CITY OF Vancouver WASHINGTON

Fourth Plain Forward

Pedestrian Safety and Access Implementation Strategy

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ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

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Fourth Plain Boulevard is the central traffic arterial through some of Vancouver's most ethnically, racially, and linguistically diverse neighborhoods. This five-lane boulevard is an important city traffic thoroughfare and supports Fourth Plain businesses, yet the street's high traffic volumes, difficult crossings, and other safety issues, have created a difficult pedestrian environment. The City of Vancouver and communities living near Fourth Plain Boulevard envision a community that has a safe and comfortable walking environment for all users.

Fourth Plain Boulevard has the potential to be a thriving pedestrian and transit corridor, however the current walking environment has thus far prevented it from realizing its full potential. The Pedestrian Safety and Access Implementation Strategy presents a series of analyses and recommendations to improve the walking environment along Fourth Plain Boulevard.

At the onset of this project, a pedestrian network analysis was conducted to better understand the extent and barriers of the walk shed to and from Fourth Plain Boulevard and the surrounding neighborhoods. Based on the results of the pedestrian network analysis and conversations with City staff, nine potential pedestrian pathways and three potential crossing locations were identified and evaluated. Further network analysis and in-field review of the potential pathways and crossings led to the recommendation to prioritize two pathways and three new crossings along Fourth Plain Boulevard. The Strategy also presents a series of recommendations to improve pedestrian scale street lighting.

The Strategy recommends the construction of three new pedestrian refuge islands, along with the provision of enhancements to two existing pedestrian refuge islands to improve the crossing environment along Fourth Plain Boulevard. Finally, The Strategy concludes with a summary of best practices and recommendations to improve the effectiveness of existing and future pedestrian hybrid beacons.

These individual analyses were part of a comprehensive approach to develop recommendations which will improve the walking environment along Fourth Plain Boulevard. If implemented, the recommendations in this plan will work in concert to create a more walkable neighborhood corridor that is inviting and safe for people walking.

Project Focus Area

The project focus area, as shown in Figure 1, is Fourth Plain Boulevard with I-5 as the western boundary and Andresen Road as the eastern boundary. Mill Plain Boulevard is the southern boundary and SR 500 is the northern boundary.

