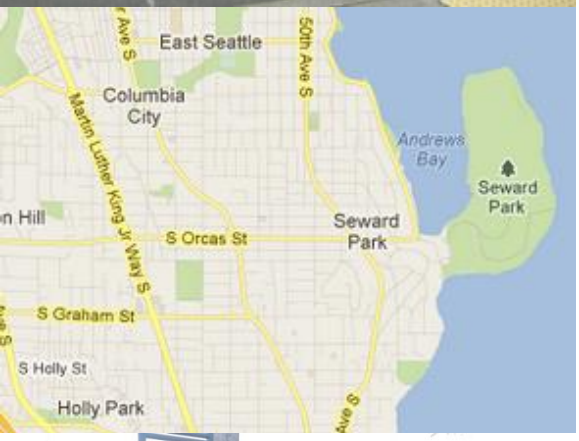

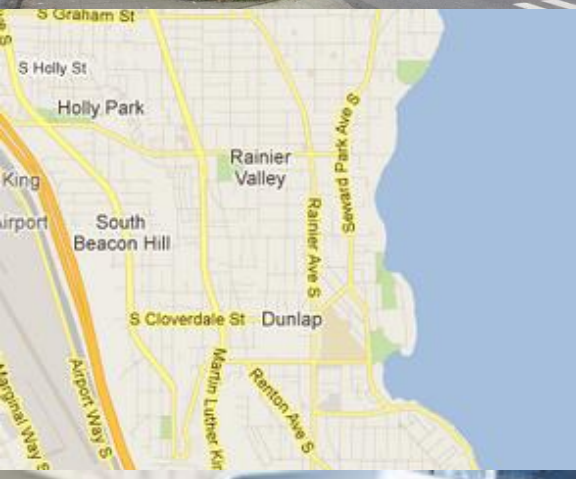

CROSSING RAINIER AVENUE:

TWO STUDIES EXPLORING THE PEDESTRIAN EXPERIENCE IN THE RAINIER VALLEY

March 12, 2013

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Acknowledgments

This report was prepared by a team of Community-Oriented Public Health Practice, Master in Public Health graduate students at the University of Washington. We respectfully acknowledge and appreciate participation from our devoted partners Cathy Tuttle (Seattle Neighborhood Greenways); Rob Mohn (Columbia City Business Association); Drew Redmond and Ross Tilghman (Rainier Valley Greenways); and Deb Salls (Bike Works). We received input from a range of community experts and offer special thanks to Brian Kemper and Greg Yee (Seattle Department of Transportation); Peter Koonce and Sirisha Kothuri (Portland State University); and Michelle Garrison and Peter House (University of Washington). This work would not have been possible without the perspectives of key informants and support from Columbia City and Rainier Beach community members.

Executive summary

Background

Transportation design and walkability are essential to the promotion of safe and healthy communities. One central feature to the walkability of a community is the time pedestrians have to safely cross the street. In February 2013, Seattle Neighborhood Greenways asked eight University of Washington Master in Public Health students to conduct a study on the barriers residents face crossing a busy arterial in Columbia City and Rainier Beach. Students conducted two studies to further understand pedestrian experiences:

1. **Signal timing:** The signal timing study was designed to test the hypothesis that traffic signals favor vehicles in the lower-income focus neighborhoods studied compared to the higher-income comparison neighborhood.
2. **Community perception:** The community perception study was designed to collect and analyze pedestrians' and key informants' perceptions of the barriers to crossing Rainier Avenue South in the Rainier Beach and Columbia City neighborhoods.

Signal timing

The team conducted observational assessments of intersections in one higher-income and two lower-income Seattle neighborhoods and compared factors related to traffic signal timing. Results indicate there is a significant difference between crossing time in the higher- and lower-income neighborhoods studied. The higher-income neighborhood had significantly longer crossing times, but there was no significant difference in pedestrian delay. The findings partially support the hypothesis that signal timing in the lower-income neighborhoods studied favor vehicles. However, a direct association between neighborhood median household income and signal timing cannot be made and results included in this report are not generalizable.

Community perception

The team also conducted a sample of resident intercept surveys with pedestrians and key informant interviews to identify barriers associated with crossing the street. Respondents supported the claim that signal timing is a barrier to crossing the street in the two lower-income focus neighborhoods, while identifying several additional barriers related to traffic considerations, personal safety, and the built environment.

Recommendations

By adopting a public health lens, we find that there are many strategies to address pedestrian safety. Seattle Neighborhood Greenways and community partners should address barriers to crossing the Rainier Avenue South in Columbia City and Rainier Beach and improve pedestrian safety through signal timing improvements; traffic infrastructure and enforcement; and community development. Collaboration with government and community partners is essential to facilitate positive and sustainable change in the Columbia City and Rainier Beach neighborhoods.

Background

Health and transportation

In 2012, Surgeon General Regina Benjamin announced the nation's first-ever National Prevention Council Action Plan, which strives to "move our health system from one based on sickness and disease to one based in wellness and prevention."[1] The plan specifically addresses transportation and encourages the development of walkable communities, bike lanes, and other healthy transit options.

> "Over the last ten years, people in the transportation sector have become more aware of the connections between health and transportation including physical activity, safety, air quality, equity, and access, but that collaboration is still in its early stages."[23]
>
> –Ed Christopher, Federal Highway Administration Resource Center Planning Team member

Public health emphasizes the value of incorporating transit in "healthy communities." Healthy communities provide residents with access to food and services; a sense of safety and community; physical activity; and clean air. Unfortunately, the transportation infrastructure in the United States still favors automobiles which creates fewer options for people to move around and interact with services and people in their environment.[2] Research indicates that a lack of alternative transportation options may have negative consequences related to physical activity, injury and prevention, air quality, and mental health status.[2]

Safety and crossing the street

The ability to safely cross the street requires sufficient time to get from one side of an intersection to the other. When traffic signals make pedestrians wait too long for a "Walk" signal, people may become discouraged from using the crosswalk or may cross against the light. Additionally, pedestrians may ignore the "Walk" and "Flashing Don't Walk" signals if they do not provide sufficient crossing time.[3] Long wait times and crossing distances, pedestrian direction of travel, number of pedestrians crossing, and the distance between crosswalks contribute to the pedestrian experience and affects non-compliance (e.g., jaywalking).[4,5]

> "[Seattle] started with…increasing bike and walking paths. In addition to increasing physical activity, you're also increasing safety, reducing injuries, increasing the social capital in the community, getting better connections between community residents and from an economic development standpoint, you're creating jobs and increasing property values, and therefore, improving one of the underlying social determinants of health." [24]
>
> –David Fleming, Director, Public Health-Seattle & King County

Multiple public health concerns are associated with crossing the street, starting with the most basic: pedestrian safety. According to aggregate King County data, there were 101 pedestrian fatalities and 625 pedestrian injuries from 2006 to 2010.[6] In September 2011, the Washington Traffic Safety Commission reported that pedestrian fatalities accounted for nearly 21% of all traffic fatalities in the county.[6] National data shows that almost three-fourths (73%) of pedestrian fatalities occurred in an urban setting and nearly 80% of pedestrian fatalities occurred at non-intersections—commonly the result of a vehicle colliding with a jaywalker.[1]

A recent study examining injury severity among pedestrian-motor vehicle collisions in King County found that the neighborhood environment and design was a significant factor in pedestrian safety.[7] Specifically, higher residential densities and lower median home values were associated with a higher risk of severe injury or death.

When pedestrians feel unsafe crossing the streets in their neighborhood they are less likely to walk. Improved access to neighborhood destinations has been shown to increase walking as a mode of transportation.[8] Safety contributes to a pedestrian's desire to cross the street, which is influenced by overall neighborhood walkability. Studies show that adults who live in high-walkability neighborhoods are less likely to be overweight or obese than those living in low-walkability neighborhoods.[9]

Localities domestically and abroad have examined pedestrian crossings and traffic calming measures to successfully address pedestrian safety, with an emphasis on children, older adults, and individuals living with disabilities.[10] See Appendix A for more detailed information on international and domestic case studies.

Signal timing standards

According to the Federal Highway Administration (FHWA), traffic signals with poor timing plans may make an intersection less efficient, less safe, or both. Traffic signals with a proper design and timing plan:[11]

- Provide for the orderly and efficient movement of people.
- Effectively maximize the volume movements at the intersection.
- Reduce the frequency and severity of certain types of crashes.
- Provide appropriate levels of accessibility for pedestrians and side street traffic.

