passed that required all new roads to include bicycle facilities. While Portland has been ranked in the top 20 most bicycle friendly cities in the world (Colville-Andersen 2011), there is room for improvement. Last, Copenhagen has 1.9 mil. people and covers 34.7 miles^2. It is perennially ranked as one the best bicycle cities in the world (Colville-Andersen 2013). While the city has constantly redefined what a successful bicycle facilities network looks like, even here there is room for improvement.

As will be shown, of these three cities, Seattle's bicycle facility network has the most room for improvement. According to the Cascade Bicycle Club (2012, 9), Seattle's bicycle mode share for is 3.6%. The complete designed network covers 211.3 miles (2012, 9). Almost 40% of these facilities (81.5 miles) are sharrows. As well, Seattle's network is 33% dedicated bicycle lanes (73 miles), 22% of multi-use trails (47.2 miles), and 0% cycle tracks. While the city has more than doubled the number of bicycle lanes since 2007, the high number of sharrows is alarming. As has been shown, sharrows do not create a perception of safety or afford social interaction. This suggests that the city of Seattle's bicycle network needs improvement.

Portland is has invested more significantly in their bicycle facilities network. Currently Portland's mode share is at 6% (Cascade Bicycle Club 2012, 9). Portland's complete designed network is 309 miles. This means Portland's network is almost 150% larger than Seattle's. It is worth nothing that. Since these two cities cover approximately the same area it can be concluded that Portland has invested more into their network than Seattle. What is more impressive is that 0% of Portland's network is sharrows (Cascade Bicycle Club 2012, 9), while 57% (176 miles) is dedicated bicycle lanes, 25% (78 miles) are multi-use trails, and almost 2% (5 miles) are cycle tracks. The greater mode share and higher percentage of quality facilities illustrates why Portland has been acknowledged as one of the world's friendliest bicycle cities.

Copenhagen has a mode share of 37% (Copenhagen City of Bicycles Bicycle Account 2010, 7) 600% more than Portland and 1000%

more than Seattle. As of 2001, the city had constructed over 190 miles of cycle tracks (Copenhagen Bicycle Plan 2002, 22). There are approximately 6 miles of bicycle lanes, and have recently started construction of another 190 miles of bicycle super-highways, multi-use trails that connect satellite suburbs to the city. The quality of the bicycle facilities network is reflected in the city's high mode share. As well, the attempts to expand the network with innovative facilities demonstrates why Copenhagen is consistently one of the world's best cities for bicycling.

So, why then do all of three of these cities have room for improvement? Each of these cities has a bicycle facilities network in a different stage of development. However, in reviewing the literature it was shown that none of them think about how social interaction influences bicycle facility design. This suggests that even world-class cities can improve their bicycle facilities if they design consciously to foster social interaction. Through an analysis of each of these cities it can be concluded that the better quality of facilities and more extensive networks puts Portland and Copenhagen in better positions to design and construct facilities that foster social interaction. Seattle, however, needs to upgrade the quality and reach of its network before its facilities can be designed to foster social interaction. Seattle's University District can be redesigned to show how a network can be upgraded at the site scale.
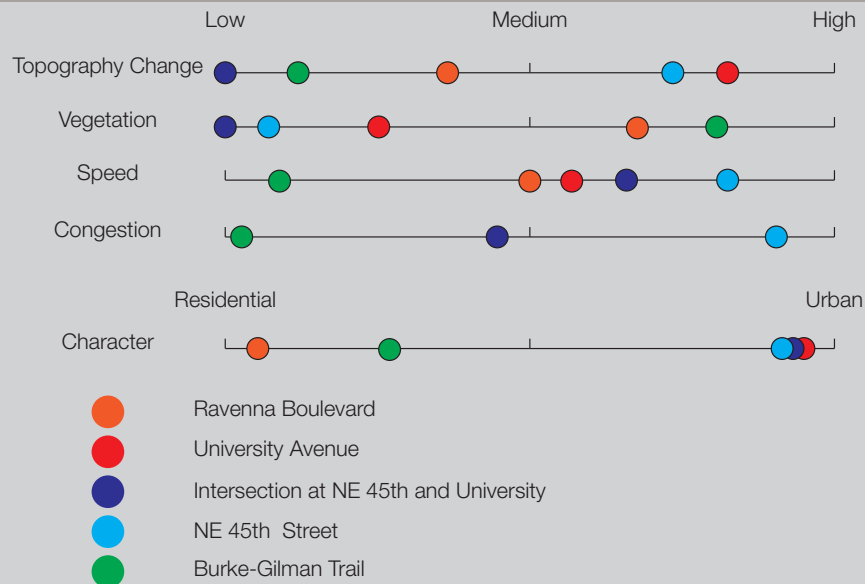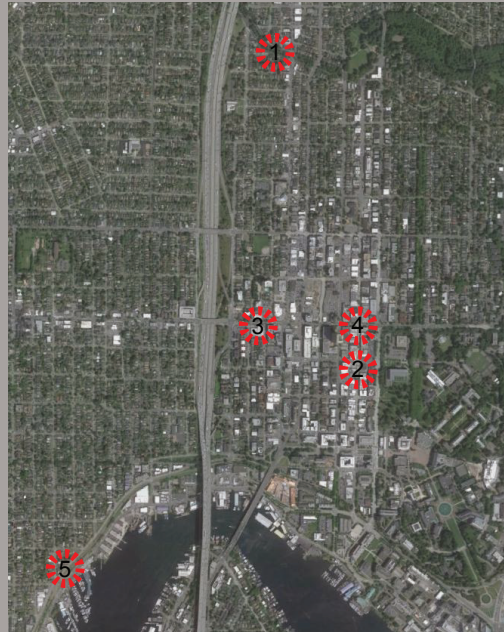
SITES: SEATTLE'S UNIVERSITY DISTRICT

As the name implies, Seattle's University district is home to the University of Washington's Seattle campus. There are 40,000 students who attend school there and 38,000 people who work either on campus or in adjacent businesses (DPD 2012[1]). The high number

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[1] Many of the conditions within the University district have recently been summarized by Seattle's Department of Planning and Development (DPD 2012) in preparation for an expansion of the city's lightrail network, and can be referenced for a deeper understanding of the district.
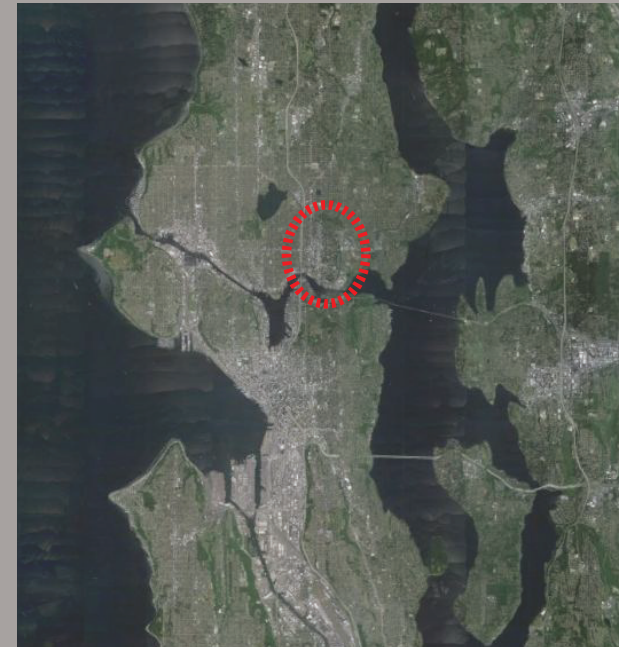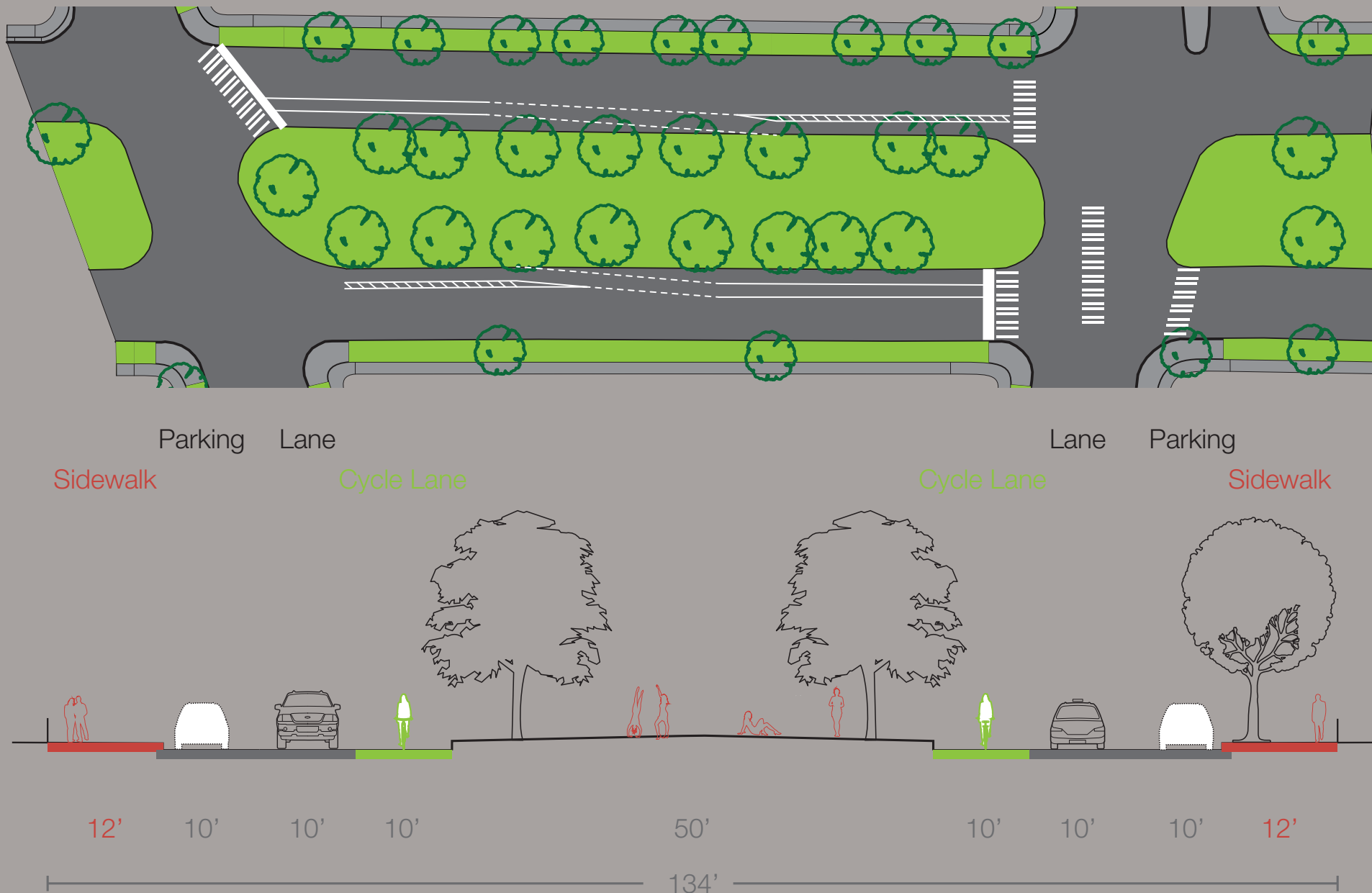
(Top) Map of the University District and the five sites. (Middle) An analysis and comparison of the five University District sites.

of people who attend school or work on campus means that the district is the second largest travel destination in the region (Street Car Network Report 2008). This makes it a good choice for bicycle facility redevelopment. Five sites - four streets and one intersection - have been selected within the district because they represent different, characteristic bicycling conditions. Together they form a network that reveals both a hierarchy and range of bicycling facilities that serves a variety of users. While long stretches or even the entire length of the roads could be redesigned key segments have been chosen that represent the character of the entire facility. There are two stages in the design process: first, each of these sites with be analyzed. Second, they will be redesigned to make the facilities safe, efficient, and afford social interaction. This gets their bicycling facilities consistent with what one finds in Portland or Copenhagen.