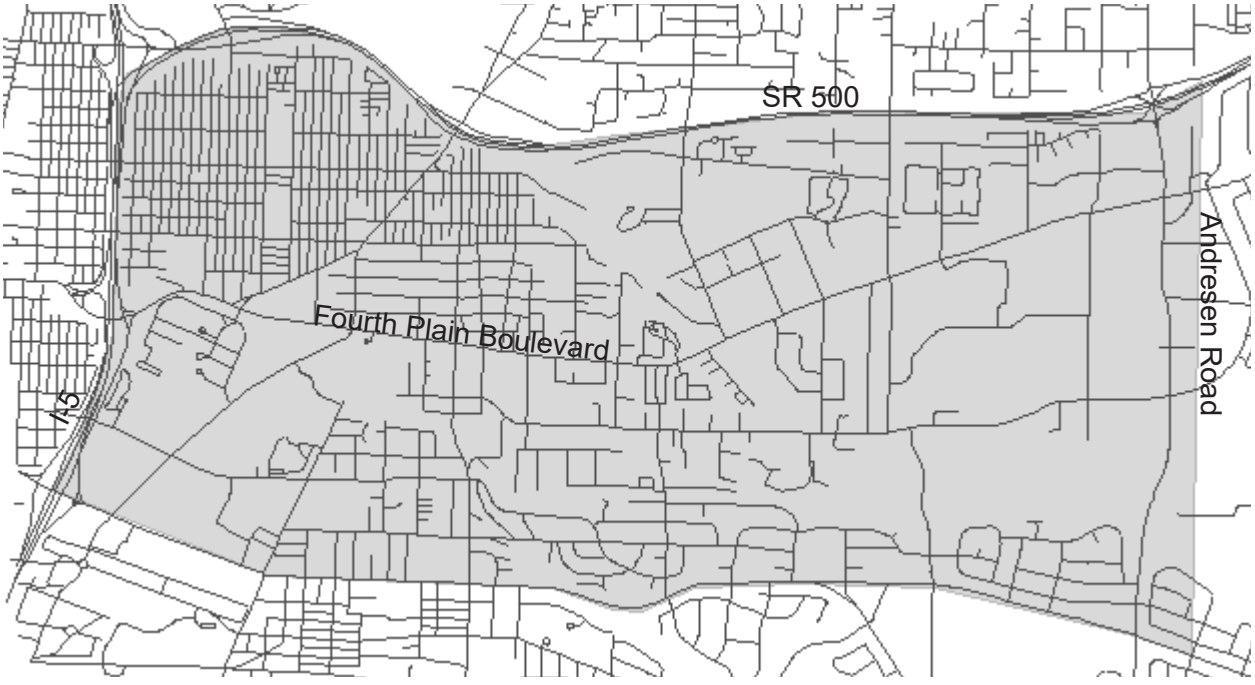

Figure 1: Project Focus Area

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CHAPTER 2

PEDESTRIAN NETWORK ANALYSIS

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TDG conducted a Pedestrian Network Analysis to understand the extent and barriers of the walk shed to and from Fourth Plain Boulevard and the surrounding neighborhoods. Using GIS data provided by the city, TDG developed a network analysis model to determine the extent of the walk shed from The Vine BRT stations along Fourth Plain Boulevard into the surrounding neighborhoods.

The project focus area includes The Vine BRT stations on Fourth Plain Boulevard and Fort Vancouver Way, which are the key origins/destinations along the corridor. In general, the stations were analyzed as a pair, since the stations needed to be accessible in both directions. There is a notable exception to this assumption which is discussed below.

Analysis

The pedestrian network analysis was based on three user types: average pedestrian, school-age children, and elderly or mobility impaired pedestrians. The user types were determined using guidance on walking speeds and mobility characteristics from the Manual on Uniform Traffic Control Devices (MUTCD) and TCRP Report 112/NCHRP Report 562: Improving Pedestrian Safety at Unsignalized Crossings. The users are further defined below.

Average Pedestrian

The average pedestrian is an adult who walks at average walking speed. In general they can maneuver intersections without curb ramps and can cross all intersections with traffic control, no matter the width of the road or the posted speed.

The MUTCD uses a walking speed of 4.0 feet/second (ft/s) when determining pedestrian clearance intervals for traffic signals. For the purpose of this analysis we used the precedent guidance from MUTCD, the average pedestrian user type was assumed to walk at a speed of 4.0 feet/second (ft/s).

School-Age Children

According to the National Highway Traffic Safe Administration (NHTSA) children vary in their readiness to handle traffic situations, such as choosing a safe time to cross a street, and are not ready to cross a street alone until age 10. The National Center for Safe Routes to School follows the recommendations of NHSTA, but state that it is less about chronological age, and more about whether children have demonstrated that they can safely walk and cross streets independently. For the purpose of this analysis and the reality that there may be children within the project scope that are walking alone at various ages, this user type is defined as school-age children, which is in general five to 17.

The major barrier school-age children face and what most threatens their safety is speed. The model uses guidance from research which has shown pedestrians struck by a vehicle at 25 mph are half as likely to die as those struck at 30 mph.

Since there are no crossings on Fourth Plain Boulevard or Fort Vancouver Way that are considered accessible for a school-age child, access to BRT stations for this user type was calculated based on arriving at either direction of transit service. This assumption was necessary to produce meaningful results, since no areas were found to be accessible to both directions of transit service for this user type.

It is assumed that the average child walks slower than the average adult. For the analysis the school-age child user type was assumed to walk at a speed of 3.0 feet/second (ft/s).

Elderly or Mobility Impaired Adults

Elderly and mobility impaired adults have different abilities and needs. However, there is overlap between the quality of the physical environment that affect both groups. Further, there is a higher chance that an older adult, 65 years or older, will have a mobility impairment. For the purpose of this analysis older and mobility impaired adults were grouped together.

The major barrier for elderly or mobility impaired adults is the ability to navigate intersections without curb ramps and the width of major crossings. Additionally, road widths present a problem when they're wide and difficult to cross during the signal cycle.

It is assumed that older and mobility impaired adults walk slower than the average adult and school-age child. The average mobility impaired adult walks at 2.6 feet/second (ft/s), with the slowest around 2.0 feet/second (ft/s). For the analysis the older and mobility impaired adult user type was assumed to walk at a speed of 2.0 feet/second (ft/s).

Further, the analysis was based on an 11 minute walk time from the BRT stations. 11 minutes was chosen because it represents a half-mile walk at the assumed average pedestrian speed of 4.0 ft/s. The analysis shows how far an average pedestrian, school-age child, and elderly or mobility impaired pedestrian could walk in 11 minutes using the parts of the pedestrian network that are considered accessible for each user type. A comparison was also made between areas that were considered accessible to average pedestrians and areas that were accessible to school-age children or elderly and mobility impaired pedestrians.

