Exploring the Relationship Between Walkability and the Built Environment: A Case Study of Three Intersections in Seattle’s University District

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CHAPTER 1 | INTRODUCTION

Purpose
In recent years, walkability has become a hot topic in urban planning. Cities across the nation, including Seattle, are implementing pedestrian master plans, and builders are starting to develop walkable communities. But what is it that makes a place walkable? Why is walkability so important, and why is this topic gaining so much attention now?

The purpose of this thesis was to examine the relationship between the built environment and walkability. In doing so, it looked at walking as a mode of transportation, as an alternative to driving, and as a way to incorporate physical activity into daily life.

Approach
This study reviews the literature regarding walkability and physical activity, how urban development patterns have affected walkability, and how certain built environment characteristics contribute to walkability. It then proposes a set of urban design guidelines for walkability based on the literature. Finally, it applies these design guidelines to three case studies to illustrate how changes might be made in the built environment to increase an area’s walkability.

Background
A majority of the people in the United States are not getting enough physical activity. According to the Centers for Disease Control and Prevention (CDC), 51.2% of the American population does not get a sufficient amount of physical activity, and 13.5% of Americans are completely sedentary (CDC 2010). This lack of adequate physical activity contributes to, among other health issues, a rising obesity rate among Americans.

Obesity is a growing problem in the United States. According to the CDC, over two-thirds (68.3%) of American adults are overweight or obese. The percentage of obese
adults has more than doubled since 1980, from 15.1% then to 33.9% in 2008, and the obesity rate continues to rise (CDC 2011). Moreover, 16.9% of children in the United States are considered obese. Only 5.5% of American children were obese in 1980, but the percentage has grown steadily since.

Some of the leading causes of death in the United States are obesity-related, including heart disease, stroke, type 2 diabetes, and some types of cancer. Not only is obesity killing us, it is also an expensive problem: estimated medical costs associated with obesity in 2008 were $147 billion (CDC 2011). On average, medical insurance companies end up paying $1,429 more for a person who is obese than for a person of normal weight.

In the last decade or so, research into the relationship between physical activity and the built environment has increased considerably, and studies have shown a strong correlation between the two (Saelens and Handy 2008). Walking is one way to get adequate physical activity from day to day, and studies have shown an inverse relationship between active transport, such as walking, and obesity (Bassett et al. 2008). The built environment influences our behavior; planners and policymakers can use this knowledge to create walkable environments – encouraging active transport and causing people to incur more incidental physical activity in their daily lives – in the hopes of contributing to a reduction in obesity rates and other health problems over time.

**Importance to the Field of Urban Design and Planning**

It is critical for planners and public health officials alike to recognize the significance of the relationship between urban form and public health; planning for healthy cities must include some consideration of the impacts of the built environment on health. To this end, this thesis investigates walkability and its relationship to public health, and also looks at the characteristics of the built environment that contribute to walkability.

Built environment guidelines and policies can help shape cities toward walkability and, therefore, toward physical activity and an improvement in public health. In the interest of
planning for healthy cities, the influence of the built environment on walkability is a topic that must be explored. Policy and design decisions can create environments in which people choose active transport over passive transport. This thesis aims to impart readers with an understanding of the ways in which the built environment impacts physical activity. Furthermore, it aims to better equip planners, policymakers, and other officials to design for healthy communities.

**Chapter Organization**

This thesis is organized into six chapters. Following the introductory material presented in the first chapter, Chapter 2 offers a history of urban development patterns and walkability in the United States. Chapter 3 presents a review of the literature on physical activity and its relationship to urban form and to public health. It also looks at measures to improve walkability, and at ways to assess walkability. Chapter 4 draws on the literature to determine the elements of urban form that contribute to walkability, and organizes them into a list of urban design guidelines for walkability. Chapter 5 presents three case studies in the University District of Seattle to illustrate how these design guidelines can be used to improve walkability. Chapter 6 discusses how this research can be used to plan for healthy cities, as well as areas for future research.
There was a time when walkability was built into the city. Before the mid-19th century, the population got around, for the most part, on foot. For this reason, the American city was a dense collection of highly mixed land uses. By necessity, buildings, people, and activities were all clustered together within a relatively small area (Muller 2004). The size of the city was generally dictated by an approximate 30-minute walking radius from the city center. Blocks tended to be smaller and human-scaled, usually around 200 to 300 feet on each side (Wheeler 2008). When urban form strayed from these rough constraints – when blocks were too large and facilities too spread out – the city failed to accommodate the primary mode of human mobility, and therefore was not successful (Muller 2004). These tightly knit, pedestrian-friendly grids can still be seen at the core of many of the nation’s cities today.

The rise of industrialization in the first half of the 19th century brought increasingly crowded living conditions to the city. With the advent of the railroad in the 1830s, the wealthy could afford to move to planned rail suburbs and commute daily to their jobs in the city. However, this luxury was unattainable for middle-income residents, whose mobility constraints relegated them to the urban life, however unpleasant.

In the 1850s, a slight improvement in mobility was achieved with the development of the horse-drawn streetcar, which presented middle-income residents with the opportunity to move out to new “horsecar suburbs” just outside the city’s edge. But the movement of middle-income residents to the city’s fringes only eased urban population growth for a short period of time. The horse-drawn streetcar’s range allowed for only a small area around the city to be developed, but the middle class was growing, and immigrants were now flocking into the newly industrialized cities. Urban populations were quickly outgrowing the capacity of their cities’ infrastructure.
A revolution in urban form took place when the invention of the electric traction motor brought about the development of the electric streetcar in the 1880s. At 15 miles per hour – triple the speed of the horse-drawn streetcar – the electric streetcar facilitated the development of a much larger area of land on the city’s outer edge. Streetcar suburbs rapidly sprung up, expanding metropolitan areas and finally providing some relief to the burgeoning urban population. The electric streetcar quickly became ubiquitous in American cities, and its low fares made it accessible to most of the city’s population – the first truly mass transit in the United States.

The 1920s saw the slow introduction of the automobile to the mainstream American population. With Henry Ford’s invention of the automated assembly line, the automobile became affordable to the majority of the population, not just the wealthy. At first, its use was generally limited to recreational purposes, but as the suburban population continued to grow, a rapidly increasing number of households were solely dependent on private automobiles for transport. As automobile use became more widespread, developers were no longer tied only to the areas that were accessible by public transportation, and cities expanded ever outward. Suburban growth boomed as the automobile gave people the freedom to move even farther outside the city. Streetcar ridership began to decline in the 1930s, and by the end of the decade was declining so rapidly that most streetcar systems had been shut down. As public transit was in decline, a number of corporations, including General Motors and Firestone Tire, began purchasing failing streetcar systems across the country. Rather than rehabilitating the streetcars, they ripped up the tracks and repaved the streets in order to better accommodate use by private motor vehicles.