Ideally, signal timing plans move people through an intersection safely, while also considering fluctuations in traffic throughout the day, week, and year.[11] The Seattle Pedestrian Master Plan aims to improve crossing conditions by evaluating "current signal timing practices and revise, as needed, to balance the pedestrian crossing delay and demand with full intersection functionality" and "adopt and install signal technologies and systems that reduce barriers to walking as well as conflicts between pedestrians and motorists."[12]

The development of timing plans is dependent on traffic conditions and the FHWA outlines the following steps to determine timing plans according to time of day:[11]

1. Select a sample of intersections and perform hourly counts.
2. Prepare a graph that plots the traffic volume as a function of time of day for the two or three most important intersections in the sample.
3. Using the graph, identify the morning, evening, and off-peak time periods for the sample.

Design, operations, and maintenance are important factors of a signal-timing plan. Traffic engineers must reassess the plan periodically to maintain intersection safety and efficiency.[11] Individual signal timing changes affect the broader traffic signaling

system.[11] The FHWA promotes strategies to avoid unnecessary vehicle stops and delays by having longer green cycle lengths and ensuring appropriate pedestrian signal timing.[11,13]

Rationale

Rainier Avenue South (referred to as "Rainier") is a major freight-carrying arterial in south Seattle, Washington that bisects the Columbia City and Rainier Beach neighborhoods. There is a mix of small businesses, restaurants, health care providers, and residences along the Rainier corridor. Rainier divides dense residential areas from major public transit access points, forcing pedestrians to frequently cross busy intersections. Rainer also functions as a major thoroughfare connecting residents of South King County to downtown Seattle and major freeways. Due to this unique combination of vibrant neighborhood activity and the fast-paced nature of Rainier as a commuter route, pedestrians in these two neighborhoods have repeatedly expressed difficulty crossing the street.

In February 2013, Seattle Neighborhood Greenways asked eight University of Washington Master in Public Health students to conduct a study on the barriers residents face crossing a busy arterial road in Columbia City and Rainier Beach. The overarching research question that informed our study design was, "What are the barriers associated with pedestrians crossing the street in Columbia City and Rainier Beach?" Students conducted two studies to further understand pedestrian experiences:

1. **Signal timing:** The signal timing study was designed to test the hypothesis that traffic signals favor vehicles in the lower-income neighborhoods compared to the higher-income comparison neighborhood.
2. **Community perception:** This study was designed to collect and analyze pedestrians' and key informants' perceptions of the barriers to crossing Rainier in the Rainier Beach and Columbia City neighborhoods.

Study methodology, results, and discussion are presented separately by study.

Signal timing study

Overview

The signal timing study was designed to test the hypothesis that traffic signals favor vehicles in lower-income neighborhoods compared to higher-income neighborhoods. To determine whether there is a statistically significant difference in traffic signal timing by neighborhood, the study team examined the length of time pedestrians had to wait at select intersections before receiving the "Walk" signal and how much time they had to cross the street. A data collection plan was designed to achieve the following objectives:

1. Observe pedestrian volume and experiences at intersections in three different neighborhoods.
2. Collect pedestrian delay data in 30-minute increments.
3. Observe the number of jaywalking incidents in 30-minute increments.

Subjects

The study partners recommended the focus neighborhoods of Rainier Beach and Columbia City, and Ballard as a comparison neighborhood. Brian Kemper with the Seattle Department of Transportation (SDOT) confirmed that NW Market Street (referred to as "Market") in Ballard is an appropriate comparison from a traffic signal and traffic volume perspective to the focus neighborhoods. Six specific intersections were selected based on location in the neighborhood, proximity to businesses, and accessibility to transit (i.e., Light Rail, bus, or freeway):

Type	Neighborhood	Intersection A	Intersection B
Focus	Columbia City	Alaska & Rainier	Edmunds & Rainier
Focus	Rainier Beach	Henderson & Rainier	51st & Rainier
Comparison	Ballard	24th & Market	22nd & Market

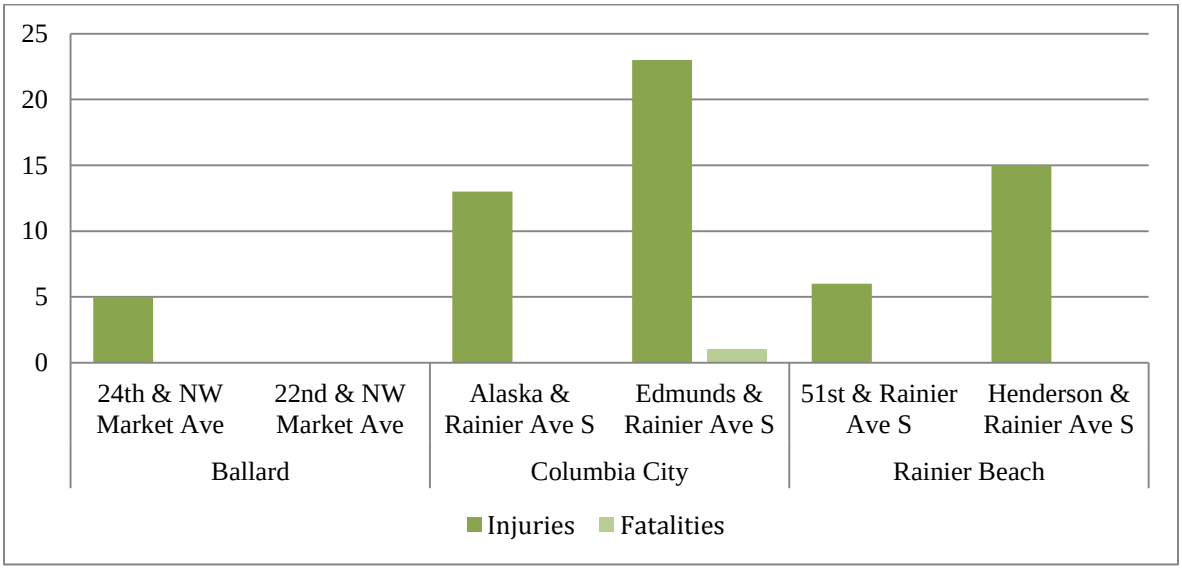
Table 1 illustrates how the demographics of the focus neighborhoods vary significantly from the comparison neighborhood, specifically in the categories of race and median household income.

Table 1. Key demographic data for Columbia City, Rainier Beach, and Ballard[14–16]

Characteristic	Columbia City	Rainier Beach	Ballard
Total population	16,883	14,567	6,739
Median age total	37.8	37.0	33.4
Population 65 and over	12%	11%	10%
Race			
White	33%	26%	85%
Non-white	67%	74%	15%
Annual daily traffic volume	26,200	22,000	23,800
Median household income	$47,500 ± $12,326	$45,956 ± $8,214	$72,443 ± $5,260

One way to measure pedestrian safety is by the number of injuries and fatalities. SDOT compiles intersection-specific pedestrian data starting in 2003. Of the three study sites, pedestrian injuries and fatalities in study intersections are highest in Columbia City, followed closely by Rainier Beach (Figure 1).

Figure 1. Pedestrian injury and fatality at study intersections, 2003-2013[17]



Procedure

Observers were positioned at pre-determined corners of study intersections. If a push button was present, observers recorded the time the first pedestrian arriving at the intersection activated the push button during a cycle (see Figure 2 for key definitions). If there was no push button, the observer recorded the time the first pedestrian approached the intersection during a cycle. Data were collected for the following variables during each 30-minute increment:

- Time of actuation (i.e., when the push button was activated or when the first pedestrian approached the intersection).
- Time when the Walk signal was granted.
- Amount of Walk time.
- Amount of Flashing Don't Walk time.
- Pedestrian volume on the crosswalk observed.
- The total number of pedestrians that jaywalked or crossed during a Don't Walk signal.