Model Assumptions

Based on the characteristics of the user types, the GIS analysis was coded to reflect assumptions made while walking along a road segment, crossing intersections, and while navigating off-road connections including trails and cut-throughs. The assumptions are shown in Table 1: Model Assumptions.

	Average Walking Speed Pedestrian	School Age Children	Elderly / Mobility Impaired Pedestrians
Facilities	*4.0 feet/second (ft/s)*	*3.0 feet/second (ft/s)*	*2.0 feet/second (ft/s)*
Segments			
Sidewalk	Yes	Yes	Yes
Missing sidewalk adjacent to >20 MPH road (route within road)	Yes	No	Yes
Missing sidewalk adjacent to <= 20 MPH road (route within road)	Yes	Yes	Yes
Sidewalk adjacent to >=35 MPH road	Yes	No	Yes
Sidewalk adjacent to <= 30 MPH road	Yes	Yes	Yes
Intersections			
<=20 MPH Road with 2 travel lanes (traffic control/no traffic control)	Yes	Yes	Yes
>=25 MPH Road with 2 travel lanes (traffic control)	Yes	No	Yes
>=25 MPH Road with 2 travel lanes (no traffic control)	Yes	No	No
Road with 3 travel lanes (traffic control)	Yes	Yes	Yes
Road with 3 travel lanes (no traffic control)	Yes	No	No
Road with >3 travel lanes (full signalization)	Yes	No	Yes
Road with >3 travel lanes (no traffic control)	No	No	No
Road with 3 travel lanes (HAWK)	Yes	No	Yes
Road with 4-5 travel lanes (HAWK)	Yes	No	No
Curb ramp present	Yes	Yes	Yes
Curb ramp missing	Yes	Yes	No
Off-Road Connections			
Hard surface path without curb ramps	Yes	Yes	No
Hard surface path with curb ramps	Yes	Yes	Yes
Cut-through or desire line/Private road	Yes	Yes	No

Table 1: Model Assumptions

Results

The results of the analysis are displayed in maps to highlight the reach of the pedestrian network from The Vine BRT stations for each user type: average pedestrian, school-age children, and elderly or mobility impaired pedestrians (large resolution maps can be found in Appendix C). The walk shed maps are arranged with high-access properties colored in blue and low-access properties colored in red. Thus, a parcel immediately adjacent to a BRT station would be colored blue. Parcels that were not considered accessible within the 11 minute walk time, either due to distance or lack of an accessible connection, were not included in the map.

Average Pedestrian

The mapped results for the average pedestrian can be found in Figure 2 and a summarized analysis is as follows:

1. Burnt Bridge Creek is centrally located within the project study area. Although there is a trail that runs adjacent to the creek, Burnt Bridge Creek creates a barrier within the neighborhood and a wide separation between BRT stations.
2. The west portion of Fourth Plain Boulevard, from Fort Vancouver Way to I-5, is not served by BRT. To get to the closest station on Fort Vancouver Way, traveling the shortest distance, Clark College is currently a barrier.
3. On E 27th Street and E 28th Street, the block between Fort Vancouver Way and Grand Boulevard, is greater than a quarter mile (1,500 feet) long and creates a barrier for someone traveling north/south to or from Fourth Plain Boulevard.
4. Large commercial blocks along and limited access between several large, dense neighborhoods, between NE 57th Avenue and NE 62nd Avenue, create a barrier to Fourth Plain Boulevard.
5. E 18th Street, an east/west street that runs parallel to Fourth Plain Boulevard has limited crossing opportunities that prevent safe travel for residents living in the neighborhoods south.

School-age Children

The mapped results for school-age children can be found in Figure 3 and a summarized analysis is as follows:

1. The posted speed along Fourth Plain Boulevard is 30 mph along the western portion and 35 mph along the eastern portion, but traffic counts have shown the speeds to be are much higher.
2. Due to the posted speed of 30-35 mph along Fourth Plain Boulevard and based on the assumptions made for this analysis, it is assumed a child cannot cross the street safely, preventing children from using the BRT in both directions.
3. Further, due to the speed, in many locations it is not safe for children to walk along Fourth Plain Boulevard. Children can primarily access Fourth Plain from cross streets with lower speed and overall there are many areas throughout the study area that children cannot get to because of high speeds and number of lanes that make crossing unsafe and difficult.