At the same time, private landowners concerned about public health called for zoning laws that created a separation of land uses, so that harmful or unpleasant uses would not adversely affect their residential or commercial properties (Frumkin et al. 2011, 20-21). Different zones were created for different land uses – residential uses were separated from commercial and industrial uses, for example – and zoning became the most fundamental tool for the urban planner. Although zoning laws were brought about mainly out of a
concern for public health, they ultimately ended up having one unintended public health consequence: the lack of connectivity between uses was a factor in making communities much less walkable.

Around 1945, after the end of the second World War, the nation prospered and automobile ownership surged (Muller 2004). With the collapse of public transportation systems, the private motor vehicle essentially became a necessity. The 1956 Interstate Highway Act put into motion an exceptional nationwide effort to build high-speed freeways, which revolutionized the way Americans got around. While this innovation allowed for much greater mobility for the automobile, the urban grid degenerated further and became much less connected for the pedestrian. New suburbs were created as the advent of the freeway era allowed populations to become more spread out. These suburbs were the antithesis of the old cities: separated land uses; larger street grids with automobile-oriented amenities; few to no amenities within walking distance of residences; buildings and signs built to automobile scale rather than to human scale. Walkable communities were almost a thing of the past. This type of growth continued to dominate development patterns through the late 20th century, creating essentially fully auto-dependent communities with little, if any, connection to the surrounding urban form (Wheeler 2008). The term “sprawl” has come to describe such communities with low walkability, low density, and high auto-dependence (Sallis et al. 2011, 36).

Now, with obesity rates skyrocketing, researchers have begun to focus more intently on the effect that this type of sprawling built environment has had on our health. As noted by Frank, et al., “[i]n the old cities, getting enough physical activity during one’s day wasn’t an issue because it was as much a part of life as eating or sleeping. Today, physical activity has been engineered out of most aspects of life” (2003). People are now required to seek out physical activity and plan it into their leisure time. However, planners can structure the built environment to encourage the integration of walking and other physical activity into daily life.
There is a well-documented relationship between physical activity and health benefits (Sallis et al. 2011). However, prior to the last decade or so, physical activity research had focused primarily on correlates of individual behavior and ways to improve health through changes at the individual level (Giles-Corti et al. 2009). Only in recent years has research on the subject begun to examine the effects of the built environment on physical activity and its potential to impact overall community health. Studies now reflect an increasing awareness of the role of environmental factors in the attainment of physical activity; in particular, on active transport through walking (Ewing et al. 2003, Saelens and Handy 2008). Researchers in the fields of public health, urban planning, and transportation have all taken an interest in the ways in which the built environment influences physical activity as the correlation between the two has become more apparent in recent years.

**Walkability, Public Health, and the Built Environment**

Public health officials recommend getting at least 2.5 hours of moderate-intensity physical activity per week, spread out over the course of the week, in order to maintain health and to prevent a host of medical problems (U.S. Department of Health and Human Services, 2009). Most Americans, however, are not getting enough physical activity to satisfy these recommendations. Walking is one form of moderate-intensity activity that can contribute to achieving adequate physical activity in the course of a week. While there are ultimately many determinants of physical activity, the built environment is one that plays an important role. Certain characteristics of the built environment can influence the amount of walking people do for active transport – that is, walking as a part of day-to-day activities, such as getting to work or making a trip to the grocery store – and can therefore increase physical activity levels in the population as a whole (Saelens et al. 2003).
As described in the previous chapter, land development in the last half of the 20th century was heavily influenced by the transportation revolution that occurred with the advent of the automobile and, subsequently, the emergence of the freeway. Many of the communities that came about during this time were built to the scale of the automobile, with little to no consideration for the needs of the pedestrian. As a result, many of our built environments today actually make it more difficult – and in some cases even dangerous – to walk to our destinations (Saelens et al. 2003, Pucher and Dijkstra 2003).

The sprawling development patterns of the last several decades have not only created communities with highly separated land uses and a lack of connectivity in street networks, they have also had an impact on our health. The low walkability associated with sprawl has been linked to obesity in a number of studies. A comparison of compact and sprawling counties indicated that residents of sprawling counties were likely to walk less and to have greater incidence of obesity and hypertension than those in compact counties (Ewing et al. 2003). Another study showed that higher land use mix was strongly associated with a reduction in the likelihood of obesity (Frank et al. 2004). It also demonstrated that those who spent more time in a car each day were subject to an increased likelihood of obesity.

A study by Smith et al. (2008) showed that the risks of excess weight are decreased when walkability is increased. In addition, the study determined that simply doubling the percentage of a neighborhood’s residents who walk to work decreased individual residents’ risk of obesity by nearly 10%. The researchers also showed that populations living in older neighborhoods – that is, those neighborhoods developed before the freeway era – had a significantly decreased risk of obesity than did their counterparts living in newer, less pedestrian-friendly neighborhoods.

Research has demonstrated the potential of the built environment to influence travel behaviors across an entire population, in contrast with earlier behavior change methods that focused only on individual behavior modification. In addition, while there is a
documented lack of maintenance for health behavior programs promoting individual change, changes in the physical environment are permanent and far-reaching (Saelens et al. 2003).

Recent studies indicate that 90% of trips in the United States are made by car; of those, 27% are short – less than a mile in length – and could likely be accomplished by walking rather than driving (Brown et al. 2007). Changing these short car trips to walking trips would allow people to incorporate physical activity, which they might not otherwise get, into the normal course of their day. Over time, similar behavior changes across a population could lead to improved public health. Places designed for walkability – those that are human-scaled, comfortable and convenient for pedestrians – could encourage more walking, and therefore could promote greater overall community health (Sallis et al. 2011).

**Elements of the Built Environment that Encourage Walking**

In light of all the research linking the built environment with walkability and public health, it is important to understand what elements of the built environment contribute to walkability. There are many environmental elements that encourage walking, and they exist at different geographical scales. Some elements, such as land use mix, exist at a large scale, such as the city or neighborhood scale; others, such as pedestrian amenities, are at street level. In addition, the city and streets consist of overlapping layers of networks and land use patterns. Because of this, it is helpful to divide the elements into a few different categories of classification.