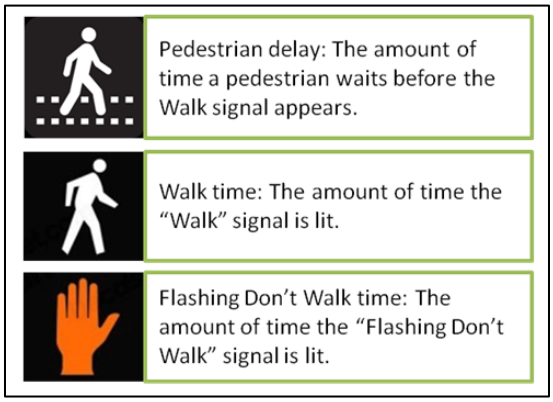


Figure 2. Key definitions for signal timing study

See Appendix B for the data collection tool.

Analysis

Data were cleaned and exported to SPSS (version 18) for coding and analysis. Descriptive statistics and frequencies were conducted on key variables. We then ran analysis of variance statistics to determine whether there were statistically significant differences by intersection and by neighborhood. Focus areas for the analysis included the mean ratio of crosswalk distance to total cross time; pedestrian delay and volume; and Walk and Flashing Don't Walk time. A linear regression was performed to determine whether the study intersections were statistically significantly different.

Results

Traffic signal observations were recorded for a total of 21.5 hours over the course of three days at different time periods (morning, afternoon, and evening). All of the study intersections are statistically different. The most notable comparisons between intersections exist in the mean crosswalk distance to total time to cross ratio; mean jaywalkers; mean pedestrian volume; and mean pedestrian delay (Table 2).

Rainier Beach observations:

- A number of cars sped down 51st and made a right on red onto Rainier without stopping.
- Car ran a red through crosswalk.
- On long waits, pedestrians hit the button repeatedly/seemed visibly impatient.

Ballard has the smallest mean crosswalk distance to total time to cross (Walk + Flashing Don't Walk time) ratio, followed by Columbia City, and then Rainier Beach with the largest value. This finding suggests that the pace at which a pedestrian must walk, on average, to successfully cross the crosswalks observed in Ballard is slower than for pedestrians crossing in the two focus neighborhoods. Additionally, the total crosswalk length or width of the arterial was longest at the four study intersections crossing Rainier.

Columbia City observation:

A mother with a toddler and a baby in a stroller was cut off by cars driving in front of her as she was trying to cross the crosswalk. This caused her to not cross during first walk signal and instead waited for the next signal.

Rainier Beach had the highest amount of jaywalking during the data collection period. Ballard had higher pedestrian volume than the two focus neighborhoods in Rainier Valley. While the mean pedestrian delay time varies by intersection and neighborhood, this variation was not statistically significant (see Figures 3 and 4). Nearly 75% of all pedestrian delays across the study sites were more than 30 seconds.

In terms of Walk and Flashing Don't Walk times, the analysis found no statistically significant variation in these times between intersections. There is a statistically significant difference between crossing time (Walk + Flashing Don't Walk) by neighborhood; Ballard had the highest amount of total crossing time. Walk time observation data was cross-checked with SDOT signal timing cards. The Walk times provided by SDOT for the study intersections were similar to the Walk times observed during the study period.

Table 2. Descriptive characteristics of study intersections

	Ballard		Columbia City		Rainier Beach		Total	Statistical significance p=< 0.05
	24th & Market	22nd & Market*	Alaska & Rainier	Edmunds & Rainier	Henderson & Rainier	51st & Rainier		
Crosswalk distance (ft)	47.9	52.3	78.6	57.6	57.1	66.0	N/A	N/A
Mean crosswalk distance / total cross time[a] (ft/s)	2.8	2.0	3.9	3.1	3.4	3.6	3.1	N/A
Frequency of observations	61	108	46	92	72	26	402	N/A
Pedestrian delay[b] (s) Mean > 30 > 60	42.6 ± 31.3 58.3% 35.0%	53.3 ± 22.8 85.0% 44.9%	55.4 ± 41.6 71.7% 43.5%	48.3 ± 36.0 75.9% 24.1%	51.1 ± 27.8 76.4% 34.7%	45.6 ± 33.4 61.5% 38.5%	49.9 ± 31.4 74.4% 36.5%	0.242
Mean pedestrian volume	2.6 ± 2.0	5.7 ± 4.1	1.8 ± 1.5	2.6 ± 1.8	2.8 ± 2.0	1.0 ± 0.9	3.3 ± 3.0	N/A
Mean jaywalkers	2.4	6.3	2.2	2.4	8.0	6.1	4.6	N/A
Walk time (s) Mean MIN MAX	7.0 ± 1.0 2 9	16.2 ± 5.4 6 26	7.4 ± 2.0 5 10	9.8 ± 1.4 6 20	6.9 ± 1.0 4 17	7.7 ± 2.7 5 20	10.3 ± 5.8 2 26	< .001
Flashing Don't Walk time (s) Mean MIN MAX	10.1 ± 0.3 10 11	10.3 ± 0.6 9 13	13.2 ± 1.4 9 14	9.1 ± 0.9 7 14	10.0 ± 0.5 8 11	10.7 ± 1.6 9 17	10.3 ± 1.4 7 17	< .001
Total crossing time[a] **(s)** MIN MAX	12 20	15 39	14 24	13 34	12 28	14 37	9 43	N/A
Total crossing time by neighborhood (s) Mean MIN MAX	23.0 13 36		17.4 14 30		19.5 16 31		20.5 13 36	< .001

Note: The intersection of 22nd & Market in Ballard is the only 5-way intersection observed (all others are 4-way intersections). In addition, one of the observation days (February 17, 2013) coincided with the Ballard Sunday Farmer's Market, which contributes to the higher than average pedestrian volumes.

[a] Total cross time = Walk + Flashing Don't Walk

[b] n=394

Figure 3. Pedestrian delay by neighborhood

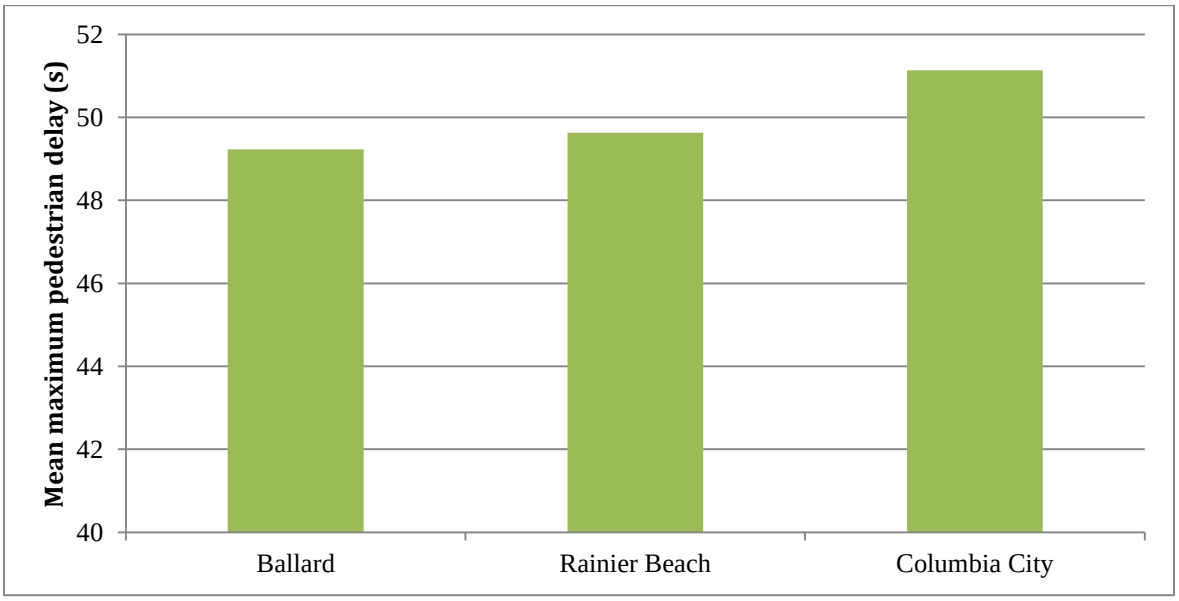
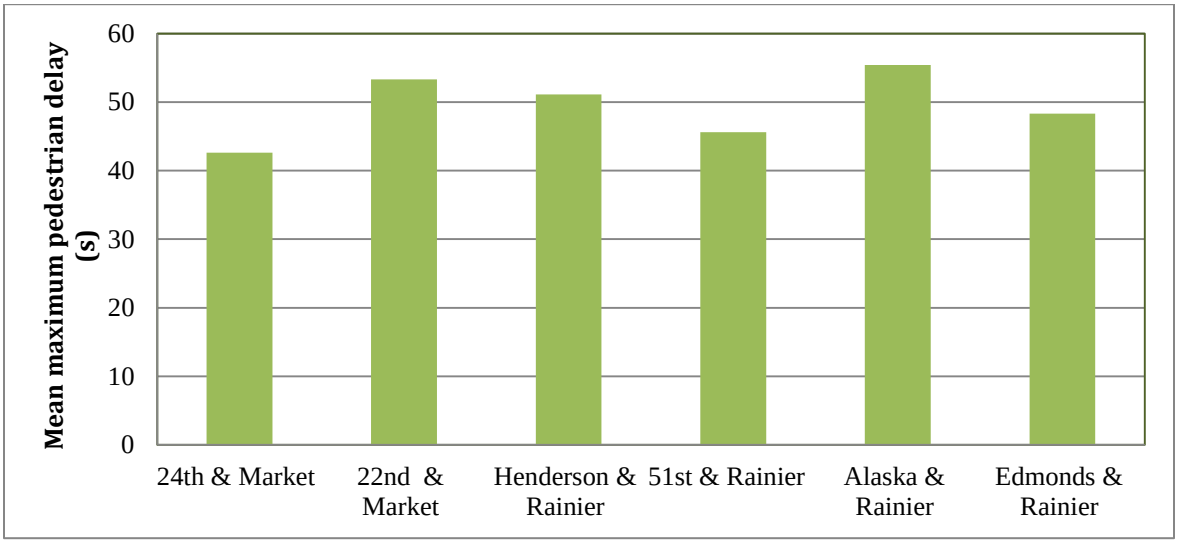