Ravenna Blvd: Starting in the north, the first site is at Ravenna Blvd between 12th Avenue and Roosevelt Way NE. Ravenna Boulevard runs along the northern edge of the University district, approximately south-east to north-west. This east-west route is an important router for a residential demographic to connect with I-5. It runs west out of the district a short distance before hitting a dead-end at Green Lake. Traffic tends to be higher around the western terminus as the irregular shape of the lake creates an awkward 5 way intersection. Similarly, Ravenna Boulevard runs east only a short distance before intersection and terminating around the Ravenna Ravine. The eastern end of the Boulevard is more residential than around the lake, and characterized by lower traffic flows (find figures). Directional flows of traffic are separated by a planted median that ranges from approximately 25 – 55 feet.

The short length, varied levels of traffic, and wide planted median means the boulevard overall has a calmer character than many of the district's other streets. Sidewalks are generally very nice, though quite narrow. As an arterial the speed limit is 30mph, which is on the cusp for bicycles and vehicles[2]. However, the generous width of the street

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[2] According to the Bicycle Alliance of Seattle, the change of a collision with a vehicle at 20mph is 5%, but at 30 mph is 45%.

Parking   Lane   Lane   Parking

Sidewalk   Cycle Lane   Cycle Lane   Sidewalk

| 12' | 10' | 10' | 10' | 50' | 10' | 10' | 10' | 12' |

134'

(Top) Pan view diagram of Ravenna Boulevard's existing conditions. (Right) Section of Ravenna Boulevard's existing conditions.
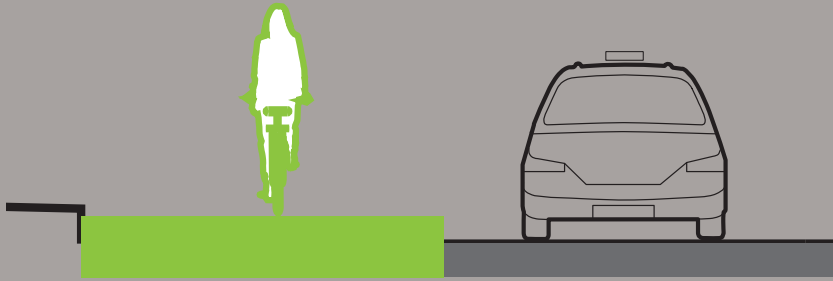
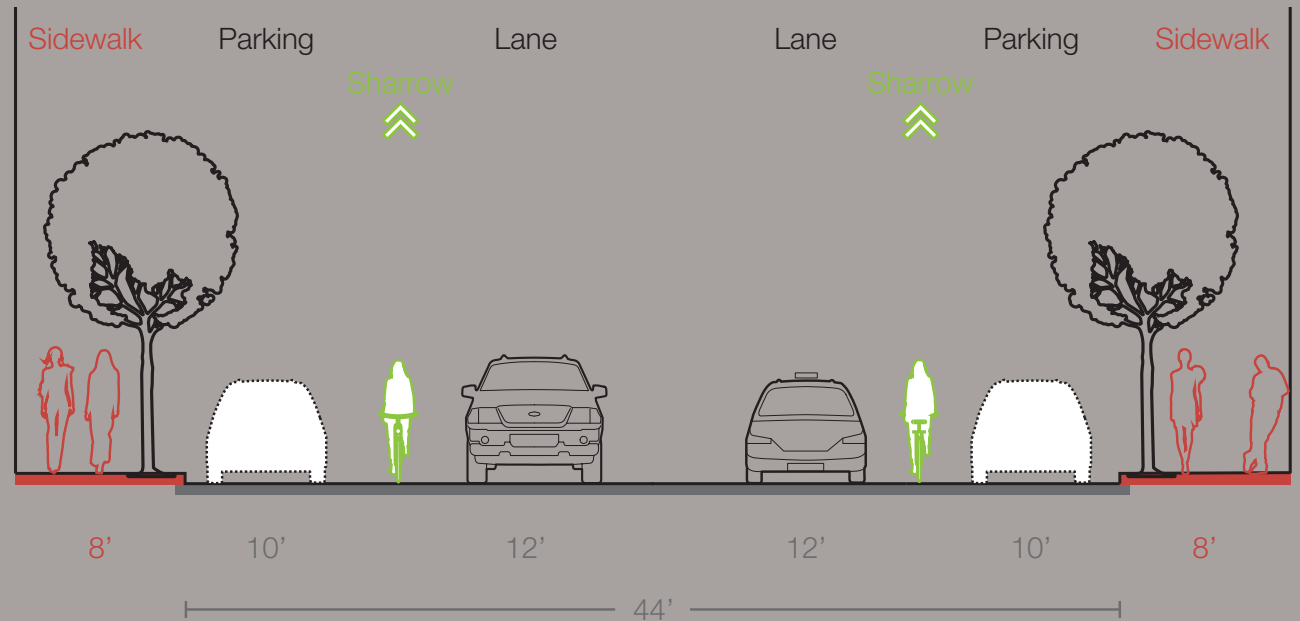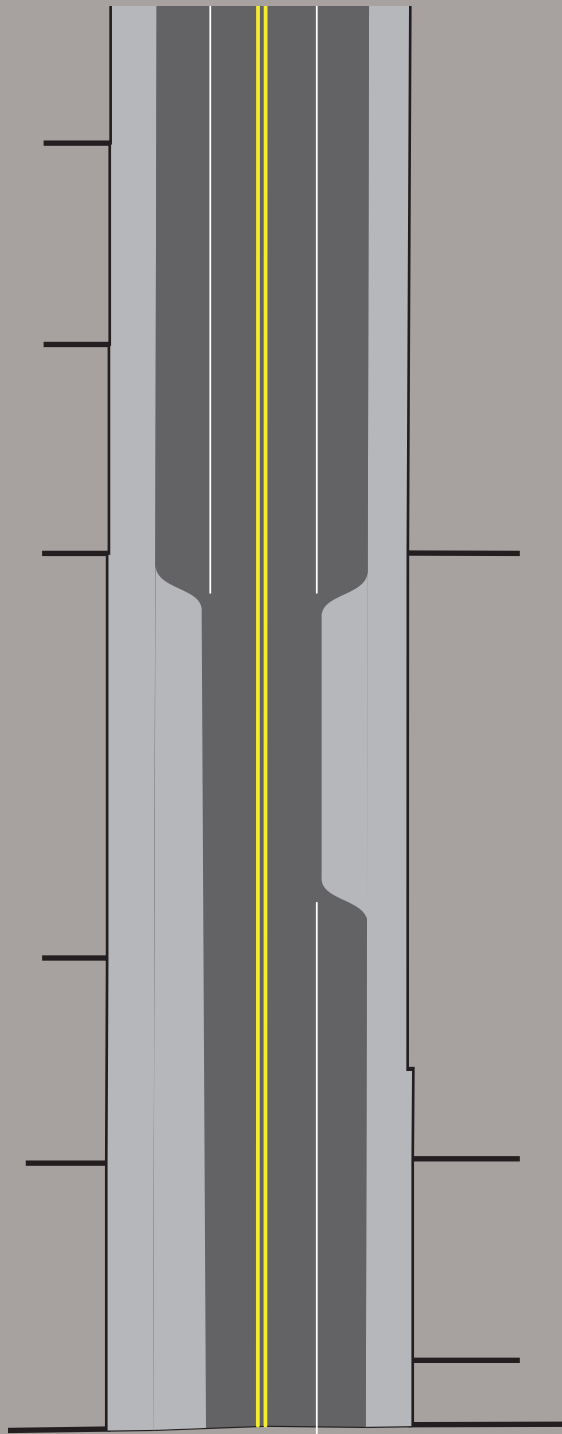**(Above) Section of a design alternative for Ravenna Boulevard**

and existing bicycle lane negate any tension or feelings of danger for bicyclists. Overall, this is already a decent bicycle route.

Recent work to update the cycling facilities on Ravenna Boulevard has been completed. As a result, the cycling conditions are fairly good. The street has been re-organized and repainted to create a wide cycle lane from the intersection with University, west to Greenlake[3]. Bold signage painted onto the ground plane demarcates cycling from automotive traffic. Despite this, it is not uncommon to observe vehicles driving through the bicycle lane when there are not cyclists. It is hard to say whether this is because they are trying to get ahead or do not understand it is a bicycle restricted lane. Raising the level of the cycle lane 2-3 inches discourage drivers from using the lane to get ahead and creates enough of a visual cue that will create awareness for those who are not familiar with cycle lanes.

University Way NE: The second site is along University Way. University Way runs north to south through the heart of the district, and parallel to the University of Washington. It starts south at the Montlake Cut and ends north at Cowen Park. The north end it intersects Ravenna Boulevard and the south end the Burke Gillman Trail. There is one lane of traffic flowing in each direction, with one lane of parking to the outside of each lane. Sidewalk widths are acceptable in relationship to the size of the street, but unacceptable for the number of pedestrians who use them. The blocks tend to be long in this section of the district, so several mid-block pedestrian crossings have been added. At these points there are bump outs that take up a few parking spaces.

University Way is a key corridor in the district. It is the busiest street in the district in terms of pedestrian flows as it is between the school and the commercial and residential neighborhoods. As well, most of the meal opportunities are on, or adjacent to, University Way. Vehicular traffic flows are lower at the ends of the avenue, but can be quite congested in the core of the district. Traffic tends to be the worst at the

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[3] It is worth noting that the city's investment in this route emphasizes the importance of connections between urban villages.