An assortment of categories for grouping important elements of the walkable built environment has emerged from various studies and reviews, including: density, land use mix, destination accessibility, street pattern or connectivity, urban design elements, safety, and aesthetics (Forsyth et al. 2008, Giles-Corti et al. 2009, Ewing et al. 2011). For the purpose of this thesis, three even broader categories will be used for classification of elements: **land use**, **street networks**, and **urban design**. This simple classification was
adapted from Frank et al. (2003); all of the categories listed above can easily be captured by one of these broad classification groups. Elements from all three categories are critical to the success of a walkable community.

Land Use
Many of the elements that encourage walkability in a community have to do with patterns of land use – the way land uses are arranged within the urban form (Frank et al. 2003). A density of housing, people, and land uses allows for a large number of activities within walking distance of a large number of people (Saelens et al. 2003, Giles-Corti et al. 2009, Van Loon and Frank 2011). Such a concentration of people and activities also provides a feeling of safety through what Jane Jacobs described as “eyes on the street” – a critical mass of people to monitor activity and create a sense of community (Jacobs 1961). Density also makes transit – another aspect of a walkable community, discussed in the next section – viable (Giles-Corti et al. 2009).

Research has shown that land use mix is another important component of land use for walkability. Sprawling developments tend to have a separation of land uses, with few to no amenities within walking distance. A mix of land uses goes hand-in-hand with density to create a proximity to destinations and activities, putting a number of different amenities all within walking distance of one another, and creating an environment in which it is much easier to walk for transport (Saelens et al. 2003).

Street Networks
A lack of network connectivity in the sprawling developments of the last half-century has greatly hindered walkability. Active transport through walking is far more likely to occur if certain elements of the street network are in place to create a more connected community.

Small block size and street connectivity both play a large role in making a community walkable (Giles-Corti et al. 2009). Small blocks and connected streets allow for more
direct routes than larger, disconnected blocks. They also provide a larger number of potential route options than do large blocks. In addition, small blocks break up the street into more manageable and enjoyable portions, whereas longer blocks can create monotony and boredom. Accessibility is another important factor in creating a walkable place; people must be able to access businesses and activities along the street with ease (Jacobs 1993). Streets and buildings should also be accessible to the handicapped.

The inclusion of off-street paths dedicated to pedestrians and bicyclists as part of a transportation network can also encourage walking (Frank et al. 2003, Pucher and Dijkstra 2003). When connected into the existing street network, these separate rights-of-way provide a convenient, safe, alternative route for pedestrians to reach their destination. Transit facilities as part of a street network can facilitate walking, as well, as a transit user is generally required to walk on at least one end of the trip (Frank et al. 2003, Ewing et al. 2011). When streets are multi-modal – when they accommodate pedestrians, bicycles, and transit in addition to automobiles – they provide the greatest amount of flexibility in route and trip planning for the pedestrian (Institute of Transportation Engineers 2010).

Urban Design

Pedestrian-oriented urban design elements represent another major contributor to community walkability. These elements work at both the street level and the site level to create a comfortable environment for pedestrian travel. They influence a pedestrian’s perception of the built environment, and ultimately, his or her decision to walk for transport (Frank et al. 2003).

At the street level, design elements that provide safety from traffic are important components of a walkable environment (Jacobs 1993, Brown et al. 2007). These include marked pedestrian crossings, raised crosswalks, pedestrian refuge islands, medians, and curb extensions, all of which give pedestrians protection from and visibility to drivers (Giles-Corti et al. 2009, Institute of Transportation Engineers 2010).
and bicycle lanes can also create separation between pedestrians and automobile traffic (Jacobs 1993, Institute of Transportation Engineers 2010).

Some street design elements provide a more pleasant aesthetic experience which, studies have shown, also helps make a street more walkable (Brown et al. 2007). Street trees and landscaping can provide a barrier between pedestrians and faster-moving traffic, but can also make walking a much more enjoyable experience by providing visual stimulation as well as protection from the elements (Jacobs 1993, Giles-Corti et al. 2009). In addition, pedestrian-scale elements like benches, kiosks, and signs can help orient the pedestrian and provide an inviting, leisurely, pleasant walking experience (Jacobs 1993).

Site level design elements can also make a significant difference in a pedestrian’s perception of the environment. Definition of the street edge – with building facades, street trees, or some other perceptible edge – helps provide a feeling of enclosure, delineating the street as a space for the pedestrian (Jacobs 1993). Spacing between buildings is one element that creates a street edge; less space between buildings makes the edge more perceptible. Building orientation and setback also help provide definition; buildings oriented to the street and abutting the pedestrian thoroughfare are certainly preferable to buildings separated from the street by, for instance, a large parking lot (Institute of Transportation Engineers 2010). The ratio of building height to street width also helps create an enclosed pedestrian space; an ideal ratio for providing definition is between 1:2 and 1:3.

Other building characteristics that help create a more pleasant walking experience include building width and variety. (Jacobs 1993, Institute of Transportation Engineers 2010). Smaller building width creates a greater variety of uses and activities, which also provides more visual interest for the pedestrian. In addition, transparency of building entries and facades provides another source of visual interest, helps break up monotony along a block, and invites pedestrians into buildings and along the street. These urban design
elements must be present in combination with the land use and street network elements in order to provide a successful, walkable built environment.

**Other Positive Outcomes of Walkable Communities**

While this thesis focuses on walkability as it relates to the built environment and physical activity, research has shown that walkability can have other health benefits, as well. Walkable neighborhoods have the ability to encourage more social interaction and greater community involvement, which in turn leads to greater social capital within the community. Social capital has been defined as “the social networks and interactions that inspire trust and reciprocity among citizens” (Leyden 2003), and it is an important contributor not only to physical health, but to mental health as well (Rogers et al. 2010). It has also been linked to additional community benefits such as crime prevention and economic development.

In addition, walking for transport decreases the number of trips a person makes by car. This has the potential to reduce greenhouse gas emissions and therefore to increase air quality (Ewing et al. 2011). A reduction in greenhouse gas emissions is critical to mitigating climate change and protecting the natural environment. Having fewer cars on the road also leads to less polluted urban stormwater runoff, and therefore to higher watershed health and water quality. Other environmental benefits of walking rather than driving include reduction of noise pollution, conservation of land, and alleviation of traffic congestion (Pucher and Dijkstra 2003). This broad range of benefits related to walkability, especially when considered in addition to the physical health benefits, makes a strong case for walkable communities.