Figure 4. Pedestrian delay by intersection



Discussion

In 2010, the Manual on Uniform Traffic Control Devices (MUTCD) revised federal standards on the crossing time calculation to 3.5 ft/sec. According to Brian Kemper, Signal Timing Manager at SDOT, this standard was adopted by Washington State in 2011 and SDOT began enforcing this recommendation by adjusting signal timing at intersections on a case-by-case basis (personal communication, February 13, 2013). Kemper acknowledged that not all of the intersections have been updated to comply with the recent MUTCD recommendations. The study findings suggest that signal timing at Alaska & Rainier and 51st & Rainier has not been adjusted since the MUTCD 2010 revision. Signal timing at the Henderson and Rainier intersection appears to meet the new standard, but just barely.

Pedestrian delay, or the amount of time a pedestrian must wait before receiving the Walk signal, is a predictor of pedestrian safety. Studies have shown that pedestrian delays longer than 30 seconds significantly contribute to pedestrian non-compliance and lead to jaywalking.[18] Jaywalking is of particular interest to public health because communities designed for cars and not pedestrians are susceptible to oversight regarding the needs of pedestrians, which may encourage jaywalking. Pedestrians who fail to properly utilize designated crossings are at higher risk for injury and death.[19]

There were statistically significant differences in pedestrians having more walking time in the higher-income comparison neighborhood, Ballard, compared to the lower-income neighborhoods of Columbia City and Rainier Beach. This suggests that traffic signals in the lower-income neighborhoods studied favor vehicles more than in the higher-income comparison neighborhood. These results are not generalizable to other neighborhoods or other intersections as they were not randomly selected and could vary greatly from other neighborhoods in Seattle.

Community perception study

Overview

The study team created a mixed-method, in-person interview survey tool to understand pedestrians' and key informants' perceptions of crossing Rainier. The tool was designed to determine whether signal timing is a community concern. Interview surveys were multi-phase: Phase 1 had four quantitative questions and allowed respondents to elaborate with qualitative responses; and Phase 2 had two follow-up qualitative questions. The survey topics included:

- Participant perceptions.
- Perceived barriers to crossing Rainier.
- Unintended consequences of changing signal timing.
- Demographic information including age, gender, and home neighborhood.

Subjects

The study team approached pedestrians on or near Rainier and intentionally sampled the following subpopulations: older adults, high school students, parents, and individuals

using a clearly visible mobility assistant (i.e., wheelchair, cane, walker, crutches, service animal, etc.). Surveys were conducted during various times of day and on multiple days of the week. Key informant interviews were conducted via phone, e-mail, or in-person.

Procedure

Pedestrian surveys

The researcher approached pedestrians and introduced him/herself as a graduate student working with SNG on a project involving pedestrian safety. The researcher asked if the pedestrian would answer questions about the neighborhood. The researcher verbally administered the survey to pedestrians who said "yes" and recorded their answers. Personally identifying information (i.e., name, address, etc.) or medical information was not collected. Open-ended questions provided opportunities for participants to share stories about experiences crossing Rainier. Non-response rates were recorded to track participation refusal.

Key informant surveys

Study partners recommended that the study team speak with specific key informants such as local business owners and community leaders. One-on-one appointments with these individuals were scheduled and interviews were conducted in an open-ended manner, loosely following the pedestrian survey tool. See Appendix C for the data collection tool.

Analysis

Survey questions that produced quantitative answers were imported into SPSS (version 18). Analyses were run to determine the frequency and statistical significance for each question. Qualitative responses were imported into an Excel document. The study team created a codebook to categorize emerging themes and used this to code qualitative responses.

Results

The study team approached pedestrians (n=160) on or near Rainier in the two study neighborhoods. Pedestrians were not surveyed in Ballard. Many pedestrians (n=101) agreed to voluntarily complete a one-time survey in Columbia City (n=56) or Rainier Beach (n=45). The response rate for survey participation was 63%. Twelve key informant (KI) interviews were conducted.

Demographics

Table 3 illustrates the significant difference in the age of survey respondents depending on the neighborhood where they were questioned. More than 50% of Columbia City respondents were between the ages of 20 and 39; whereas only 23% of Rainier Beach respondents fit this age range. The majority of survey respondents lived in the neighborhood in which the survey was administered; 54% of Columbia City survey respondents lived in Columbia City and 60% of Rainier Beach respondents lived in Rainier Beach.

Table 3. Survey responses and participant demographics by survey neighborhood

Variable	Columbia City n=56	Rainier Beach n=45	Total n=101	Statistical significance p=< 0.05
Age (%)				
<19	5 (9)	8 (18)	13 (13)	
20-29	14 (26)	8 (18)	22 (22)	
30-39	16 (29)	2 (5)	18 (18)	
40-49	5 (9)	5 (11)	10 (10)	.025*
50-59	6 (11)	5 (11)	11 (11)	
60-69	6 (11)	12 (27)	18 (18)	
>70	3 (6)	4 (9)	7 (7)	
Missing	1 (2)	1 (2)	2 (2)	
Gender (%)				
Female	29 (52)	21 (47)	50 (50)	.609*
Visible Mobility Assistance (%)				
Yes	2 (4)	5 (11)	7 (7)	.138*
Neighborhood lives in (%)				
Columbia City	28 (54)	0 (0)	28 (28)	
Rainier Beach	2 (4)	25 (60)	27 (29)	
Seward Park	4 (8)	2 (5)	6 (6)	.000 *
Skyway	0 (0)	8 (19)	8 (9)	
Other neighborhoods in Seattle	16 (31)	5 (12)	21 (22)	
Other neighborhoods outside of Seattle	2 (4)	2 (5)	4 (4)	
Missing	4 (7)	3 (7)	7 (7)	
Primary mode of transportation (%)				
Walk	32 (57)	14 (31)	46 (46)	.017*
Bike	0 (0)	2 (4)	2 (2)	
Car	9 (16)	6 (13)	15 (15)	
Transit	15 (27)	23 (51)	38 (38)	
Safety rating				
Mean (SD)	3.7 (1.2)	3.2 (1.0)	3.5 (1.2)	.044**
Median	4	3	3	
Reasons feel unsafe crossing Rainier (%)				
Traffic	9 (16)	5 (11)	14 (14)	.473*
Car speed	12 (21)	18 (40)	30 (30)	0.042*
Personal safety	2 (4)	9 (20)	11 (11)	0.008*
Signal timing	12 (21)	9 (20)	21 (21)	0.860*
Sidewalk	1 (2)	1 (2)	2 (2)	0.876*
Crosswalk	5 (9)	1 (2)	6 (6)	0.156*
Buses	0 (0)	1 (2)	1 (1)	0.262*
Nothing	12 (21)	8 (18)	20 (20)	0.647*
Other	13 (23)	6 (13)	19 (19)	0.207*
Enough time to cross Rainier (%)				
Yes	36 (64)	24 (53)	60 (59)	
No	14 (25)	18 (40)	32 (32)	.075*
Sometimes	1 (2)	2 (4)	3 (3)	
I don't know	5 (9)	0 (0)	5 (5)	
Missing	0 (0)	1 (2)	1 (1)	

***Chi-square*

***Analysis of variance*

Primary mode of transportation

Respondents in Columbia City and Rainier Beach reported statistically significant differences both in their primary mode of transportation and in the factors that make them feel unsafe when they cross Rainier. Respondents from Columbia City listed walking (57%) as their primary mode of transportation and 27% noted transit as their primary mode. In Rainier Beach, however, the majority of respondents (51%) listed transit as their primary mode of transportation and 31% noted walking as their primary mode.