Sidewalk   Parking   Lane   Lane   Parking   Sidewalk

Sharrow   Sharrow

8'   10'   12'   12'   10'   8'

44'

(Above) Section of Univeristy Way's Existing Conditions. (Right) Plan view diagram of Univeristy Way's Existing Conditions.
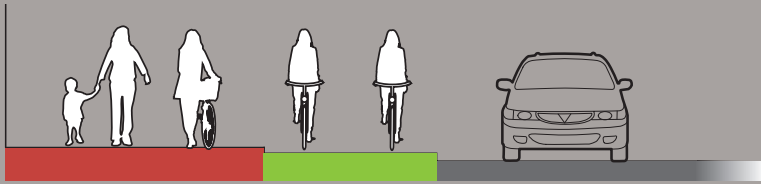
(Top) Sectioni of the design alternative for University Way. (Right) Plan view diagram ofthe design alternative for University Way.
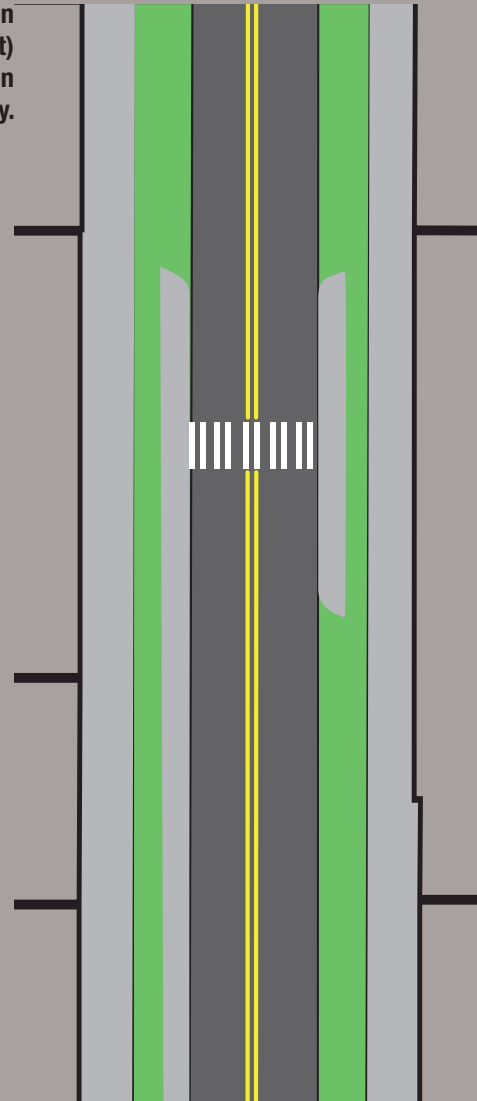
NE 45th street intersection. The speed limit on the University Way is 30 mph, which, again, is not too fast for cars and bicycles to peacefully coexist. However, unlike Ravenna Boulevard, there are many busses that travel along the avenue, circulation the flow of students and workers for the university. As we will see, this create a low perception of safety for bicyclists.

Some effort has been made to accommodate bicycles, however there is little to spare under the avenues current organizational configuration. A the southern end of the avenue there are bicycle lanes, approximately 4 feet wide. However, Once north of Campus Park Way the lane turns into a Sharrow. This is an issue since all of the buses that drive on University Ave turn on/off of campus parkway meaning bicyclists and busses share a 12 foot lane. It is unfortunate since the high levels of pedestrian activity provides a rich opportunity for indirect social interaction. Until bicyclists feel safe on this route no social interaction will happen.

There are several design opportunities for reorganizing University Way. Foremost, the issue of the sharrows should be addressed. While proponents of the sharrow claim it is better than nothing, it has been shown here that they do not meet the basic needs of the majority of bicyclists. In this context they are less of a problem on the downhill side of the street since there is less difference of speed between automobiles and bicycles. However, it is a huge point of conflict on the uphill side of the road when either bicyclists or busses need to pass bicyclists. When bicyclists need to pass each other it creates tension as it forces the passer into traffic. There is not enough room for busses to pass if there is traffic coming in the other lane. This creates tension as busses either have to wait for a stop light – where cyclists are not moving and are closer to the curb – or follow behind the bicyclist. Neither experience is comfortable for the bicyclist. Particularly on the uphill side, the parking lane should be removed to allow a full 8' lane for cyclists. This is enough room for one cyclist to ride and another to pass comfortably. As well, like on Ravenna Boulevard, this street needs a raised cycle lane to create something of a barrier between automobiles and bicyclists. The same could be done on the downhill side, though a full 8' lane is not necessary. Rather, a 5' lane would be generous

enough for a slower bicyclist to feel safe, while a faster cyclist could easily pass by entering that automotive lane with downhill momentum. Last, the issue of the pedestrian bump out needs to be addressed. The image to the (right) shows one potential solution that is used in Copenhagen to deal with bus stop islands that extends into the road. A narrow (4-5 foot) lane is carved between the island and sidewalk to allow a pedestrian to quickly cross well letting cyclists continue uninterrupted. These interventions will allow a high level of perceived safety, efficiency, and afford social interaction.

NE 45th Street: According to the 2012 City of Seattle Department of Transportation, NE 45th street is not only one of the busiest streets in the district, but the entire city. Starting in the east at the turn of Sandy Point Road, the street technically does not terminate until in the west until the Lake Washington Ship Canal. However, the highest rates of traffic occur in the University District between University Way and Interstate 5. This is the most heavily used I-5 entrance in North Seattle with the 45th Street eastern entrance facilitating approximately 34,000[4] vehicles/weekday (Seattle Traffic Flow Data and Map 2011) in comparison to the 50th Street entrance (the next closest I-5 entrance) which facilitates approximately 21,400 vehicles (Seattle Traffic Flow Data and Map 2011), or roughly 80% more. To accommodate traffic there are 5 lanes; two in each direction and a center turn lane. Unlike the previous 2 sites the speed limit on 45th street is 35 mph. While this is closer to the cusp of cars and bicycles will feel comfortable sharing a lane, the problem is exacerbated by the fact that each of the lanes are only 10 feet wide, 2 feet narrower than University Way. The strong automobile presence on this route means pedestrians and bicyclists alike are secondary to conveying traffic to and from Interstate 5.

It is hard to imagine anyone cycling on 45th Avenue given the fast speeds, high traffic flows, and narrow lanes. There are however both sharrows and a few brave souls who tackle this route. Perhaps these bicyclists are aided in some small way by the sheer number of

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[4] According to the Velo Québec guide to designing bicycle facilities shared roadways (sharrows) should not be used on urban streets that exceed 3,000 vehicles/day (2010, 76)

Lane   Lane   Turn Lane   Lane   Lane

10'   10'   10'   10'   10'   10'   10'

50'
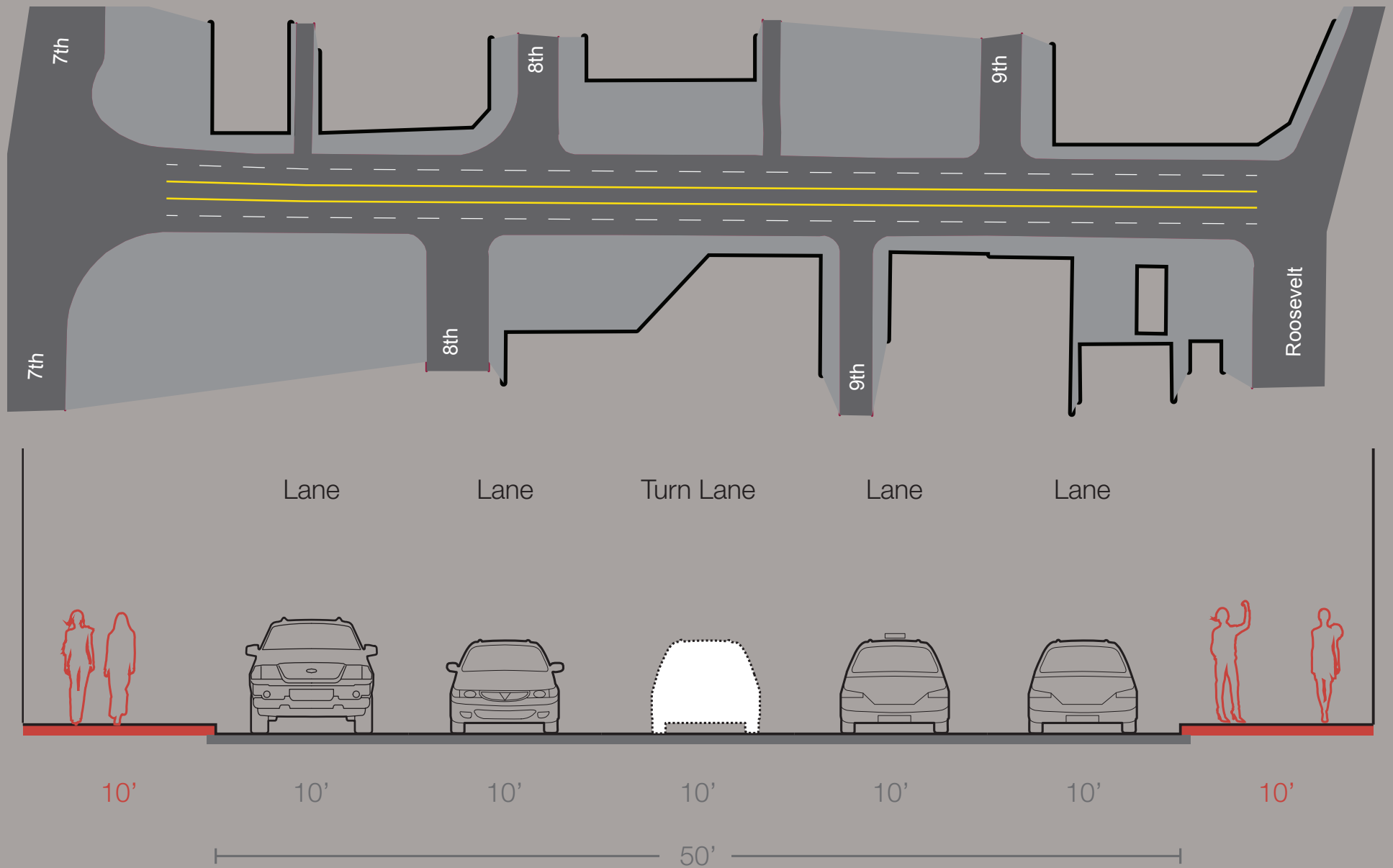
(Top) Plan view diagram of 45th Street NE's existing conditions. (Middle) A section of 45th Street NE's existing conditions.

vehicles on 45th; there are so many people that, despite the speed limit a 'grid-lock' condition occurs. Three adaptations by bicyclists have been observed: 1) since there is not enough room to ride between the automobiles and curb, bicyclists will ride between the two stopped lanes of traffic. 2) Bicyclists will take up space in a lane like an automobile, moving and stopping with the flow of traffic. 3) Bicyclists will ride on the sidewalk to avoid these conditions. None of these conditions are acceptable for large scale bicycle travel.

If these conditions are so undesirable for bicyclists, why ride on 45th street at all? Heading west from University Way, the 45th street route runs flat for almost half-a-mile before climbing into the Wallingford district. Unless one heads south to the Burke Gilman trail, this is one of the only places in the district where traffic can cross I-5. And, since we now know that University Way climbs uphill as it runs north, 45th street is the only place one can cross I-5 directly into Wallingford while staying on the topography line. It is possible to go north to 50th, but that is less safe than 45th since it does not even have a sharrow and is not listed on the Seattle Department of Transportation's Bicycle Map as a bicycle route[5]. Thus, one either sacrifices speed or efficiency by taking an alternative route. While there has been a proposal to build a pedestrian and bicycle bridge across I-5, there is no such plan at present.