**Walkability Assessment Tools**

As walkability has become an ever more important issue in the fields of urban planning, public health, and transportation, researchers have been developing ways to evaluate it quantifiably. Many walkability audit tools now exist, but there is no consensus as to which tool is best for measuring walkability (Dannenberg and Wendel 2011). Moudon
and Lee (2003) reviewed over 30 audit instruments for walkability and bikability, and found that no instrument comprehensively assesses the built environment; each is meant to assess only certain parts of the built environment. Some are more geared toward pedestrian safety, for example, while others may focus more on network characteristics or level of service. In addition, the study found that nearly 200 variables – from sidewalk width and presence of street crossings to land use type and network density – exist across the 30 audit tools to describe the environmental factors related to walkability. This illustrates the wide variety of built environment features that can contribute to creating a walkable community.

Additionally, different tools may be appropriate to different situations. For example, some tools rely on GIS information and other existing objective data in order to analyze an area’s walkability; these tools are more appropriate for use by researchers and sometimes by city planners or other professionals. Other tools use subjective data collected in the field; these are also appropriate for professional use, though some are even geared toward the layperson, such as the Pennsylvania Department of Transportation’s short walkability checklist for neighborhoods (2003). This five-question list addresses safety, ease of movement, and user perceptions; it would be helpful in a setting, such as a community meeting, where many participants with no experience in assessing the built environment might be asked to evaluate neighborhood walkability.

Many walkability audit tools allow the user to rate different elements of the built environment; the tool then weights certain elements depending upon their impact on walkability. These ratings are then added up to generate a final score that indicates an area’s walkability. One relatively new tool, Walk Score, exists online as a free, publicly accessible website (Walk Score 2012). The user can enter any address – for instance, the location of their residence – and the Walk Score tool applies an algorithm to evaluate walking distances to certain destinations, such as restaurants and public transit; it also evaluates the number of different destinations available within walking distance. Based on this information, it generates a score from 0 to 100 that reflects the area’s walkability. Of
course, like any walkability audit tool, the information it provides is not perfect; its algorithm only functions with respect to amenities and does not consider other pedestrian facilities such as sidewalk conditions or existence of crosswalks, for example. However, it is certainly useful for people who want to find out what areas of a city are generally the most walkable; moreover, it has helped generate greater public interest regarding the issue of walkability. While many different types of walkability audit tools exist, they all provide assessments that can be useful indicators of an area’s built environment deficiencies. Equipped with this knowledge, planners and other decision makers can determine what changes need to be made in order to create more walkable communities.
The review of the literature showed that walkability is strongly influenced by elements of the built environment. Based on the urban design elements found through the literature review to increase walkability, this chapter proposes a set of urban design guidelines for walkability. Importantly, as discussed in the literature review, all three components of the built environment – land use, street network, and urban design – must be present together in order to facilitate walking (Frank et al. 2003).

Land use and street network elements are macro scale elements that are intrinsic to an urban environment; many urban environments exist, however, that are missing the pedestrian-scale urban design elements that create a walkable environment. Sound land use and street network components, such as density and connectivity, create a strong backbone for walkability, but those alone will not create a walkable environment. A suburban environment will likely lack all three components, but it must put the land use and street network elements in place before attempting to adopt urban design guidelines for walkability. The suburban environment that wishes to implement these urban design guidelines must first make regulatory changes and investments in infrastructure in order to achieve the land use and street network characteristics of a walkable environment. The Guide to Community Preventive Services (2010) is an online resource that can provide information and serve as a guide for making policy changes toward walkability beyond the recommendations presented in these design guidelines.

These guidelines are intended to guide development toward a more walkable community, and can be applied in a number of urban areas desiring more walkability. Should a municipality wish to incorporate an element of walkability into existing policy, these walkability guidelines can be adapted into their existing design guidelines. Ideally, as many as possible of these elements should be in place in order to provide a safe, pleasant walking experience. It should be noted that some of these elements could potentially impede on bicycle travel when proper consideration is not given to their use on the
roadway; therefore, deference should also be given to bicyclists and other modes of travel when using these guidelines.

**Providing Safety from Traffic**

These elements of the built environment will help provide pedestrian protection from traffic and make the pedestrian setting perceivably safer.

**Marked pedestrian crossings** (Figure 4.1). In order to create a walkable environment, the pedestrian network should be as continuous as possible (Institute of Transportation Engineers 2010).

- Designated pedestrian crossings should be marked for greater visibility and to direct pedestrian traffic across the street. A clearly marked network of crosswalks can be an indication to drivers that they should expect pedestrian activity.
- Crosswalks should be located at all legs of an intersection to provide maximum connectivity for the pedestrian. Intersections are the best place for pedestrian crossing because automobile traffic is controlled, allowing for greater pedestrian safety.
- Midblock crossings should be used when blocks are greater than 400 feet in length in order to keep pedestrians from going too far out of their way to cross the street. A midblock crossing may also be appropriate at transit stop locations or at similarly trafficked midblock nodes requiring pedestrians to cross the street. Because midblock crossings are generally unsignalized, care should be taken to mark them clearly, and

Figure 4.1 | *Marked pedestrian crossings can increase visibility and create a connected network for pedestrians.* (Source: Pedestrian and Bicycle Information Center / Nicole Schneider.)
they should be used in combination with other elements that provide pedestrian safety from traffic.

- If additional definition of crosswalks is desired, treatments such as colored paint or textured pavers may be used.

**Raised crosswalks.** Where appropriate, crosswalks raised to the height of the sidewalk should be used as a traffic calming device and to provide a more continuous pedestrian path.

- Raised crosswalks may be used at midblock crossings, or at crossings in an area where traffic needs to be slowed down or additional visibility is needed.
- The road pavement should ramp up at a gradual incline to meet the elevation of the sidewalk so as to require vehicular traffic to slow down.

**Curb extensions (Figure 4.2).** When possible, curb extensions should be used at crosswalks in areas with a great deal of pedestrian activity. They increase the area of the pedestrian realm, increase pedestrian visibility, and help to slow traffic.

- Curb extensions should only be used in areas where there is an on-street parking lane into which the curb may be extended.
- The curb should be extended no further than the edge of the travel lane; preferably at least 12 inches should be allowed off the edge of the travel lane.
- The area of extension should be at least the width of the sidewalk, but wider is preferred to increase pedestrian visibility.

Figure 4.2 | Curb extensions increase the area of the pedestrian realm. (Source: Pedestrian and Bicycle Information Center / Carl Sundstrom.)
Curb extensions should not extend into the bicycle lane or otherwise impede bicycle travel.