Perception of personal safety when crossing Rainier

On a five-point scale in which 1 represented "very unsafe" and 5 represented "safe," Columbia City respondents reported feeling significantly safer (mean=3.7) than respondents in Rainier Beach (mean=3.2) when crossing Rainier. This difference in safety rating is more pronounced when comparing the mean safety rating of Columbia City survey respondents who are residents of Columbia City (3.9) to the mean safety rating of Rainier Beach survey respondents who reside in Rainier Beach (3.2).

> "You know what I hate? When you're crossing in front of a car, a lot of times they'll speed up like they're trying to kill you or something."
>
> –Rainier Beach Resident

Feelings of safety also vary based on survey respondent age. Respondents aged 60 and older feel safer than respondents 19 and younger. When asked what specific factors make them feel unsafe when crossing Rainier, the majority of Rainier Beach respondents under 19 stated "personal safety" while no respondents over 60 years of age list this as their main concern. Rainier Beach respondents over 60 years of age feel much safer than respondents younger than 19, but their median safety score (3) is the same as that of Columbia City respondents younger than 19.

When respondents elaborated on what contributed to their level of safety, many said it depended on location. "Location" was defined to include respondents feeling more or less safe on or in certain corners, crosswalks, and neighborhoods. Eleven respondents reported that location affects their level of safety. Four respondents mentioned that time of day influenced their safety, particularly in Rainier Beach, where pedestrians mentioned increased crime at night. Five respondents mentioned that perceived safety was dependent on their familiarity with the area.

Factors that affect personal safety when crossing Rainier

As Table 4 illustrates, respondents in Columbia City were significantly more likely to report that nothing made them feel unsafe (18%) when crossing Rainier compared to respondents in Rainier Beach (8%). Although respondents from both neighborhoods noted speed as a concern (21% in Columbia City; 40% in Rainier Beach), there was a statistically significant difference in the number of respondents in Columbia City concerned with traffic (14%) on Rainier compared to no respondents in Rainier Beach.

> "Speeding is equally hurtful in affecting the walkability of crossing Rainier."
>
> –Columbia City Business Owner

As predicted, signal timing was a concern for a quarter of respondents in both neighborhoods (25% in Columbia City; 28% in Rainier Beach). However, while 43% of Rainier Beach walkers cited signal timing as the main reason they feel unsafe crossing, only 8% of transit users and none of the car users cited signal timing as a concern.

Similar numbers of respondents listed "other" reasons for feeling unsafe while crossing Rainier on foot (21.4% in Columbia City; 20% in Rainier Beach). Among the 83 pedestrians and 12 KIs who provided qualitative answers, "other" factors contributing to feeling unsafe included:

- Drivers not respecting traffic lights.
- Distracted and malicious drivers.
- Turning cars.

As is mentioned above, space was provided on the surveys for respondents to elaborate on their experiences crossing Rainier. Many of these in-depth responses simply elaborated on barriers already captured in the first portion of the survey. Specifically, the most common response from pedestrians and key informants regarding their experiences crossing the street in the two focus neighborhoods involved near-miss collisions with cars (n=12); admission of or witnessing jaywalking (n=11); and actual collisions with cars (n=5). Many of the near-miss collisions involved pedestrians running out of time when crossing, turning cars failing to see or yield to pedestrians, or cars running through signals.

Table 4. Perspectives on crossing Rainier per residents who live in respective survey neighborhoods

	Columbia City n=28	Rainier Beach n=25
Enough time to cross Rainier (%)		
Yes	16 (57)	14 (56)
No	11 (40)	11 (44)
Sometimes	0 (0)	0 (0)
I don't know	1 (4)	0 (0)
Reasons feel unsafe crossing Rainier (%)*		
Traffic	4 (14.3)	0 (0)
Speed	6 (21.4)	10 (40)
Personal safety	1 (3.6)	3 (12)
Signal timing	7 (25)	7 (28)
Sidewalk	0 (0)	1 (4)
Crosswalk	1 (3.6)	1 (4)
Buses	0 (0)	1 (4)
Nothing	5 (17.9)	2 (8)
Other	6 (21.4)	5 (20)

**Note: Respondents were allowed to report multiple factors.*

The study team defined "drivers not respecting traffic lights" to include cars running red lights, rushing through yellows, and "jumping" greens. A number of respondents (n=23) cited these concerns. In addition, the team defined "distracted and malicious drivers" as drivers using cellphones to talk or text, not looking for pedestrians, and aiming for pedestrians in the street. Many respondents (n=19) felt that dangerous driving compromised their safety. The term "turning cars" included drivers failing to yield to pedestrians when turning; drivers making unsafe right turns at red lights; and cars blocking crosswalks while preparing to turn. Turning cars negatively influenced pedestrian perception of safety (n=19). Qualitative data results are compiled in Table 5.

Table 5. Qualitative survey responses (N=83 residents and 12 KIs)

Statement	Total	Columbia City	Rainier Beach	KI	Example quote
Level of safety					
Safety dependent on location	**11**	4	5	2	"This area is okay but a few blocks down is not the same."
Safety dependent on familiarity of neighborhood	**5**	1	2	2	"Over time I've come to feel safer in the area because I know more people."
Safety dependent on time of day	**4**	1	3	0	"It's dangerous walking around here, especially at night."
Factors affecting perceived safety					
Drivers do not respect traffic lights	**23**	9	8	6	"I see a car run a red light on Rainier every day. That's a huge problem."
Distracted/malicious drivers	**18**	12	5	1	"Drivers don't yield for pedestrians. They are too busy texting, even when it's crazy."
Turning cars	**18**	8	4	6	"People turning right don't see pedestrians. That's when I feel like I might get hit."
Distance between crosswalks/number of crosswalks	**8**	4	1	3	"Because there are not a lot of crosswalks, people jaywalk."
Near misses	**12**	4	4	4	"One day when I was crossing, right here, I almost got hit. A guy almost ran me over. I was in the crosswalk and I had the light, but this guy turning was going too fast and I had to jump back on the curb or he would have hit me."
Collisions	**5**	1	1	3	"I'm wary on Rainier in general. It's like a loaded gun. I've seen two hit and runs in two weeks."

Statement	Total	Columbia City	Rainier Beach	KI	Example quote
Jaywalking	**11**	6	1	4	"Because of the wait time to cross, I see a lot of jaywalkers. I jaywalk myself sometimes. If it's 6 am and I'm waiting to cross Rainier and there are no cars, I'll jaywalk."
Signal timing					
Concerned about other pedestrians having enough time to cross	**13**	5	3	5	"For me, usually there is enough time, but probably not for elderly people or little kids. It may need to be a little longer."
Consequences of increasing crossing time					
No concerns	**9**	2	4	3	"It could be longer. A couple more seconds to get across wouldn't hurt anyone."
Traffic concerns	**10**	1	3	6	"There is so much traffic volume north and south, the drivers would probably be upset."

Signal timing concerns

When asked whether they had enough time to cross at the signal, the majority of survey respondents in both focus neighborhoods (64% in Columbia City; 53% in Rainier Beach) reported they had enough time, but expressed concerns for other pedestrians in the community. A number of respondents (n=13) were concerned that older pedestrians, children, or those with limited mobility might not have enough time to cross the street.