Elderly or Mobility Impaired

The mapped results for elderly or mobility impaired pedestrians can be found in Figure 4 and a summarized analysis is as follows:

1. Overall the lack of sidewalks and curb ramps throughout the study area prevent accessibility to and from Fourth Plain Boulevard.
2. The distances between BRT stops are difficult for elderly or mobility impaired pedestrians.
3. There are direct connections to Fourth Plain Boulevard from collector roads. Not all of these roads have sidewalks. While an elderly or mobility impaired pedestrian can reroute within the road, it is neither safe nor comfortable on some of these roads.
4. Large, multi-lane intersections within the study area create a burden for elderly or mobility impaired pedestrians who cross intersections slowly.

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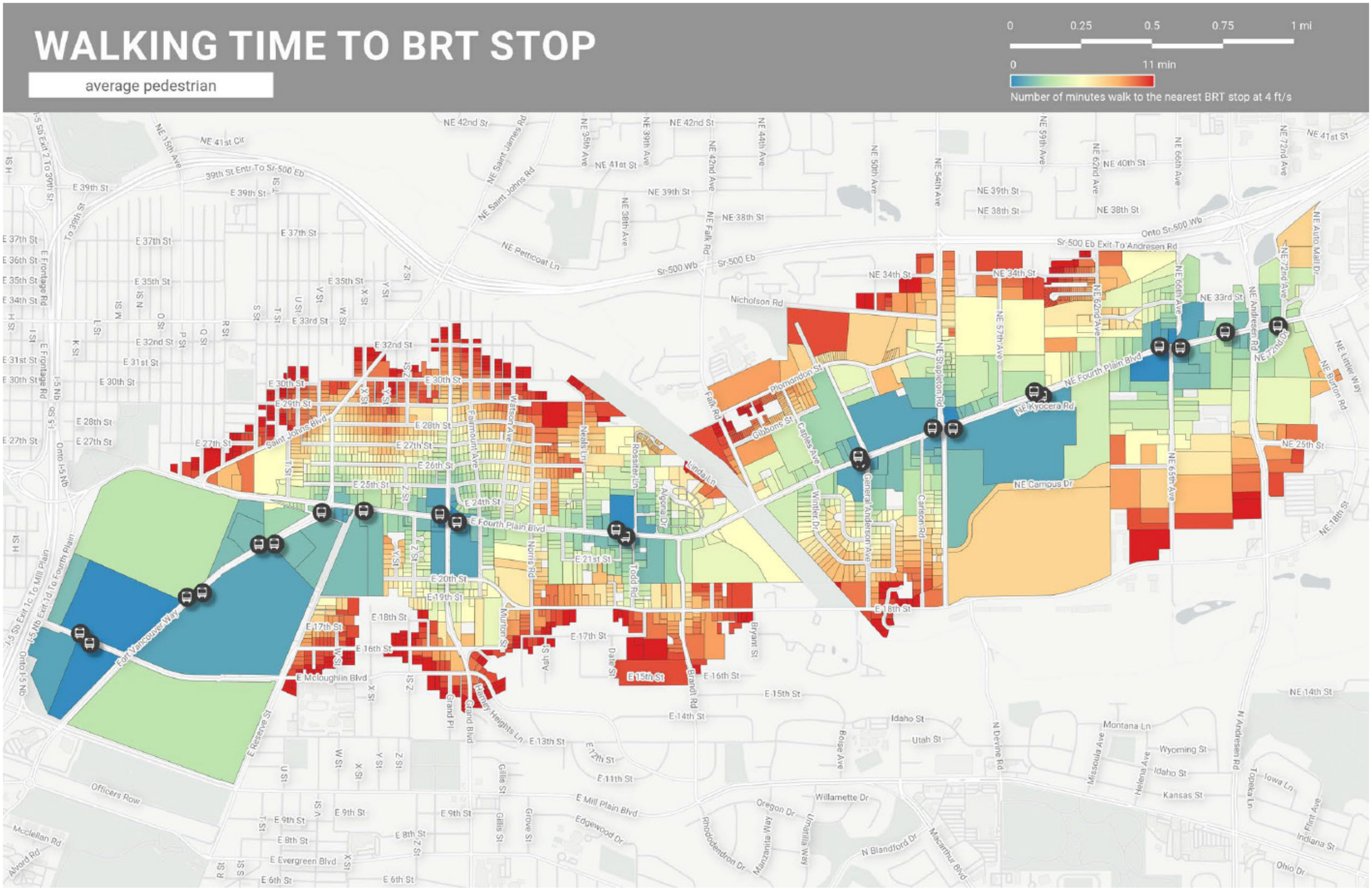