Medians. Medians can help slow traffic by creating a narrower travel way; they are ideally used on multilane streets to separate directions of travel. They can also serve an aesthetic purpose on a wide street.

- Medians should not exceed a width of 18 feet in order to keep streets from becoming too wide to traverse on foot; and installation of a median should not occur if it will compromise sidewalk width.
- A median may be landscaped or planted with street trees; see “landscaping” and “street trees” guidelines below.
- Pedestrian access should not be impeded by the median. A median is an ideal location for pedestrian refuge at intersections or midblock crossings in order to provide shorter crosswalks at multilane crossings; median should be wide enough to accommodate pedestrians safely and comfortably.
- Care should be taken not to decrease road width to the point that it impedes on bicycle travel.

On-street parking. A lane of parking between the travel lane and the sidewalk provides a buffer between pedestrians and traffic. It can also help to slow traffic, providing a safer, more pleasant pedestrian experience.

- Parking stalls on high volume streets with higher speeds should be parallel to the flow of traffic. Diagonal, back-in spaces may be used along low-volume, low-speed streets.
- On-street parking should comply with local parking policies.

Defining the Street Edge

A defined street edge helps to delineate the pedestrian realm and enhances the pedestrian experience.
Ratio of building height to street width. When buildings are in scale with the width of the street, a pleasant, enclosed pedestrian space can be achieved. If the street is too wide for the scale of the buildings, it will feel open and difficult to traverse for the pedestrian. If the buildings are too tall for the scale of the street, the street may begin to feel cramped and constricted (Jacobs 1993, Institute of Transportation Engineers 2010).
- When possible, a ratio of building height to street width between 1:2 and 1:3 should be achieved.
- A larger ratio is acceptable, but a smaller ratio may create a street that is too wide and unwelcoming for pedestrian travel.

Spacing between buildings. The closer together buildings are along a street, the more they begin to form a defined street edge for the pedestrian.
- Buildings along the street should be built as closely together as possible in order to create a more perceptible street edge.

Building orientation. Buildings oriented to the street help create an inviting, pedestrian-oriented space (Institute of Transportation Engineers 2010).
- A building should be oriented so that its main facade looks toward the street and its main entrance opens onto the street.
- Loading docks and other service entrances should be located in back of the building so as not to disrupt pedestrian flow.

Building setback. Buildings directly abutting the pedestrian thoroughfare provide definition to the pedestrian realm; buildings separated from the street create discontinuity in the pedestrian experience (Frank et al. 2003).
- Buildings should be set back as little as possible from the right of way; preferably, setbacks should be zero.
- When necessary, off-street parking should be located in back of buildings; it should never be located between the building and the street.
Providing a Pleasant Aesthetic Experience and Visual Interest

These elements build upon the important elements of traffic safety and street definition to create a comfortable, interesting pedestrian experience.

Sidewalk width. The sidewalk helps to provide a pedestrian realm. When wider, it can accommodate pedestrians of varying speeds and give pedestrians more room for leisurely walking.
  - The sidewalk should be as wide as possible to comfortably accommodate pedestrians and related uses without making the street realm too wide for the scale of the buildings.
  - Café seating or other appropriate building-related uses should be encouraged to occupy space on the sidewalk if it can still comfortably accommodate pedestrians; such activity contributes to a lively and pleasant pedestrian environment.

Street trees (Figure 4.3). Trees along the street can make walking an enjoyable experience by providing visual stimulation as well as protection from the elements. They can also act as a buffer between pedestrians and traffic (Jacobs 1993, Institute of Transportation Engineers 2010).
  - Trees should be located no more than 25 to 50 feet apart in order to provide definition along the street.
  - An area of at least 5 feet by 5 feet per tree should be provided in order for trees to be successful.
  - Trees should be a locally appropriate species and should be of an upright type whose canopy will not spread too far toward buildings along the street.

Figure 4.3 | Street trees can provide protection from the elements and help define the street edge. (Source: Pedestrian and Bicycle Information Center / Laura Sandt.)
Trees may also be located in a median if the median is wide enough – at least 6 feet wide, preferably greater – to accommodate them.

**Landscaping.** Like street trees, landscaped areas along the street create a pleasant walking experience and can also serve as a buffer for pedestrians.

- Landscaped areas may be provided along the street edge of the sidewalk, but should not impede pedestrian traffic.
- Landscape planters may also be provided in front of buildings to create visual appeal or to break up a long blank wall, but should not be wide enough to create significant separation between the building and the walkway.
- Landscaping may also be provided in a median for visual appeal, particularly in medians that are too narrow to accommodate street trees.

**Benches.** Well-placed benches invite the pedestrian to rest, creating a comfortable walking experience (Jacobs 1993).

- Benches should be provided in locations that experience heavy pedestrian traffic in order to provide a respite for weary travelers, a meeting place, or a place to wait for others.
- Benches may be placed at transit stops to encourage multimodal travel.
- Benches should be conveniently located adjacent to the pedestrian walkway, but should not impede pedestrian traffic.

**Kiosks.** Retail or informational kiosks adjacent to the walkway help to enliven the street.

- In order to be functional, kiosks should be located in areas of heavy pedestrian traffic.
- Kiosks should be located adjacent to the pedestrian walkway, but should not impede pedestrian traffic.

**Signs.** Signage helps orient the pedestrian and also provides visual interest.

- Signs should be oriented to the pedestrian; text should be large enough to be read by the pedestrian.
Business signs should be ideally located on the building or awning to be read from across the street; an additional sign should hang perpendicular to the walkway to be read by those approaching on the sidewalk.

Directional signs should be located adjacent to the walkway, oriented toward pedestrians, and should not impede pedestrian traffic.

Building width. Smaller building width creates a greater variety of uses and activities, which also provides more visual interest for the pedestrian.

Buildings should be as narrow as possible in order to create variety along the street.

When buildings take up more than half the block, articulation and a variety of materials should be used to visually break them up.

Building variety. Variety in building types and materials helps break up the monotony along the block and provides visual interest for the pedestrian.

Buildings should be given a variety of treatments – different materials and colors, a variety of window and awning types – in order to provide interest along the street and to avoid a massive wall of monotony.

When possible, the character of buildings situated together on a block should have complementary qualities – one particular style or quality should not stand out too much from everything else – in order to give the street a pleasing character for pedestrians.