> "The timing is all messed up. They should try and walk across with a walker. I'd like to see those engineers get across in time!"
>
> – Rainier Beach Resident

Unintended consequences of increasing signal timing

Some respondents (n=9) did not express concerns about lengthening the crossing time, while other respondents (n=10) noted traffic consequences including:

- Pollution from cars idling longer.
- Cars diverting to non-arterial streets.
- Increased incentive to run lights.
- Angering drivers.
- Adding more congestion.

See Appendix D for a list of ideas and recommendations, generated by community input, to improve pedestrian safety.

Discussion

The hypothesis that signal timing is a community concern was partially supported by the results. Overall, respondents noted signal timing was a factor affecting personal safety when crossing Rainier; however, it was not the most reported factor. Signal timing was one of the top three concerns, behind "car speed" and "nothing." At the neighborhood level, Columbia City respondents reported signal timing as a concern more often than Rainier Beach respondents. The neighborhoods have distinct views and before a solution is put forward, it should be tailored to address the specific needs and concerns of each community.

Additionally, respondents provided personal opinions regarding signal timing. Some described air pollution or making drivers angry as unintended consequences of changing the signal timing to favor pedestrians. This suggests a need for further input from additional perspectives, such as environmental health and drivers, to fully understand the advantages and disadvantages of changing signal timing.

By including opportunities for respondents to provide qualitative responses, other issues not initially considered by the study team surfaced as pedestrian safety concerns. Examples include drivers not respecting traffic signals or turning right when the pedestrian Walk signal was lit. Respondents also provided personal recommendations that would improve their community, highlighting the importance of seeking community input when attempting to address a problem (see Appendix D).

Strengths

- **Data collection at different times of the day:** To observe variability in pedestrian demand and traffic volume, signal timing and survey data were collected at different times of day and during different days of the week.
- **Large sample size:** The amount of data collected for signal timing (N=402) and pedestrian surveys (N=101) was substantial for the week-long period allowed for data collection.

Limitations

- **Lack of push button in comparison neighborhood:** The comparison neighborhood and intersections were matched for traffic volume, arterial type, and proximity to local businesses and restaurants. The intersections in the comparison neighborhood did not have a push button. The study team was still able to calculate pedestrian demand and observe pedestrian experiences at intersections, but the methodology for collecting pedestrian demand at comparison intersections differed slightly than that for the focus neighborhoods.
- **Collection of signal timing data on one side of the street:** Observers were responsible for collecting data on a specified side of the intersection and did not include observations from the other side. However, during the pilot-testing phase, a small number of observations were made on the opposing side of the study site intersection. The study team decided these observations were still valid and included them in the final analysis.

- **Varying characteristics of intersections:** While 22nd & Market in Ballard is comparable to the other intersections for many reasons, it is the only five-way intersection observed, while the others are four-way intersections. In addition, on one of the days observed in Ballard there was a Sunday Farmer's Market close to the intersections observed, which resulted in higher than average pedestrian volumes for this day.
- **Exclusion of non-English speakers:** Excluding non-English speakers limits the degree to which the sample population is representative of the population in these areas.

Recommendations

To address the barriers and safety issues faced while crossing Rainier in Rainier Beach and Columbia City, the study team created recommendations organized into the following categories:

1. Signal timing.
2. Traffic infrastructure and enforcement.
3. Community development.

Each category contains short-, medium-, and long-term recommendations, representing varying levels of feasibility. The study team urges our partners to share these recommendations with the community to gain input from residents. See Appendix E for a one-page snapshot of these recommendations organized by feasibility and timeframe.

1. Signal timing improvements

1.1 Increase total crossing time

The study team recommends SNG urge SDOT to increase total crossing time for pedestrians crossing Rainier in the Rainier Beach and Columbia City neighborhoods. This recommendation is supported by communications with SDOT and the signal timing study results. Specifically, the study team recommends the intersections of Alaska & Rainier and Henderson & Rainier be an immediate focus as crossing times fail to meet the State's standard of 3.5ft/sec.

While other intersections studied in Rainier Beach and Columbia City did meet the State's standard, they did so within only a small margin and were significantly shorter than the timing in Ballard (2.0 and 2.8 ft/sec. respectively). Due to similar traffic conditions in the two focus and one comparison areas, we urge SNG to recommend crossing times along Rainier be comparable to the levels along Market at the intersections studied.

1.2 Reduce wait times for pedestrians

The study team recommends SNG urge SDOT to shorten wait times for pedestrians attempting to cross Rainier in Columbia City and Rainier Beach. Signal observations from the signal timing study indicate that pedestrian delays at all intersections in Columbia City and Rainier Beach exceed 30 seconds for a majority of crossings, and over 60 seconds for a quarter to nearly a half of crossings.

1.3 Implement early-release signal timing

Early-release signal timing is a traffic signalization strategy that assigns pedestrians a three to five second gap between the end of the Flashing Don't Walk signal and the activation of the green light for opposing traffic. This gap provides pedestrians with additional time to cross and increases the likelihood that vulnerable pedestrians can safely cross prior to the acceleration of opposing traffic.

1.4 Implement exclusive traffic signal phasing

Exclusive traffic signal phasing stops all vehicle traffic for part or the entire pedestrian crossing signal and is sometimes referred to as "scrambling." This evidence-based intervention has been shown to improve pedestrian safety and should be considered by SDOT as a strategy to improve pedestrian safety in Rainier Beach and Columbia City.

2. Traffic infrastructure and enforcement

2.1 Install speed- and crosswalk-related signage

The study team recommends increased speed limit signage along Rainier, specifically in Columbia City and Rainier Beach. Several survey respondents voiced concern about the perceived lack of speed limit signage, and observed drivers routinely speeding by 10 to 20 miles per hour.

In addition to increased speed limit signage, the study team recommends adding highly visible pedestrian crossing signs that flash during high traffic volume times and alert drivers of potential pedestrians. These signs may be posted at the start of high foot traffic areas such as the Columbia City business district and/or near busy intersections with a high density of school-aged children, such as Henderson & Rainier in Rainier Beach.

2.2 Install red light cameras

The study team recommends SNG urge SDOT to address the identified issue of red light runners by installing red light cameras at high-volume intersections. These cameras have the potential to deter drivers from running a red light and endangering pedestrians.

2.3 Prohibit right turns during red light cycles

The study team urges SDOT to consider banning right turns off of Rainier during red light cycles. Many study respondents remarked that drivers turning right were often conscious of vehicle traffic only, resulting in the neglect and endangerment of pedestrians crossing.

2.4 Increase traffic enforcement

The study team recommends SNG continue conversations with community members regarding an increased police presence, with the goal of enforcing speeding violations along Rainier in the Columbia City and Rainier Beach neighborhoods. Police officers have the potential to enforce vehicles running red lights and reduce criminal activity.

However, this recommendation is not without limitations. There is a perceived and/or actual risk of unintended consequences of an increased police presence in lower-income

areas such as Rainier Beach and Columbia City. Examples of potential consequences, supported by this study, include singling out marginalized individuals and creating an environment of fear.

3. Community development

3.1 Enlist support from a range of community members

Without the support, involvement, and unique perspectives of the broader community these recommendations will be difficult, if not impossible to implement. Therefore, the study team recommends SNG continue to expand community engagement efforts in the Rainier Valley. Specifically, the study team urges SNG to seek input from:

- Ethnic, racial, religious, and cultural groups.
- Visually- and aurally-impaired populations.
- Drivers, bikers, and transit users.

3.2 Promote community beautification projects

These efforts may include landscaping and urban design interventions; increasing density of green space; repairing damaged sidewalks; and incorporating public seating areas. Beautification efforts may include temporary events and installments, such as community art walks and neighborhood murals painted by local artists; with the goal of increased community engagement and pride.

3.3 Revitalize small business development

While efforts to revitalize small businesses are significant in scope and feasibility, they offer opportunities to decrease crime, and encourage walkability in Columbia City and Rainier Beach.

Conclusion

Pedestrian safety is a public health issue. Walkable neighborhoods; safe and timely street-crossing experiences; and controlled traffic all contribute to a healthy neighborhood and healthy residents. This exploratory study investigated the pedestrian experience and barriers associated with crossing Rainier in the focus neighborhoods of Rainier Beach and Columbia City.