The 45th street stretch between University Way and I-5 is a metaphorical perfect storm of conditions. Bicyclists who want to head to/from Wallingford are forced to use this route, which means that many would-be bicyclists are deterred from riding. Yet, if one were to take an entire lane of traffic away in each direction to provide cycle-tracks, it would greatly exacerbate the automobile traffic conditions. There are two lines of thought in providing a solution: 1) compromise and 2) Move Forward! The first solution involves taking away the turn lane to turning traffic and reallocating it for through vehicles. In the

[5] This suggests that the city of Seattle does not consider 50th as a viable alternative East-to-West route to 45th street. Thus, the only current route into Wallingford, besides the aforementioned Burke-Gilman route, is to bicycle on 45th street.
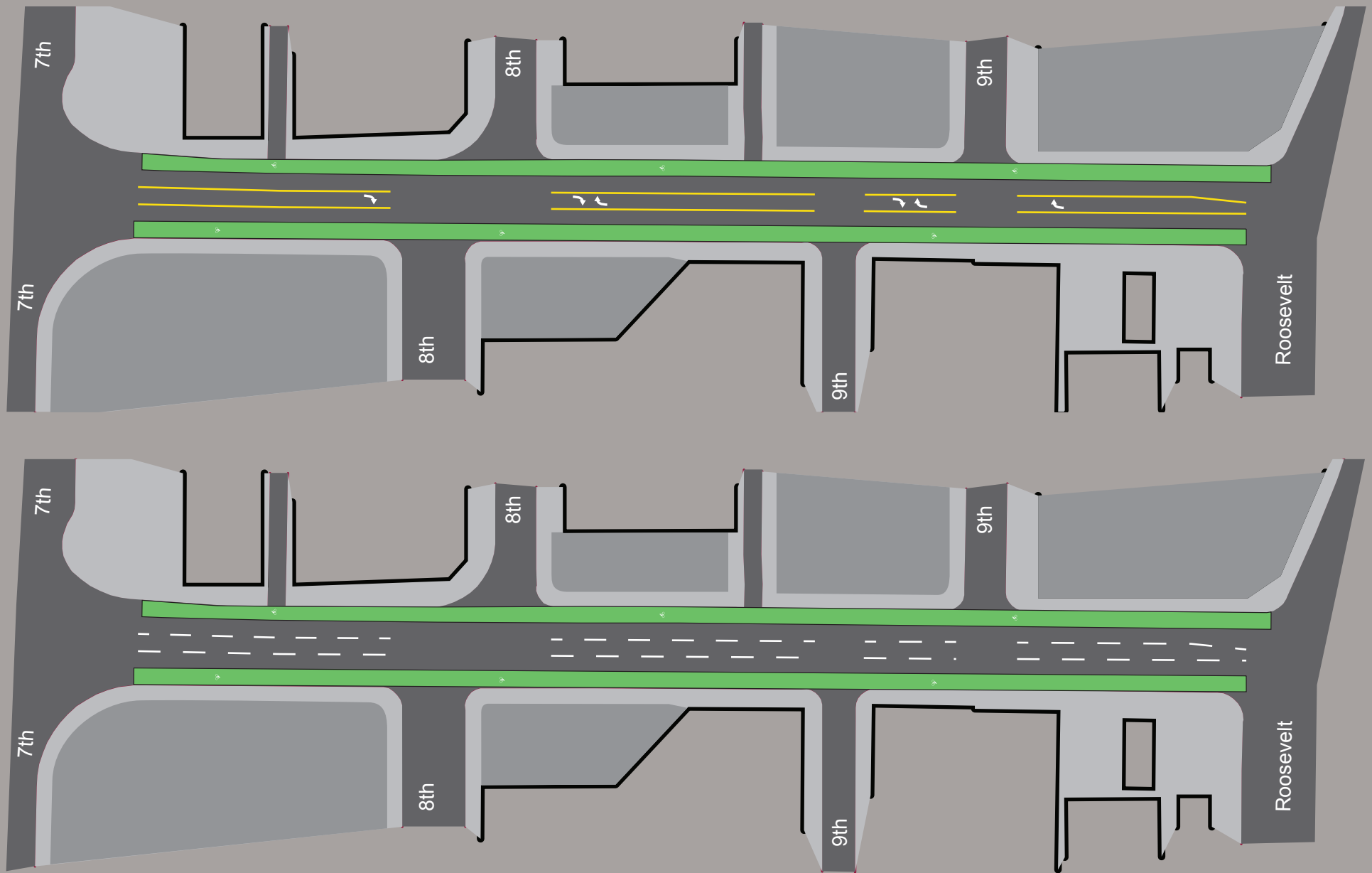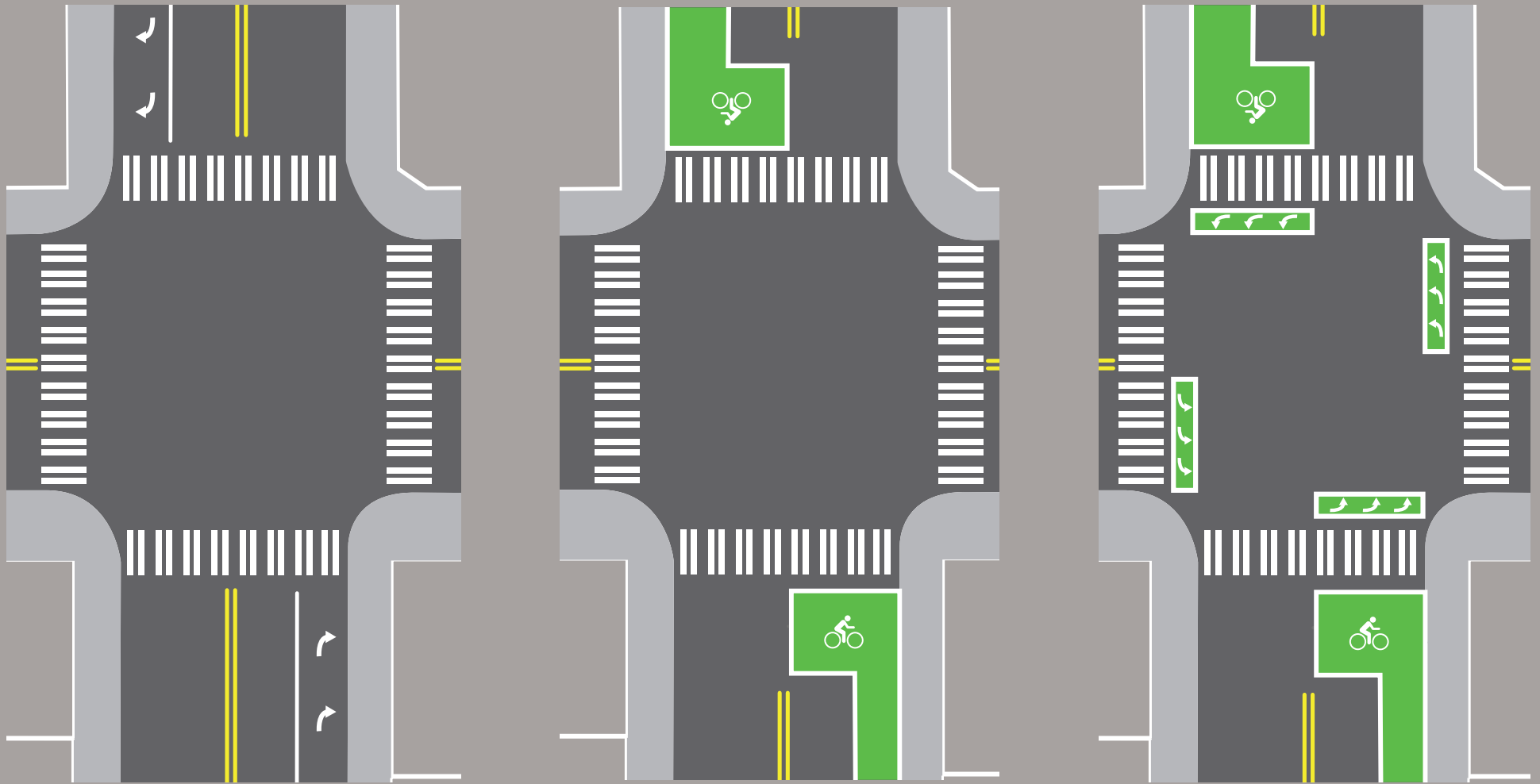
(Top, Middle) Two plan view diagrams of design alternatives for 45th Street NE.

morning when people are heading into the district the center lane is used for west-bound traffic the two lanes shift north to allow a bus and bicycle shared lane. Likewise, in the evening when everyone is going home from the University District, the center lane is used by the East-bound traffic and all the vehicles shift south to allow a bicycle and bus lane. This results in a compromise by all with none getting exactly what they want.

The second option is to just take the lanes away from the vehicles since they are going to be gridlocked during the worst hours anyways. Three things will happen: Automobile drivers get really mad; some people find alternative routes, possibly to the 50th street I-5 entrance; some people make a mode shift from the automobile. The fear is that removing some lanes will create worse traffic conditions, a reality that does not always manifest once changes are made . If, however, cycle-tracks were installed on 45th a major missing connection between the University District and Wallingford would be resolved for bicyclists.

Intersection at 45th Street and University Way: As can be guessed from the previous two site descriptions, the confluence of these two arterials makes for one of the busiest and important intersections in the University District. Because of the high flows of traffic on both streets no left turns are allowed. This creates more of a problem for automobilists than bicyclists. A few simple design interventions might be implemented to increase safety and efficiency, while affording indirect social interaction. Bicycle boxes can be added at each light to allow bicyclists to stack horizontally as well as vertically. This creates more of a presence for bicyclists while they wait for the light, which puts more people in proximity, affording greater indirect social interaction, As well, it prevents right-turning vehicles from trying to accidently turn through cyclists both as they wait and as they start through the intersection when the light changes. On the other side of the crosswalk there is a 'landing strip', a place for left turning bicyclists to stop and wait for the light to change out of the way of through bicyclists and without having to cut through the crosswalk or push into already waiting cyclists in the bicycle box. A last intervention is the bicycle traffic light. In Copenhagen many intersections have these smaller, bicyclists exclusive lights. It turns green 6 seconds before the

(Left) Plan view diagram of the Intersection at 45th Street NE and University Way's existing conditions. (Middle, Right) Two plan view diagrams of design alternatives.

automobile light allowing those cyclists stacked in front of automobiles to safely proceed through the light and into the bicycle lane. These three measures are important at any stoplight, but particularly at lights where left turns are not allowed.