Transparency of building entries and facades. A transparent facade provides another source of visual interest. It creates a comfortable environment by inviting pedestrians along the street and allowing them to feel connected to what is going on in the buildings around them (Jacobs 1993, Institute of Transportation Engineers 2010).

Building fronts should be as transparent as possible, with windows and doors along the street front to create an inviting pedestrian environment.

Blank walls fronting the street should be avoided.
This chapter offers a case study of three intersections in Seattle that illustrate how these design guidelines may be applied to areas lacking in walkability design elements. A walkability audit was performed to evaluate each case study site before design guidelines were applied. The audit tool was adapted from the CDC’s Healthier Workplace Initiative walkability audit tool, available for download on their website (CDC 2010). This tool was selected because it focuses on many of the same pedestrian-scale and safety-oriented elements of the built environment that are addressed by these design guidelines. Performing the audit was useful for determining the deficiencies in the built environment that would need to be addressed to improve walkability. The full audit for each site can be found in the appendix to this document.

Rationale for Site Selection

The three intersections selected for this case study are Burke-Gilman Trail at Brooklyn Avenue NE, NE 42nd Street at Brooklyn Avenue NE, and NE 45th Street at Roosevelt Way NE. All intersections are located in the University District of Seattle (Figure 5.1).

This study was delimited to the University District in order to focus on a compact urban environment that offers a connected street network, a variety of activities, and a number of different user types owing to its location adjacent to the University of Washington, thereby satisfying the first two built environment components for walkability. In addition, the University District offers a variety of street types. Roosevelt Way NE and NE 45th Street are both principal arterials, which “serve as the principal route[s] for the movement of traffic throughout the city” (Seattle Department of Transportation 2011); both are also major transit streets. Brooklyn Avenue NE is a collector arterial, distributing traffic to local destinations, and also a major transit street. NE 42nd Street is an access street, which is not part of the arterial network, but acts as a local street. The Burke-Gilman Trail is a path limited to pedestrians and bicyclists, with no vehicular access.
These intersections were selected because they represent the diversity of street types within the district.

Figure 5.1 | Locations of the case study intersections. A – Burke-Gilman Trail at Brooklyn Avenue NE; B – NE 42nd Street at Brooklyn Avenue NE; C – NE 45th Street at Roosevelt Way NE.

Limitations

An in-depth study of the impact of these environmental changes on walkability would involve more time and resources than were available for a paper of this length. Therefore, this study only illustrates the use of the design guidelines without further studying the effect that their implementation has on walkability. Additionally, this study looks at the application of urban design guidelines for pedestrian-scale elements of the built environment, so it focuses on an urban area that already has the density and connectivity
needed for walkability. Finally, many other factors, both environmental and behavioral, contribute to physical health and activity; this study only focuses on the influence of one aspect – the built environment.

**Burke-Gilman Trail at Brooklyn Avenue NE**

This intersection scored a 90 out of 100 on the walkability audit. While this is a high score, particularly in relation to the scores of the other two intersections studied, there still existed a number of things that could be done in order to provide a more comfortable pedestrian environment. Because this is the intersection of an arterial and a non-vehicular trail, pedestrian safety and visibility is a priority.

Where the trail crosses Brooklyn Avenue mid-block, there is no signalization for automobiles; there is a stop sign on each side of the trail as it approaches the street so pedestrians and bicyclists know to stop for automobiles. The crosswalk is striped, but traffic can come through, at times, at relatively high speeds, so visibility is not good. There is very little pedestrian-scale lighting for safety and visibility at night, which is important as this trail is used heavily by commuters. In addition, few buildings exist at this intersection; there is a large parking lot at one corner of the intersection. This reduces the feeling of safety that comes with having “eyes on the street” (Jacobs 1961). However, there are plenty of trees along the street, and the trail is well-separated from the road, which both enhance the aesthetic experience.

The design solution proposes a few things to increase walkability in this area. The crosswalk is raised to serve as a traffic-calming device for automobiles and to increase pedestrian visibility, helping to avoid conflict between automobiles and pedestrians. It ramps up gently so cyclists traveling on Brooklyn Avenue can cross it easily. Pedestrian-scale lighting is proposed along all legs of the intersection to increase visibility at night. Benches are added along the trail near the intersection to make the walking environment more comfortable. In addition to the residential and university buildings that exist at the southwest corner, a building fronting the street is proposed on the northeast corner in
lieu of the existing parking lot in order to facilitate activity, creating a safer area for walking. See figures 5.2 through 5.5 on the following pages for illustration.
Figure 5.2 | Burke-Gilman Trail at Brooklyn Avenue NE, existing conditions.

Figure 5.3 | Burke-Gilman Trail at Brooklyn Avenue NE after applying design guidelines.
Figure 5.4 | Burke-Gilman Trail at Brooklyn Avenue NE, existing conditions.

Figure 5.5 | Burke-Gilman Trail at Brooklyn Avenue NE after applying design guidelines: elements added include a raised crosswalk for pedestrian safety, pedestrian-scale lighting for safety and visibility, and benches along the trail for pedestrian comfort.
NE 42nd Street at Brooklyn Avenue NE

This intersection scored a 63 out of 100 on the walkability audit; there are many areas for improvement in the pedestrian environment. There are no marked crossings for pedestrians, even though the streets are wide and this is a fairly busy intersection. The sidewalk is buckling in areas, which might make it difficult to use for someone in a wheelchair, and might make it unpleasant or unsafe for those on foot. There is also very little protection from the elements along the legs of this intersection. However, on the positive side, the buildings are not set back from the sidewalk, which helps to create a defined pedestrian zone along the street. The parking lanes help create a buffer between the sidewalk and the street. In addition, a variety of uses and activities are located within a block’s distance from this intersection.

The design solution proposes curb extensions into the existing parking lanes to decrease crosswalk length and increase pedestrian visibility. It also proposes marked crosswalks at each leg of the intersection. The sidewalk is currently sparsely populated with street trees; trees are added to fill in the gaps and to provide appropriate protection from the elements. See figures 5.6 through 5.9 on the following pages for illustration.
Figure 5.6 | NE 42nd Street at Brooklyn Avenue NE, existing conditions.

- Streets are wide for pedestrians to cross (2 parking lanes and 2 driving lanes across)
- Intersection has no marked crosswalks
- Sparse trees provide little protection from the elements

Figure 5.7 | NE 42nd Street at Brooklyn Avenue NE after applying design guidelines.

- Marked crosswalks help increase pedestrian visibility
- Curb extensions create a narrower street crossing without impeding the driving lanes
- Additional street trees provide protection from the elements and help define the street edge
Figure 5.8 | NE 42nd Street at Brooklyn Avenue NE, existing conditions.