Study findings support the study partners' hypothesis that traffic signals in the lower-income focus neighborhoods were more likely to favor vehicular traffic than in the higher-income comparison neighborhood. Pedestrian delays exceeding 30 seconds are associated with non-compliance and injury; nearly 75% of all pedestrian delays across the focus and comparison study sites exceeded 30 seconds.

Residents and pedestrians in Columbia City and Rainier Beach identified signal timing as a primary barrier to crossing Rainier. Other barriers identified by pedestrians include traffic, personal safety, and the built environment. Pedestrian experiences varied by neighborhood and action steps should be tailored to address the specific needs and concerns of each community.

By adopting a public health lens, we find that there are many strategies to address pedestrian safety. Our primary recommendations for enhancing pedestrian safety in Rainier Valley include signal timing improvements; traffic infrastructure and enforcement; and community development. Collaboration with government and community partners is essential to facilitate positive and sustainable change in the Columbia City and Rainier Beach neighborhoods.

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Appendices

Appendix A: Pedestrian and traffic safety case studies

REGION(S)	FINDINGS
Europe	Researchers from the U.S. Department of Transportation conducted a scan of Europe to determine innovative traffic signal features and design practices with the potential of improving pedestrian safety domestically.[20] Some of these best practices in signal feature and design include: ▪ Detection of pedestrians while in crosswalks to extend or cancel the pedestrian phase at traffic signals. ▪ Near-side traffic signals to reduce motorist encroachment on pedestrian crosswalk. ▪ Near-side pedestrian signals encourage pedestrians to view oncoming traffic. ▪ Raised crosswalks at unsignalized pedestrian crossings. ▪ Crossing islands even if confined or limited space requires the use of smaller islands. ▪ Railing used to direct pedestrian movements to defined crossing locations. ▪ Photo enforcement: Although photo enforcement is viewed primarily as a tool for improving motor vehicle safety, better motorist compliance with speed limits and traffic signals also improves pedestrian and bicyclist safety when crossing the street.
Netherlands	**Boot (1987):** This study examined traffic accidents at crossings. A few key findings and recommendations include:[13] **Unsignalized crossings** ▪ Installation of unsignalized crossings does *not* lead to improvement in traffic safety. ▪ In some cases, the number of accidents is increased after the installation of an unsignalized crossing. ▪ The authors note that in contradiction with these findings, research in Switzerland showed an improvement of traffic safety after the installation of unsignalized pedestrian crossings. ▪ Recommendation: Revise the legal status of unsignalized pedestrian crossings. To reduce both waiting times and dangerous conflicts, pedestrians waiting to cross should also have priority. **Signalized crossings** ▪ Installation of signalized crossings proved to have a positive effect on traffic safety. ▪ Signalized crossings in the Netherlands are only realized when volumes of motorized traffic as well as crossing pedestrians are high. ▪ Recommendation: Installation of signalized crossings should only be taken in consideration if volumes of both motorized traffic and pedestrian traffic are high.
	Levelt (1992): This study represents the Dutch component of a larger international (French, British, and Dutch) evaluation of new pedestrian crossing facilities, referred to as "Pussycats." [13] Pussycats is a "new system, characterized by technical improvements, better adapted to the behavior and needs of pedestrians, particularly those of vulnerable road users."[13] Specifically, this new system involves:[13] ▪ Moving the pedestrian display to the near side of the crossing, facing the oncoming traffic. ▪ Having a mat detector replace the push button, with infrared sensors detecting the presence of pedestrians on the crossing. **Key findings** from this study include:[13]

REGION(S)	FINDINGS
	▪ Contrary to expectations, no relationship was found between the number of vehicles and red crossing. Watching, as demonstrated by head movements, is considerable, particularly before crossing. Red crossers are more careful. ▪ There are no indications that the short green period (7 seconds) bothers the pedestrians. ▪ The position of the pedestrian display at the near side of the crossing is regarded as a negative point. Two factors could improve the situation: o If people know that an infra-red detector protects them from passing traffic, the unpleasant feelings linked to not seeing the display turn red could be tempered. o Many people say that they are not use to such a position. Longer experience, covering more sites, could alter the situation. [13]
Sweden	Three main **conclusions** from a study in Sweden include:[16] ▪ Safety potential at signalized intersections is not fully achieved. ▪ Behavior adaptation/modification is the key to safety improvements or failure. ▪ Safety potential is great at both zebra crossings and at signalized intersections, since two thirds of all pedestrians cross at these locations. In response to the above conclusions, the study team in Sweden installed a new big warning sign, activated by the presence of pedestrians. The **results** from this new installation is a remarkable increase in the number of vehicles stopping to let pedestrians cross the street[16]: ▪ Before the new sign was introduced, about 12% of arriving cars stopped when pedestrians where present. ▪ Right after the sign was introduced, 50% of the cars stopped. ▪ After 1 year, more than 50% of the cars stopped
United Kingdom	One unique and innovative pedestrian crossing design can be seen in the U.K. This design is an offset or staggered pedestrian crossing that "places oncoming traffic in the crossing pedestrian's field of view so the pedestrian is more likely to notice it."[21] Offset pedestrian crossings may be used at both signalized and unsignalized crosswalks.[21] The most important design feature is that the "offset forces pedestrians to walk longitudinally in the median for a short distance so they face oncoming traffic."[20] Researchers in U.K. have observed that simply "providing a pedestrian crossing does not necessarily reduce pedestrian casualties, partly because the crossing may cause changes in levels and type of pedestrian activity."[21] Furthermore, it has been observed that one type of crossing is not necessarily safer than another. The general rule followed in the U.K. is to choose the type of pedestrian crossing most appropriate for the "circumstances of the site and the demands and behavior of the road users."[21]
United States	**Tucson, AZ:** Because Arizona ranks very poorly nationally on pedestrian fatalities Tucson adopted traffic control measures similar to those used in Europe. TOCAN (too-kan) costs $175,000 and it is a "smart" traffic signal that lengthens the crossing time when both pedestrian and bicyclists are trying to cross the street.[15] PUFFIN (Pedestrian User Friendly Intelligent Crossing), was used primarily for school crossings to allow school crossing guards to control the pedestrian signal signs and freeze a red light until everyone has crossed the street.[15] The PUFFIN cost about $100 per unit.
	Northern, Virginia: Because of high rates of growth, the Northern Virginia District (NOVA) of the Virginia DOT realized that their planning priorities needed to change so

REGION(S)	FINDINGS
	that they could improve pedestrian accessibility and safety. Reston Parkway is a four-lane arterial road that has an average use of 29,000 vehicles per day, which heavily impeded pedestrians' ability to cross the street for commercial purposes.[15] Before the change, nine of the seventeen intersections that crossed Reston Parkway had walk signals that were coordinated with the traffic light timing and did not require pedestrian activation. This led to long wait times (up to three minutes) for pedestrians and higher incidences of illegal street crossing.[15] NOVA changed this so that signals were responsive to pedestrian needs. Additionally, in high-traffic intersections, pedestrian walk phasing was established that allowed pedestrians to begin crossing the street before cars traveling the same direction were given a green light. Walk phasing allows pedestrians to "establish their presence" in the crosswalk before vehicles are permitted to turn. NOVA reports that these among other changes were inexpensive and resulted in several citizens stating that the improvements "made it much safer to get across [the street]."[15]
	Hillsborough County, FL: Busch Boulevard is a high-traffic corridor that was difficult for pedestrians to navigate. To address problems in this corridor, the Hillsborough County Metropolitan Planning Organization's Transportation Disadvantage Coordinating Board developed an accessibility evaluation of the corridor to inform the Florida State Department of Transportation on the barriers for pedestrians.[15] The Board asked a number of disabled citizens and their advocates to identify barriers to accessibility and their primary reasons for use of the corridor. The assessment noted a number of problems including:[15] ▪ Conflicts between pedestrians and motorists; and ▪ Crossings (too little time to cross, no median refuge) The group finalized a report that "detailed the existing conditions and made recommendations to improve the environment."[15] This report made an impression on professionals and legislators and incentivized the DOT to commit to incorporating some of their design suggestions into improvements in the area.
	Portland, Oregon: Portland has done a lot to improve the city for pedestrians and bicyclists including addressing signal timing issues. Portland has had a comprehensive pedestrian plan since the late 1990s in which they highlight crossing improvement projects.[1] Examples of these projects include curb extensions, raised sidewalks, median refuges and the installation, replacement, or modification of traffic signals.[21] A few of the Principles for Pedestrian Design include: ▪ The pedestrian environment should be safe. ▪ The pedestrian network should be accessible to all. ▪ The pedestrian environment should be easy to use. ▪ Pedestrian improvements should be economical. Furthermore, Portland's Central City Transportation Management Plan (CCTMP) emphasizes that intersection design should "promote the use of bicycles as an alternative mode of transportation," and "give maximum accommodation to walking in the core."[22] These priorities have encouraged recommendations that will improve bike and pedestrian travel. A group of Portland State University Transportation Engineering Students concerned with this issue decided to study intersections (West Burnside and 3rd Ave being the major one) to inform their recommendations for the plan.[22] They collected data at multiple times of day on the following:[22] ▪ Hourly pedestrian flow ▪ Jaywalkers ▪ Pedestrian delay ▪ Vehicle delay