Burke-Gilman Trail: The last site is the only one for which automobiles are absent. Running from Ballard in the west to Redmond in the east, the multi-use trail spans over 19.8 miles on lake shore and abandoned railways. As a multi-use, bicycle specific trail the Burke is already a good facility in that it is safe and efficient. Particularly on nice days there are lots of opportunity for acknowledgement with on-coming bicyclists and joggers. In some ways that is actually the trails strength and weakness. The trail has few stops so does not offer many opportunities for negotiation (see indirect social interaction chapter for more explanation). As well, the trail system has may issues with organization between pedestrians and cyclists . Last, since the Burke is isolated from the road there is a real lack of lighting on most sections of the trail creating an unsafe perception at night.

Several design interventions might be made to improve the Burke-Gilman. Offering places to stop, stay, and use services (would be helpful in increasing opportunities for indirect social interaction. This could be a bathroom, drinking fountain, mechanical bicycle pump, bicycle counter, or even just a shaded bench for people to catch their breath or take in a view. The trail should be widened 4-5 feet where possible to accommodate the increase in users. As well, a uniform system of organization should be put in place to facilitate smooth negotiations between users. Last, a lighting system should be installed to increase safety for nighttime users. These measures would help the Burke-Gilman become safe and efficient while affording important social interaction.

Summary

This section has look at how bicycle facilities form a network. The quality of this network gives a sense of well-designed cities look
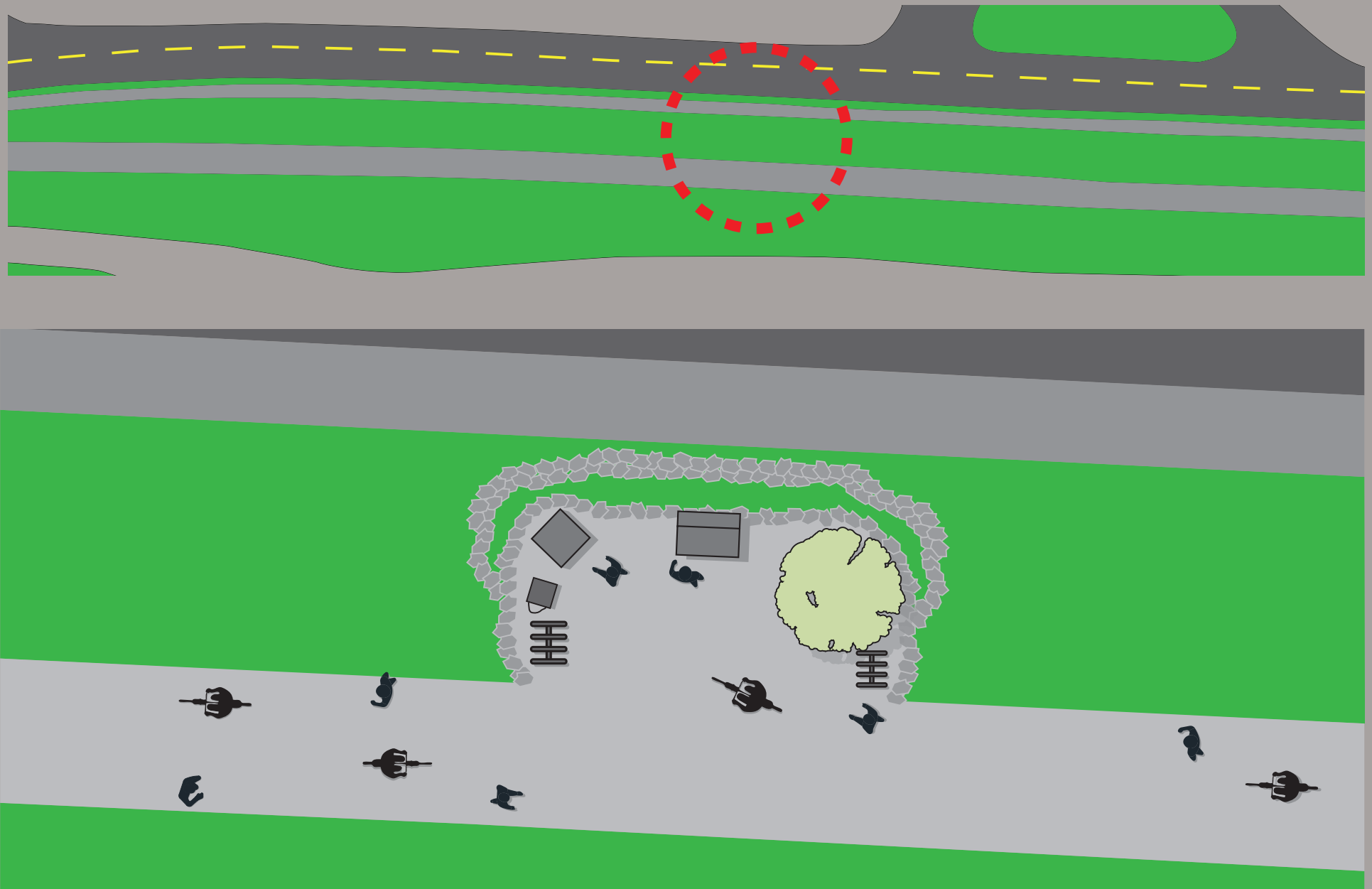
(Top) Plan view diagram of the Burke-Gilman's existing conditions. **(Middle)** A plan view diagram of Burke Gilman design alternatives.

like and how not so well designed cities can improve. Seattle's University District was analyzed and redesigned to demonstrate how improvements can increase a networks invitation to bicycle by providing efficiency and perception of safety.

The exploration of this specific district allowed a wide ranging investigation of potential bicycle facilities and designs. By describing actual site conditions, the designs proposed in the following section needed to respond to the realities of an existing site and place. On the other hand, as the intention of the thesis was to propose a variety of approaches, the realities of the site were also used to generate a series of proposals that may remain speculative. This speculative approach thus draws on both the given circumstances and realities of roads and transportation networks in 2013 as well as the potential of creative responses to both problem solving and responding to a series of design challenges.

Once these preconditions have been met bicycle facilities will afford social interaction. The next section will demonstrate how bicycle facilities can be designed to foster social interaction between bicyclists.

INTERVENTIONS TO INVITE AND FOSTER

INDIRECT SOCIAL INTERACTION

Following are eleven distinct proposals for design interventions that will invite indirect social interaction. Some of them are simple while others are farfetched. None of them are placed in situ. The objective of this chapter is not to thresh out how realistic each interventions is or whether they would work in an exact context, but to get you, the reader, thinking about what bicycle facilities could be like if we planned and designed bicycle facilities for social experiences first and then found ways to make them safe and efficient. Each intervention fosters a social interaction either by encouraging people to resolve a negotiation or acknowledge each other. That being said, the following interventions have been grouped by whether they foster negotiations or acknowledgement.

NEGOTIATIONS

Bicycle Bench: This is perhaps the simplest of the eleven designs and clearest to understand how it invites indirect social interaction. It combines a bench – a common piece of hardware on most urban streets – with bicycle parking, something every bicyclists needs. When a bicyclists goes to park their bicycle they negotiate space with pedestrians who are using the bench; this accommodate two needs at one time while fostering social interaction.

Pullout: Often, when a bicyclist arrives at their destination, they are mid-
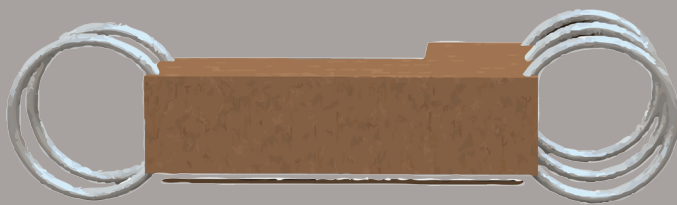
Biclcye Bench: Puts pedestrians and bicyclists in proximity to each other while providing essential services to both.
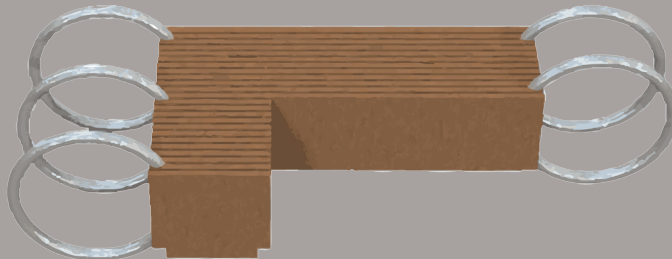
block, which is a difficult place to stop. As was shown in the design precedents chapter bicycle lanes or cycle tracks are often vertically separated from pedestrian facilities with a curb. As bicycle parking is almost always within pedestrian facilities there is an awkward traverse between the bicycle lane and parking. Stopping to get off one's bicycle can create a negative negotiation where other cyclists are forced to swerve around the stopping cyclist. To circumvent this problem a pull out can be installed to allow a smooth transition through the curb. This would include a slight ramp that deposits the rider in front of the parking. This makes it easier for bicyclists to do what they want to do and prevents negative interactions between bicyclists. As well, the ramp allows a bicyclist to easily and thoughtfully re-enter to flow of traffic.

Hillout: Building upon the pullout concept, the hillout provides a similar service while also preserving momentum. Perhaps most useful in an open multi-use trail, the hillout provides several adjacent lanes to the cycle track that climb a small hill – it need not be more than four or five feet high but can be higher for dramatic effect. There are several uses for the hillout. When one goes up the hill their momentum is transferred into the topography. It allows slower riders to pull off and let others pass. While at the top a bicyclists becomes a focal point, allowing opportunities for scanning and eye-contact. As well, if several people pull out onto the hill it becomes a place of pasue that fosters negotiation. Last, when it is time to start again their momentum is re-established by going downhill. The gain in momentum requires the bicyclist to scan and acknowledge others as they re-enter the flow of traffic..