Figure 5.9 | NE 42nd Street at Brooklyn Avenue NE after applying design guidelines: elements added include curb extensions and marked crosswalks for pedestrian safety and visibility.
NE 45th Street at Roosevelt Way NE

Both of these streets are busy, multilane arterials with a variety of land uses and activities located nearby. This intersection scored a 68 out of 100 on the walkability audit. The crosswalks are one area for improvement; while they are marked, the painted stripes are fading. Because the intersection is heavily traveled by fast-moving vehicular traffic, the existing markings are not effective in defining the crossings as a pedestrian zone. In addition, with the exception of the northwest corner of the intersection, all buildings are set back quite a bit from the road, with parking lots separating the buildings from the street, which defines the area as an automobile zone rather than a pedestrian zone.

The design solution proposes adding crosswalks of a different color or texture to delineate them as part of the pedestrian realm in this busy intersection, and to create a stronger pedestrian connection across the wide streets. A median replaces the center lane of traffic on NE 45th street to help slow traffic and to provide an area of pedestrian refuge in the crosswalks. Street trees are added in the median to further separate and calm the lanes of automobile traffic, and to add a pleasant aesthetic quality to the streets. Buildings are moved closer to the pedestrian walkway, and parking lots are moved to the back of the buildings in order to create a more human-oriented, rather than an automobile-oriented, experience along the sidewalks. See figures 5.10 through 5.13 on the following pages for illustration.
Figure 5.10 | NE 45th Street at Roosevelt Way NE, existing conditions.

Crosswalks are marked, but fail to properly define the pedestrian space because of fading paint and low visibility.

Parking lots between sidewalk and buildings create a dangerous and ambiguous pedestrian space.

Figure 5.11 | NE 45th Street at Roosevelt Way NE after applying design guidelines.

Marked crosswalks highlighted with color to increase pedestrian visibility.

Median with street trees to help slow traffic.

Retail/residential buildings abutting street to define pedestrian environment.

Parking moved to parking garage or back of building.
Figure 5.12 | NE 45th Street at Roosevelt Way NE, existing conditions.

Figure 5.13 | NE 45th Street at Roosevelt Way NE after applying design guidelines: elements added include a raised median with street trees and colored crosswalks for increased visibility.
CHAPTER 6 | CONCLUSIONS

The literature review revealed some significant connections between the built environment, walkability, and public health. The study in writing urban design guidelines for walkability and then applying them to an area of Seattle was a useful illustration of how simple environmental changes could potentially make a big difference in the ways we choose to travel, thereby affecting public health through the built environment.

Areas for Future Research

A study of pedestrian counts before and after implementing the urban design elements proposed in chapter 5 of this thesis would be useful for understanding to what extent the improvements enhance walkability. A user survey would help to further make clear what elements of the built environment make a difference in improving the walking environment.

This study was delimited to the University District of Seattle; moreover, the study was limited to application of urban design guidelines in areas that already meet the land use and street network qualifications for walkability. A more extensive study might look at the effects of changing land use and street network characteristics in a more suburban environment in order to create a more walkable community. It would also be useful to look at walkability in different areas as correlated with socioeconomic status, age, and other demographics to determine whether certain communities are walkability disadvantaged.

In addition, because this is a thesis in the field of urban design and planning, this study looked only at the built environment as a contributor to walkability and therefore to physical health. However, there are many other determinants of physical health, including diet, personal behaviors and genetics. These are worth studying separately, and
public health officials should collaborate with planners in order to determine the best ways to encourage healthier lifestyles toward the overall improvement of public health.

Finally, while many different tools exist for auditing walkability, none exists specifically for auditing intersections. This study used a tool that considered many of the pedestrian-scale urban design elements discussed in the design guidelines, but a few were missing. Development of a walkability audit tool tailored to the needs of pedestrians at intersections would ideally include a more specific examination of crosswalk conditions, including walk times and wait times at signalized crossings, which are critical to pedestrian safety at intersections.

**Relevance to the Field of Urban Design and Planning**

Planning for healthier cities is a concern for planners and public health officials alike. The literature revealed that the built environment plays a large role in our day-to-day decisions, particularly those affecting physical activity. Policy and design decisions affecting the built environment can have a significant impact on physical activity and public health in our communities. Built environment guidelines, such as the ones produced in this thesis, can shape a more walkable community in which people choose active transport rather than passive transport. With this in mind, and in the interest of planning for healthy cities, planners and policymakers can create walkable environments that encourage physical activity, and that over time contribute to a healthier population.
Bibliography


Appendix | Walkability Audits of Case Study Sites

Location: Burke-Gilman Trail at Brooklyn Avenue NE

A. Pedestrian Facilities (high importance): presence of a suitable walking surface, such as a sidewalk or path.
   1. No permanent facilities; pedestrians walk in roadway or on dirt path
   2
   3. Sidewalk on one side of road; minor discontinuities that present no real obstacle to passage
   4
   ✓ 5. Continuous sidewalk on both sides of road, or completely away from roads

B. Pedestrian Conflicts (high importance): potential for conflict with motor vehicle traffic due to driveway and loading dock crossings, speed and volume of traffic, large intersections, low pedestrian visibility.
   1. High conflict potential
   2
   ✓ 3
   4
   5. Low conflict potential

C. Crosswalks (high importance): presence and visibility of crosswalks on roads intersecting the segment. Traffic signals meet pedestrian needs with separate ‘walk’ lights that provide sufficient crossing time.
   1. Crosswalks not present despite major intersections
   2
   3
   4
   ✓ 5. No intersections, or crosswalks clearly marked

D. Maintenance (medium importance): cracking, buckling, overgrown vegetation, standing water, etc. on or near walking path. Does not include temporary deficiencies likely to soon be resolved (e.g. tall grass).
   1. Major or frequent problems
   2
   3
   4
   ✓ 5. No problems

E. Path size (medium importance): measure of useful path width, accounting for barriers to passage along roadway.
   1. No permanent facilities
   2. <3 feet wide, significant barriers
   3
   4
   ✓ 5. > 5 feet wide, barrier free
F. **Buffer** (medium importance): space separating path from adjacent roadway.
   1. No buffer from roadway.
   2.
   3.
   ✓ 4. >4 feet from roadway
   5. Not adjacent to roadway