REGION(S)	FINDINGS
	▪ Yellow and red times ▪ Saturation flow-rate ▪ Vehicle volumes Their methods for measurement were defined and proved useful in shaping this study's data collection methods. In addition, they collected information about collisions at their intersections, historical data on traffic volume, and bus use and timing. Based on their research, they made a number of recommendations, including changing the intersection geometry, creating a bicycle roundabout, and lengthening the signal timing cycle. In their proposal, they suggested lengthening the signal timing cycle to 80 seconds from 70 seconds to allow for an exclusive bicycle split which would reduce the green light for cars by up to 14 seconds.[22] They reason that shortening the green would bring the intersection closer to the saturation flow rate. In another intersection, the students proposed reducing the lanes of traffic from two to one to add a two bike lanes.[22] Although they knew this would not directly affect pedestrians, narrowing the road would reduce the traffic and slow it so that pedestrians could more easily cross the street. In other areas, Portland made signal timing improvements that emphasized reducing car wait times to lessen pollution emissions.

Appendix B: Signal timing data collection tool

Date: _____ Time: _____ am/pm Location: □ CC □ RB □ BA
Intersection: _____ Observer Initials: _____

Pedestrian Push Button Data Collection Form

Jaywalkers:[†]	

Note: Start the time when a pedestrian pushes the button (if there's one available).If there is not one available, start the time when a pedestrian walks up to the crosswalk

A	B	C	D	E	F	G
No	**Time of Actuation (start at 0 s)**	**Time when Ped Walk was served (s)**	**No. of Pedestrians crossing (#)**	**End of W Time (s)**	**End of FDW Time (s)**	**Max. Ped Delay (s) (C-B)**

[†] Jaywalkers are defined as anyone who crosses the street at a point other than a marked crosswalk OR crosses against a traffic signal indication at a marked crosswalk. Please tally the number of jaywalkers that you see during each data collection period (anyone you see).

Appendix C: Community perception survey tool

Date: _____ Time: _____ am/pm Location: □ CC □ RB
Intersection: _____ Observer Initials: _____

Columbia City/Rainier Beach Walking Survey

For Survey Collector: *Familiarize yourself with Seattle Greenway info sheet before conducting surveys.*

Approach people on the street: "Excuse me, do you mind if I ask you a few questions about walking in the neighborhood? This should only take a few minutes, and I will not ask you for any money." If yes, introduce yourself as a graduate student at UW working with SNG and explain that you're working on a project about pedestrian safety and hoping to get the perspective of people who walk in the area. If no, mark this on a separate "non-respondent" tracking sheet.

Getting Around

Q1. What is your main mode of transportation most in this neighborhood?
(*Surveyor: try listing options)*

__ Walk __ Bike __ Car __ Transit __ Other: _____

Q2. On a scale of 1-5, with 1 being very unsafe, 3 neutral, and 5 being safe, how safe do you feel when you cross Rainier Ave, in general? _____

Open-Ended

Q3. What factors make you feel unsafe when crossing Rainier Ave?
(Surveyor: listen for key words and check below/take notes)

□ Traffic □ Car Speed □ Personal Safety (i.e., "I don't feel safe walking)

□ Signal Timing (waiting for signal/ not enough time to cross) □ Sidewalks (quality, location, etc.)

□ Crosswalks (too few, too far apart, etc.) □ Buses □ Nothing (I feel safe)

Q3a.

_____

_____

_____

Q4. As a pedestrian in this neighborhood, do you have enough time to cross Rainier?
□ Yes □ No □ I don't know

Demographics: *Participant can choose not to answer)*

Age:
□ <19
□ 20-29
□ 30-39
□ 40-49
□ 50-59
□ 60-69
□ >70
□ Prefer not to answer

Gender:
□ Female
□ Male
□ Other: _____
□ Prefer not to answer

Visible Mobility Assistant? (*observation*)
(wheelchair, walker, cane, etc.)

Describe: _____

What neighborhood do you live in?

_____

Q5. **Phase II:** Do you have any memorable experiences crossing Rainier Ave in this neighborhood?
(Optional: Ask for stories).

_____

_____

_____

_____

_____

Surveyor explains "SNG has asked us to look into the issue of signal timing, which determines how long you have to cross the street. We want to make sure we capture all sides of the issue."

Q6. Do you have any concerns with giving pedestrians more time to cross the street?

_____

_____

_____

_____

Thank you so much for your time, and have a great day! GIVE SWAG!!!

Notify participants that if they're interested in improving pedestrian safety, they can get involve with Greenway (contact information on pencil).

Appendix D: Recommendations from the Community

"[I want] to see the walkable part of Columbia City extended further south to create a "boulevard" full of small businesses. [I think] increased walkability would be attractive to developers." – Columbia City Resident

"The primary concern is sidewalk maintenance, general neighborhood beautification, and getting big companies (i.e., Safeway, Jack in the Box, etc.) supportive of efforts to make the Rainier Beach neighborhood more walkable and safe--possibly include pedestrian safety plan in building development plan... [I hope a potential] art walk will improve the community's sense of safety in the Rainier Beach neighborhood by supporting the feeling of ownership over the area."

– Rainier Beach Community Leader

"In an ideal world, [I] would increase signal times AND have there be no buses on Rainier (they would all be Light Rail) or on parallel streets." – Rainier Beach Community Leader

"Making more drivers aware of pedestrians could help." – Columbia City Business Owner

"[At Henderson, regarding crossing guards]; there's only one [crossing guard] but there should be two."– Rainier Beach Community Leader

"It would be nice if the cars turning right [have] a protected turn/their own signal phase to go during the signal." – Columbia City Community Leader

"It would be really nice to have those audible signals in a consistent place, so when you are blind you don't have to search around for them. I would put the push button in a convenient place to cross Rainier since it is more dangerous and more traffic heavy. Because the amount of time to cross Rainier is short if you are searching for the button and then trying to get a line across the street, you may miss your chance to get across Rainier." – Columbia City Community Leader

"Once going south on Rainier [I] started looking for speed limit signs and didn't see one through Columbia City. For this issue, [I] recommend more signs." – Columbia City Business Leader

"If [I] had to make changes, [I] would vote for changes in the heart of Columbia City or something that slows people down coming down the hill." – Columbia City Business Owner

"Hopes that the new Community Center will be a regional draw because of all of its amenities, hopes it will revitalize and attract small businesses." – Rainier Beach Community Leader

"[I want] Edmunds to be a one-way street (it doesn't matter which direction) because it's very tight with street parking to turn. [I would] like orange flags at traffic lights (thinks would be a good idea for both lights and sides of the street." – Columbia City Business Owner

Appendix E: Research team recommendations

SHORT TERM	**Signal Timing Improvements** ▪ Increase total crossing times on Rainier
	Traffic Infrastructure and Enforcement ▪ Install speed- and crosswalk-related signage ▪ Prohibit right turns off Rainier during the red light cycles
	Expanding Community Engagement ▪ Enlist support from a range of community members
MEDIUM TERM	**Signal Timing Improvements** ▪ Reduce wait times for pedestrians crossing Rainier ▪ Implement early-release signal timing on Rainier
	Traffic Infrastructure and Enforcement ▪ Install red light cameras ▪ Increase traffic enforcement
	Promoting Community Development Efforts ▪ Promote community beautification projects
LONG TERM	**Signal Timing Improvements** ▪ Implement exclusive traffic signal phasing
	Promoting Community Development Efforts ▪ Revitalize small business development