Light Lanes: Night presents a challenge as well as an opportunity to bicyclists, both in terms of safety and social interaction. Without lighting it is difficult to see the quality of the lane surface, other users, and a challenge to be seen. One solution is to add lighting into the bicycle lane, projecting out the fixed lights in the curb. There would be these wonderful lanes of light flowing in each direction illuminating bicyclists to other bicyclists, pedestrians, and motorists. This makes bicyclists the focal point of the landscape while facilitating negotiations between passing bicyclists.
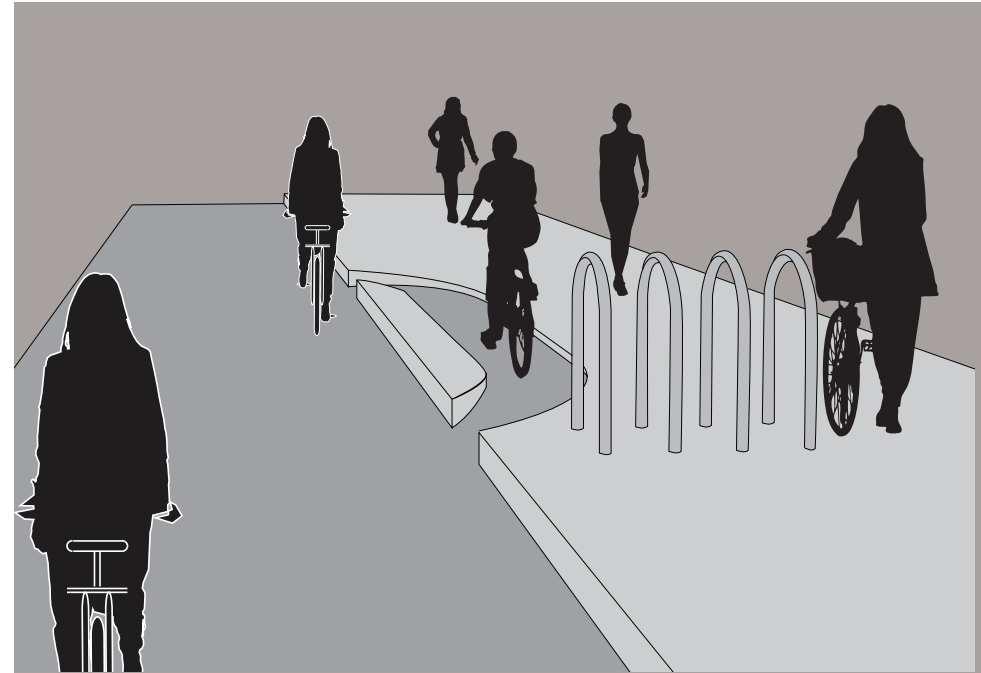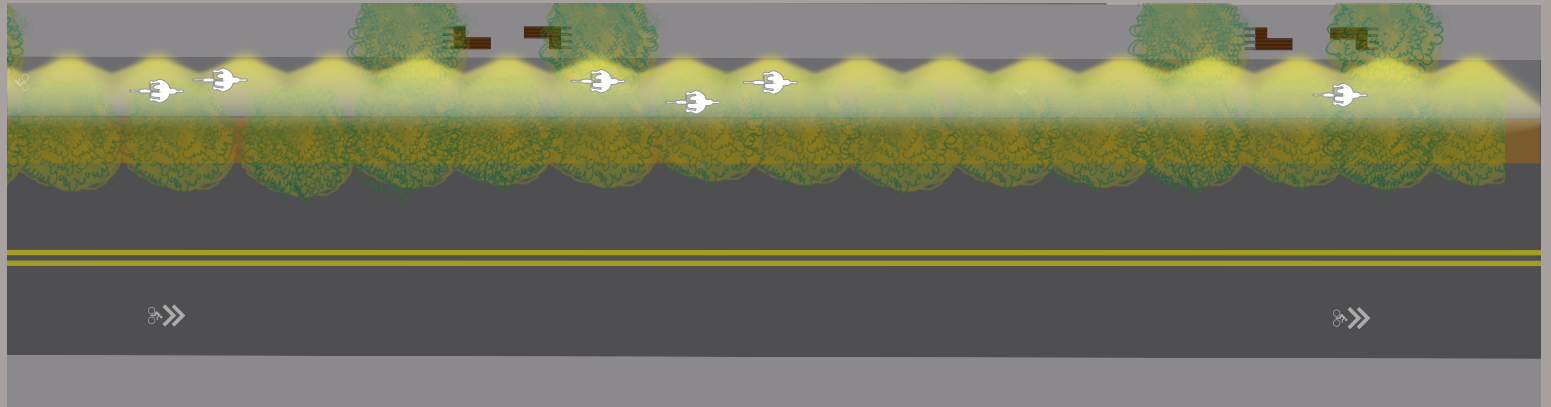
Pullout
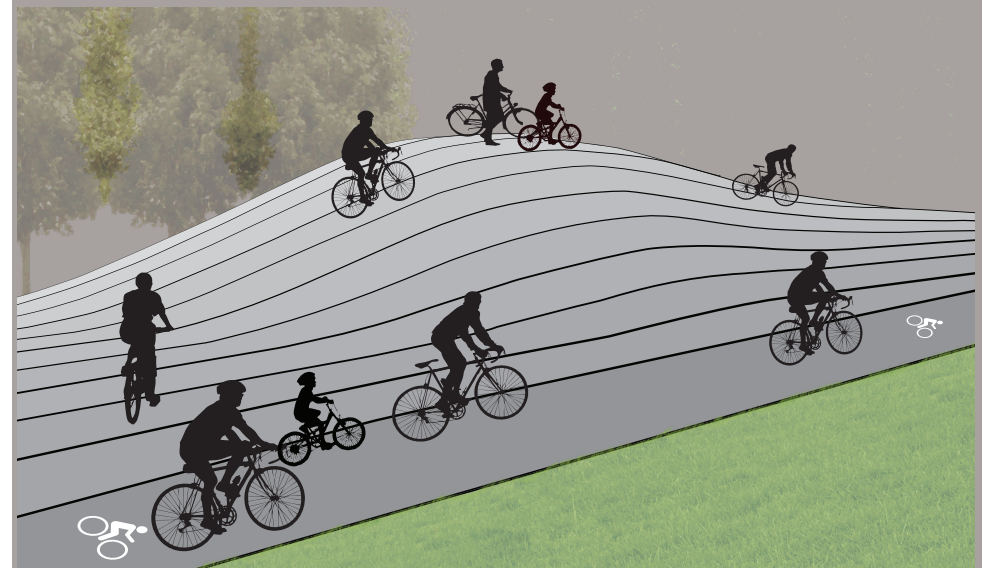
Hillout
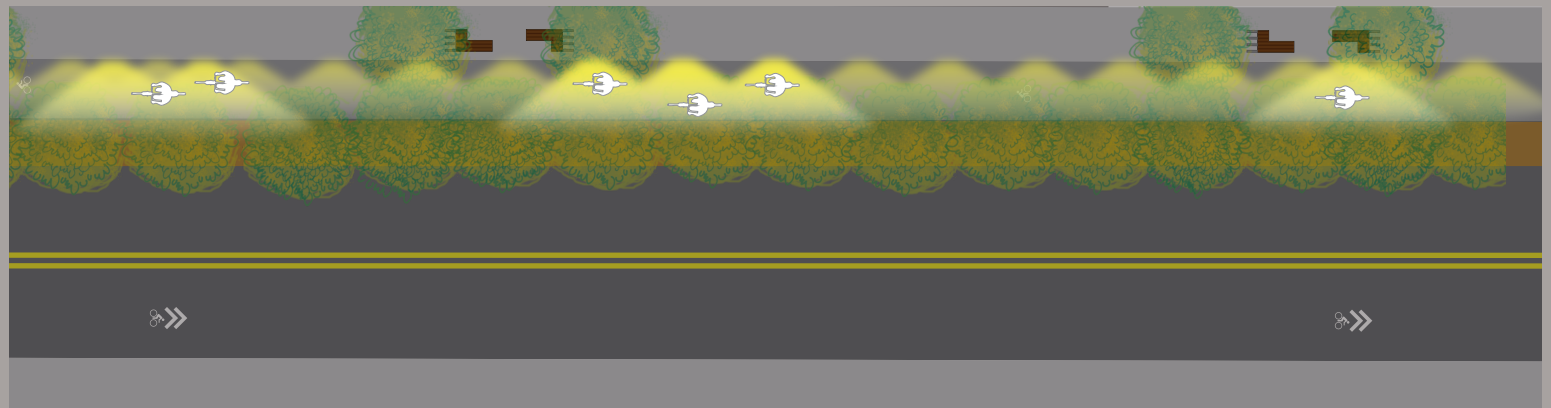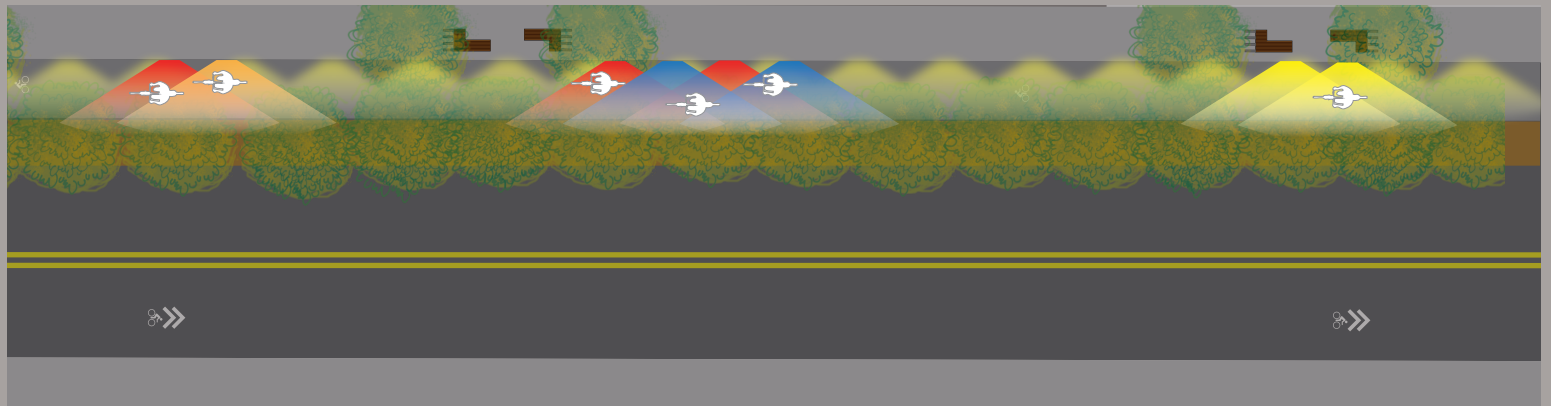
Light Lanes: Three iterations of a bicycle light lane. Low lights stay on all the time.

Low ligths stay on all the time, but bright lights illuminate riders as they pass.