G. **Universal Accessibility** (medium importance): ease of access for the mobility impaired. Look for ramps and handrails accompanying steps, curb cuts, etc.
   1. Completely impassable for wheelchairs, or no permanent facilities
   2. Difficult or dangerous for wheelchairs (e.g. no curb cuts)
   3.
   4. Wheelchair accessible route available but inconvenient
   ✓ 5. Designed to facilitate wheelchair access

H. **Aesthetics** (medium importance): includes proximity of construction zones, fences, buildings, noise pollution, quality of landscaping, and pedestrian-oriented features, such as benches and water fountains.
   1. Uninviting
   2.
   3.
   ✓ 4.
   5. Pleasant

I. **Shade** (low importance): amount of shade, accounting for different times of day.
   1. No shade
   2.
   3.
   4.
   ✓ 5. Full shade

Sum of high importance elements (A-C): $13 \times 3 = 39$
Sum of medium importance elements (D-H): $23 \times 2 = 46$
Sum of low importance elements (I): $5 \times 1 = 5$

**Total Score:** 90 / 100
Location: NE 42nd Street at Brooklyn Avenue NE

A. Pedestrian Facilities (high importance): presence of a suitable walking surface, such as a sidewalk or path.
   1. No permanent facilities; pedestrians walk in roadway or on dirt path
   2. Sidewalk on one side of road; minor discontinuities that present no real obstacle to passage
   4. ✓ 5. Continuous sidewalk on both sides of road, or completely away from roads

B. Pedestrian Conflicts (high importance): potential for conflict with motor vehicle traffic due to driveway and loading dock crossings, speed and volume of traffic, large intersections, low pedestrian visibility.
   1. High conflict potential
   2. ✓
   3. 4. 5. Low conflict potential

C. Crosswalks (high importance): presence and visibility of crosswalks on roads intersecting the segment. Traffic signals meet pedestrian needs with separate ‘walk’ lights that provide sufficient crossing time.
   ✓ 1. Crosswalks not present despite major intersections
   2. 3. 4. 5. No intersections, or crosswalks clearly marked

D. Maintenance (medium importance): cracking, buckling, overgrown vegetation, standing water, etc. on or near walking path. Does not include temporary deficiencies likely to soon be resolved (e.g. tall grass).
   ✓ 1. Major or frequent problems
   2. 3. 4. 5. No problems

E. Path size (medium importance): measure of useful path width, accounting for barriers to passage along roadway.
   ✓ 1. No permanent facilities
   2. <3 feet wide, significant barriers
   3. 4. 5. >5 feet wide, barrier free
F. **Buffer** (medium importance): space separating path from adjacent roadway.

- ✓ 1 No buffer from roadway.
- 2
- 3
- 4 >4 feet from roadway
- 5 Not adjacent to roadway

G. **Universal Accessibility** (medium importance): ease of access for the mobility impaired. Look for ramps and handrails accompanying steps, curb cuts, etc.

- 1 Completely impassable for wheelchairs, or no permanent facilities
- 2 Difficult or dangerous for wheelchairs (e.g. no curb cuts)
- 3
- ✓ 4 Wheelchair accessible route available but inconvenient
- 5 Designed to facilitate wheelchair access

H. **Aesthetics** (medium importance): includes proximity of construction zones, fences, buildings, noise pollution, quality of landscaping, and pedestrian-oriented features, such as benches and water fountains.

- 1 Uninviting
- 2
- ✓ 3
- 4
- 5 Pleasant

I. **Shade** (low importance): amount of shade, accounting for different times of day.

- 1 No shade
- ✓ 2
- 3
- 4
- 5 Full shade

Sum of high importance elements (A-C): \(9 \times 3 = 27\)
Sum of medium importance elements (D-H): \(17 \times 2 = 34\)
Sum of low importance elements (I): \(2 \times 1 = 2\)

**Total Score:** \(\frac{63}{100}\)
Location: NE 45th Street at Roosevelt Way NE

A. Pedestrian Facilities (high importance): presence of a suitable walking surface, such as a sidewalk or path.
1. No permanent facilities; pedestrians walk in roadway or on dirt path
2
3. Sidewalk on one side of road; minor discontinuities that present no real obstacle to passage
4
✔ 5. Continuous sidewalk on both sides of road, or completely away from roads

B. Pedestrian Conflicts (high importance): potential for conflict with motor vehicle traffic due to driveway and loading dock crossings, speed and volume of traffic, large intersections, low pedestrian visibility.
1. High conflict potential
2
✔ 3
4
5. Low conflict potential

C. Crosswalks (high importance): presence and visibility of crosswalks on roads intersecting the segment. Traffic signals meet pedestrian needs with separate ‘walk’ lights that provide sufficient crossing time.
✔ 1. Crosswalks not present despite major intersections
2
3
4
5. No intersections, or crosswalks clearly marked

D. Maintenance (medium importance): cracking, buckling, overgrown vegetation, standing water, etc. on or near walking path. Does not include temporary deficiencies likely to soon be resolved (e.g. tall grass).
1. Major or frequent problems
2
3
✔ 4
5. No problems

E. Path size (medium importance): measure of useful path width, accounting for barriers to passage along roadway.
1. No permanent facilities
2. <3 feet wide, significant barriers
3
4
✔ 5. > 5 feet wide, barrier free
F. **Buffer** (medium importance): space separating path from adjacent roadway.
   - ✓ 1 No buffer from roadway.
   - 2
   - 3
   - 4 >4 feet from roadway
   - 5 Not adjacent to roadway

G. **Universal Accessibility** (medium importance): ease of access for the mobility impaired. Look for ramps and handrails accompanying steps, curb cuts, etc.
   - 1 Completely impassable for wheelchairs, or no permanent facilities
   - 2 Difficult or dangerous for wheelchairs (e.g. no curb cuts)
   - 3
   - ✓ 4 Wheelchair accessible route available but inconvenient
   - 5 Designed to facilitate wheelchair access

H. **Aesthetics** (medium importance): includes proximity of construction zones, fences, buildings, noise pollution, quality of landscaping, and pedestrian-oriented features, such as benches and water fountains.
   - 1 Uninviting
   - 2
   - ✓ 3
   - 4
   - 5 Pleasant

I. **Shade** (low importance): amount of shade, accounting for different times of day.
   - ✓ 1 No shade
   - 2
   - 3
   - 4
   - 5 Full shade

Sum of high importance elements (A-C): \(11 \times 3 = 33\)
Sum of medium importance elements (D-H): \(17 \times 2 = 34\)
Sum of low importance elements (I): \(1 \times 1 = 1\)
**Total Score: 68 / 100**