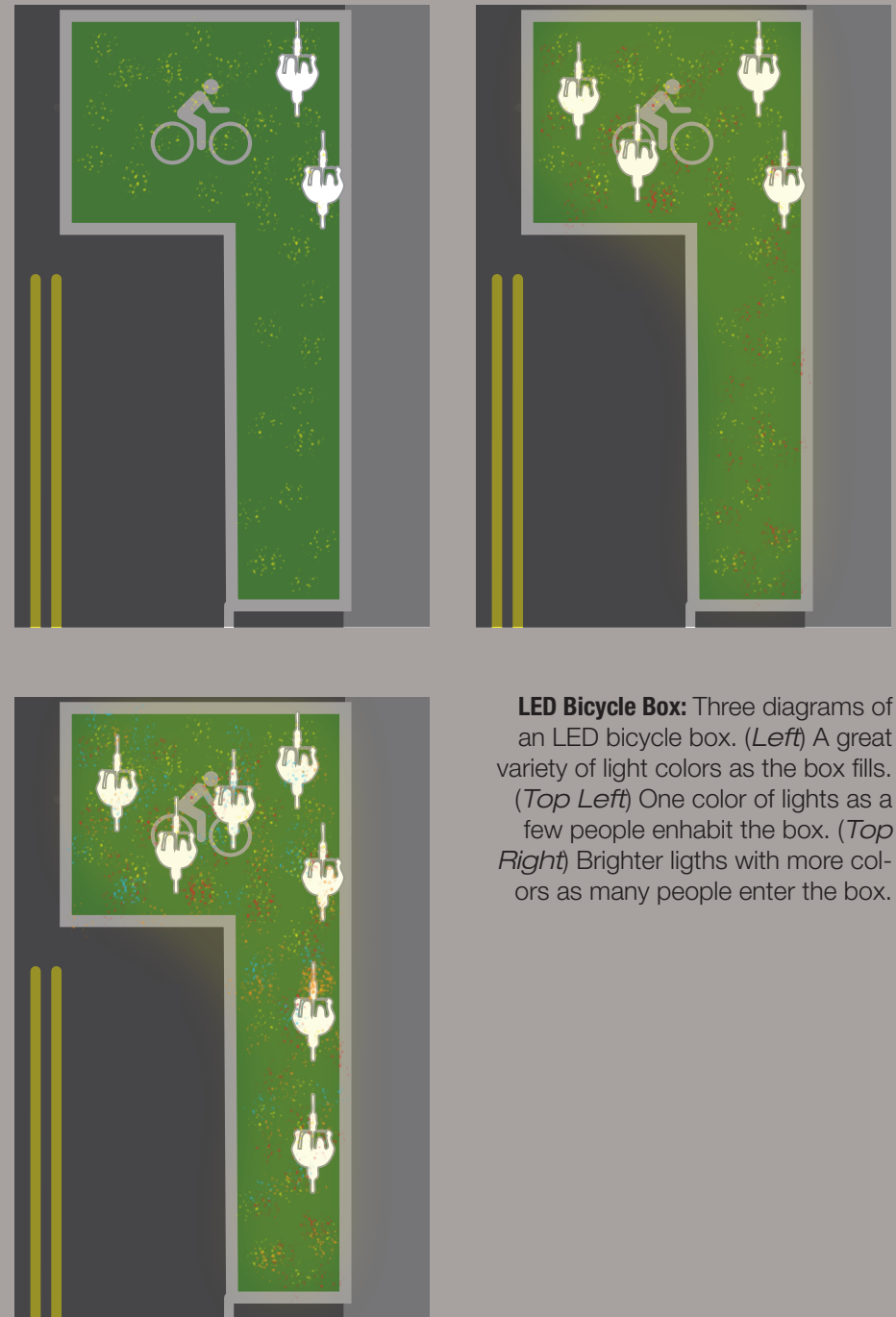A great variety of light colors as people group together in the lane.

Another iteration of this idea uses sensors to turn on ground lighting in the bicycle lane when a bicyclists approaches and goes off after they pass.. The rider would be enveloped with a cushion of light while observers would see their presence and movement. Materiality can be played with; instead of having traditional down lights they could be small LED bulb in the concrete that twinkle as one rides. The lights turn on and recede based upon movement, meaning if multiple people were to ride together – in proximity to one another – they would show a longer trail of light. Thus, groups of bicyclists would have more of a presence.

Last, rather than a single color light, there could be a variety of colors. The idea of weighted presence can be taken even further by having more complex color combinations for more bicyclists riding together. Bicyclists would be attracted to riding in groups of increasing size to see these color combinations. Depending upon the matrix of lights in the concrete (essentially the quantity of lights/square foot) different patterns could be made in the concrete as a person rides. Perhaps passing a sensor puts off a ripple of light as with a stone dropping into water.

Bicycle Box Lights: While the interaction between light and the presence of bicyclists can be powerful for facilities of movement, it can also be explored in a bicycle box. There could be LED lights in the pavement that illuminate with the presence of a bicyclist. The more bicyclists that enter the bicycle box the more lights and colors that turn on. Perhaps there is even a relationship between the number of people in opposing bicycle boxes – those across the street from each other, further encouraging acknowledgement of other bicyclists. This group dynamic fosters negotiation between bicyclists stacked in the box, inspiring them to pack in to see just how many bicyclists they can fit and how far they can push the light show.

Symphony Lanes: Similar to the Light Lanes, Symphony Lanes work on the principal of drawing attention to the presence of bicyclists. This iteration is similar to the third Light Lanes iteration that increases in complexity with groups of riders. In this intervention the presence of a bicyclist would trigger a sensor, sending a signal to play music out of


LED Bicycle Box: Three diagrams of an LED bicycle box. (*Left*) A great variety of light colors as the box fills. (*Top Left*) One color of lights as a few people enhabit the box. (*Top Right*) Brighter ligths with more colors as many people enter the box.

speaker in the curb. A single bicyclists would trigger a song played by one or two instruments. However, as more people grouped together the song would increase in complexity as more instruments joined in. The result of groups of bicyclists would be a symphony of instruments playing the song. Like with the Light Lanes, this encourages groups of bicyclists to ride together in order to create increasingly complex symphony arrangements. This draws attention to each bicyclist that joins the group – the person in the front might see another join the group, but recognize their presence by hearing the increased complexity of the music.

What is enticing about the Light Lanes and Symphony Lanes iterations is that they are a playful way to engage bicyclists as they ride while encouraging bicyclists to ride together. It invites riders to share in a social experience simply by being in proximity to each other. It also brings attention (acknowledgement) to riders from any pedestrians who are in the area. Bicycle facilities suddenly become an event to be watched and experienced. Now bicycle infrastructure is not something to be accommodated or plopped into the street by a designer, it is something to be programmed to create unique experiences. Bicyclists are no longer drawn to a particular route only because it is the safest or most efficient route, but because it is the most enjoyable.

ACKNOWLEDGEMENT

Bicycle Rooms: People notice when you break a rhythm. Taking up the idea that streets are 3-dimensional spaces with a floor, walls, and ceiling, this intervention uses plants in the landscape to make 'rooms' that draw attention between pedestrians and bicyclists. Genreally, planting strips are between sidewalks and bike lanes, creating an inherent grouping between bicycle facilities and the street. However, if the planting strip is placed between the bicycle lane and the street it group bicycle and pedestrian facilities. This simple changes the whole focus of the riders attention and feel of the street section. Next, if two groupings of trees are planted in the pedestrian facilities, the spatial effect creates a room. The break in the rhythm draws a bicyclist's
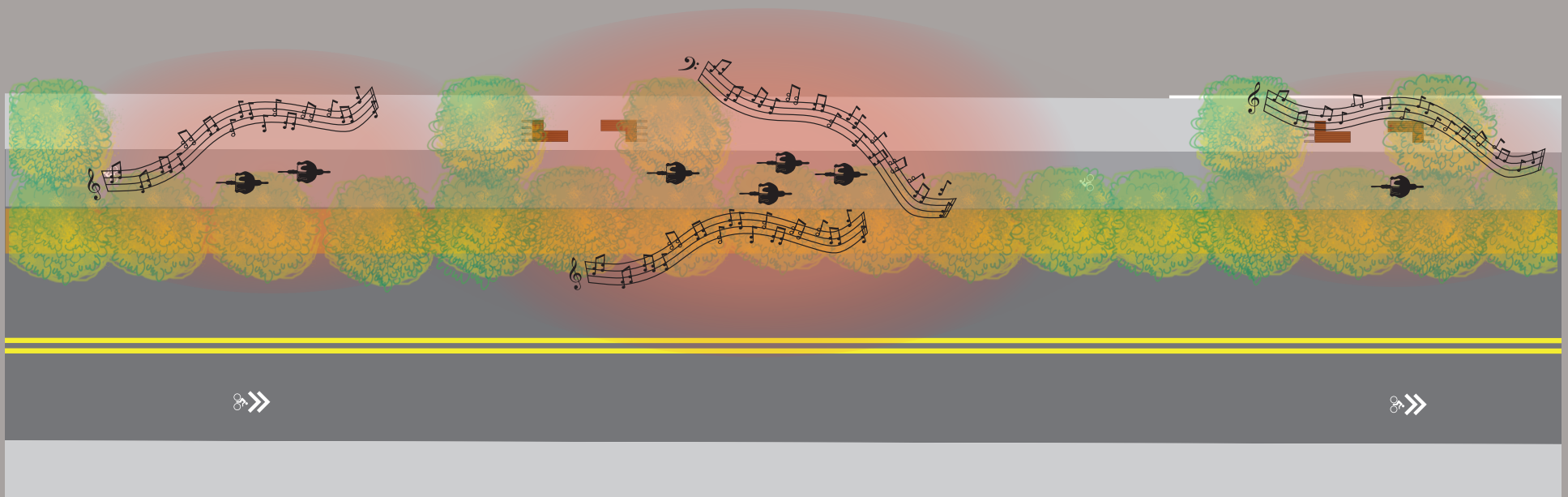
Symphony Lane
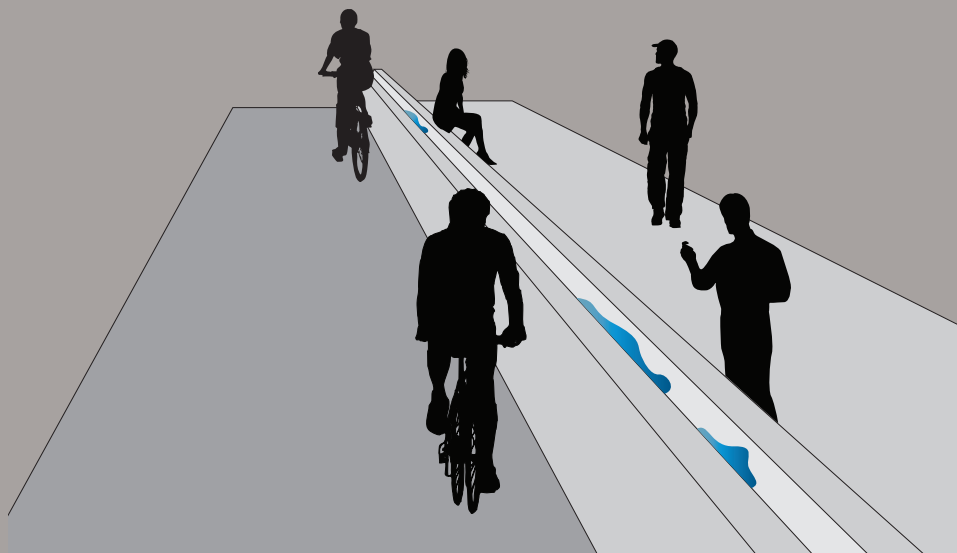
Runnels and Fountains

attention into the sudden definition of the volume of space. If benches and bicycle parking are added to this space activity is fostered within the room. This activity invites acknowledgement between bicyclists and pedestrians.

LID Room: Building upon the idea of the bicycle room, Low Impact Development (LID[1]) Rooms use the water and planting to group bicycle and pedestrian facilities. Bio-swales and stormwater retention troughs, can be used to frame rooms within the pedestrian environment. Moreover, the movement of water through these networks draws attention from the bicycle lane to pedestrian facilities, and back again. In this way, LID principals can be mixed with bicycle facilities to invite acknowledgement between bicyclists and pedestrians.

Runnels and Fountains: Building on the concept of using the movement of water to direct attention runnels running down slopes create cascading fountains alongside bicycle facilities. The flow in these runnels tends to be controlled by the presence of stormwater runoff. However, the flow could be determined by the presence of bicyclists. Using motion sensors, like in previous interventions, interval floods of water could be established in the runnel. When a bicyclist reaches the top of the hill they trigger a sensor that pulls water from a cistern and released as a wave of water into the runnel. The water would cascade through the runnel past other bicyclists. As bicyclists worked up hill they would see the presence of the cyclists vis-à-vis the cascades of water moving downhill. This creates acknowledgement of other cyclists by drawing attention to their presence when they might not otherwise be seen.

Slides: The next progression of water and hills is people flowing downhill in a runnel. Imagine if there was a waterslide running downhill next to a bicycle lane. It takes the idea of passing a person and brings it to another level of interaction. Children going down a water slide have a higher level of exuberance than a bicyclist or pedestrian going in the other direction. There would be all kinds of joyful

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[1] For more information about LID practices please see Low Impact Development: A Design Manual for Urban Areas, published by the University of Arkansas Community Design Center, 2010.
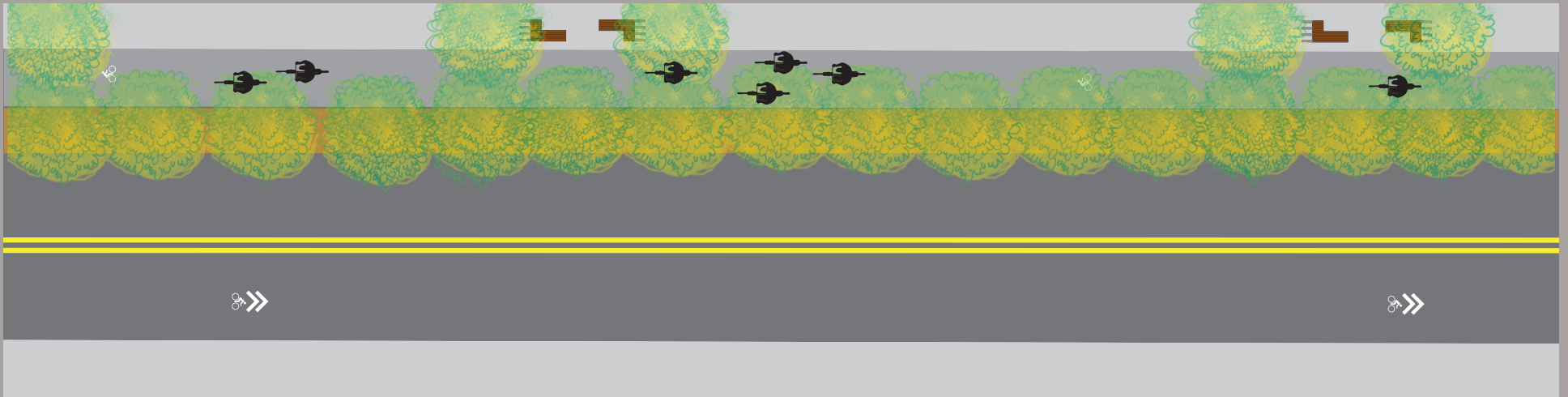
(Top) Plan view diagram of *Bicycle Rooms*. (Middle) Vignette of a *Bicycle Room*.
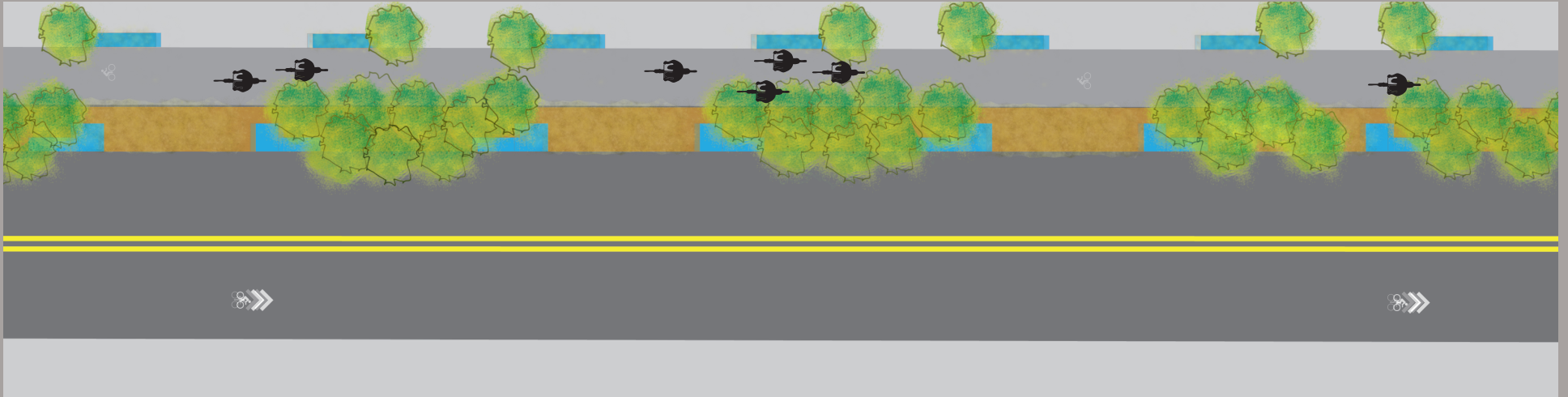
(Top) Plan view diagram of *LID Rooms*. **(Middle)** Vignette of a *LID Room.*

acknowledgement between the child and bicyclist. Alternatively it could be a long slide that runs next to a bicycle track. This could easily be accomplished if the bicycle lane ran past a park. This iteration creates acknowledgement between people in the urban landscape at a level that us hereto unkown.

Dragons: A final intervention is a huge dragon straddling the bicycle lane. Bicyclists would either ride into or shoot out of the mouth of the dragon. It would be a destination that children would drag their parents to ride through or watch. If placed on a hill bicyclists would burst out of the dragon's mouth like fire. Pedestrians would gather just to watch the spectacle. This is the exact kind of whimsical intervention that draws hoards of people, creates excitement, and fosters countless instances of acknowledgement between pedestrians and bicyclists.

SUMMARY

Some of these design interventions are realistic while others are completely off the wall. The later ideas are encouraged by the like of James Corner of *Field Operations*, who daringly pitched the idea of temporary hot tub installations on Pier 62/63 of the Seattle Waterfront. While many scoffed at these ideas because they are not realistic, it captured the imagination of others. When someone proposes an idea that imagines how dynamic a place could be there is a level of excitement that transforms the way we think about the potential of that site. That is the hope here as well; by pitching exciting ideas it challenges our paradigms of what bicycle facilities can be.

Water Slide

Dragons

CONCLUSIONS AND REFLECTIONS

This thesis grew out of several key experiences in my life. Almost fifteen years ago I moved to Portland, Oregon for my undergraduate studies. During the following ten years that I lived there I rediscovered my lost childhood love of riding bikes. I grew up in small town Washington State where everything was reachable by bicycle. Portland's comprehensive bicycle network afforded this same experience as an adult.

A few years ago I moved back to Seattle for my graduate studies. I quickly came to discover that my experiences of bicycling in Portland did not continue in Seattle. No doubt this had to do with the smaller bicycle facilities network in Seattle, but there was also something missing, a certain je ne sais quoi.

In my second year of graduate school I had the pleasure of studying urban design in Copenhagen, Denmark for several weeks. Renowned as one of the best bicycle cities in the world, I again experienced the joy of bicycling. Upon returning to Seattle it was gone again. Supported by my undergraduate major in psychology, eventually I came to hypothesize that bicycling in Portland and Copenhagen was different because it was a social act. On further reflection it now occurs to me for the first time that this is true of my experience bicycling while growing up. All the children had a bicycle, and bicycling was very much a social act.

In my last year of graduate school I had the opportunity to work

as an intern in Copenhagen for four months studying firsthand the relationship between social interaction and the built environment. It was during these formative months, surrounded by some of the brightest urban quality consultants in the world, that I developed the theory of a social experience of bicycling. At the time I was trying to figure out why many European cities have a greater balance in their bicycle ridership gender split. One of the consultants suggested that women are a sign to other women that an activity or location is safe. For Bryant Park, NYC conducts weekly gender counts to see find out the patron gender split. They theorize that if the percentage of women drops too low then the park is not being perceived as safe. While it is hard to know what truth there is to this, it raised the question of whether behavior and activities are socially reinforced? With that I was off.

A return to my psychology roots revealed at least one clear study that found behavior is socially reinforced. Hall et al. (1968) found that student behavior – both good and bad - is reinforced through social interaction. Thus, the presence of others reinforces whether we do something. A critical mass, or 'tipping point', must be reached before the people are encouraged to bicycle by the mere presence of other people bicycling. This is in line with Whyte's observation that 'people attract people', and Gehl's paraphrased observation that, with social interaction in public, 'one-plus-one is three - at least' (2011, 73).

Last, it occurrs to me that emphasis on social interaction in bicycle facilities design invites a greater variety of people to bicycle. Eugene Goffman, amongst many other sociologists, makes the analogy that "life is a stage and all men and women are players", to use the words of Shakespeare. As such, we all put on our makeup and costumes daily to engage in the drama of life. When bicycling becomes a social act more people feel they can be themselves while bicycling. As a result, more types of people are invited to bicycle and fostered by the built environment.

While working through these ideas it quickly became apparent that for any of them to come to fruition, this thesis needed to demonstrate a social experience of bicycling. Thus, many of these theories, while relating to this thesis, will have to remain unsubstantiated threads at

this time.

The next step is to consider how these interventions might be further analyzed to both generate new and alternative responses. They might be presented to a variety of audiences and users to consider how thinking about bicycle infrastructure with social interactions as the primary or at least a major lens alters the responses and solutions to urban design challenges of transportation and community building. Guidelines might be re-imagined as well to promote bicycle culture as a contributor to urban vitality. Finally the possible design ideas might be eventually constructed and used by the public. They need not be permanent interventions, temporary is fine. Base line data should be collected for the site before installation. Through the life of the project monitoring should be conducted. The firm, Gehl Architects have come up with a strong methodology for observing and recording public life in public space. Such a methodology can be used to create metrics for determining the success of the installation. Further refinement and testing could then improve upon earlier designs. In this way, a body of work can be created to justify wide scale implementation of bicycle facilities that foster social interaction.

I will conclude with Jan Gehl's observations on the transformation of pedestrian facilities:

During the many years in which pedestrian traffic was primarily treated as a form of transport that belonged under the auspices of traffic planning, city life's bounty of nuances and opportunities was largely overlooked or ignored. The terms used were "walking traffic", "pedestrian streams," "sidewalk capacity," and "crossing the street safely." But in cities there is so much more to walking than walking! (2010, 19)

Currently, bicycle facilities are planned for as a form of transport. However, if they can be designed with the same attention to detail as pedestrian facilities then it may one day be remarked that, in cities there is so much more to bicycling than bicycling!

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