Figure 2: Average Pedestrian Walking Time to BRT Stop

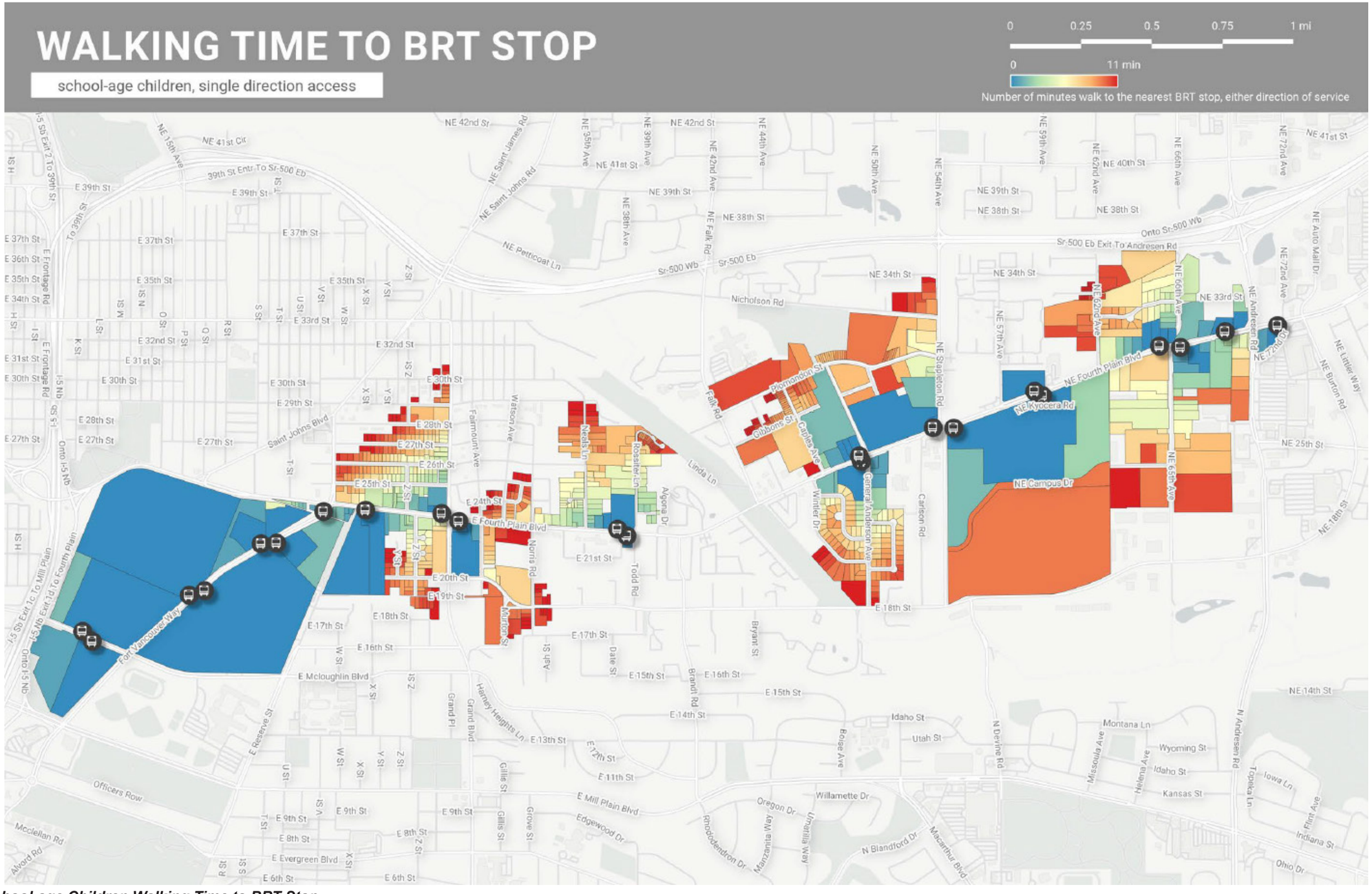

Figure 3: School-age Children Walking Time to BRT Stop

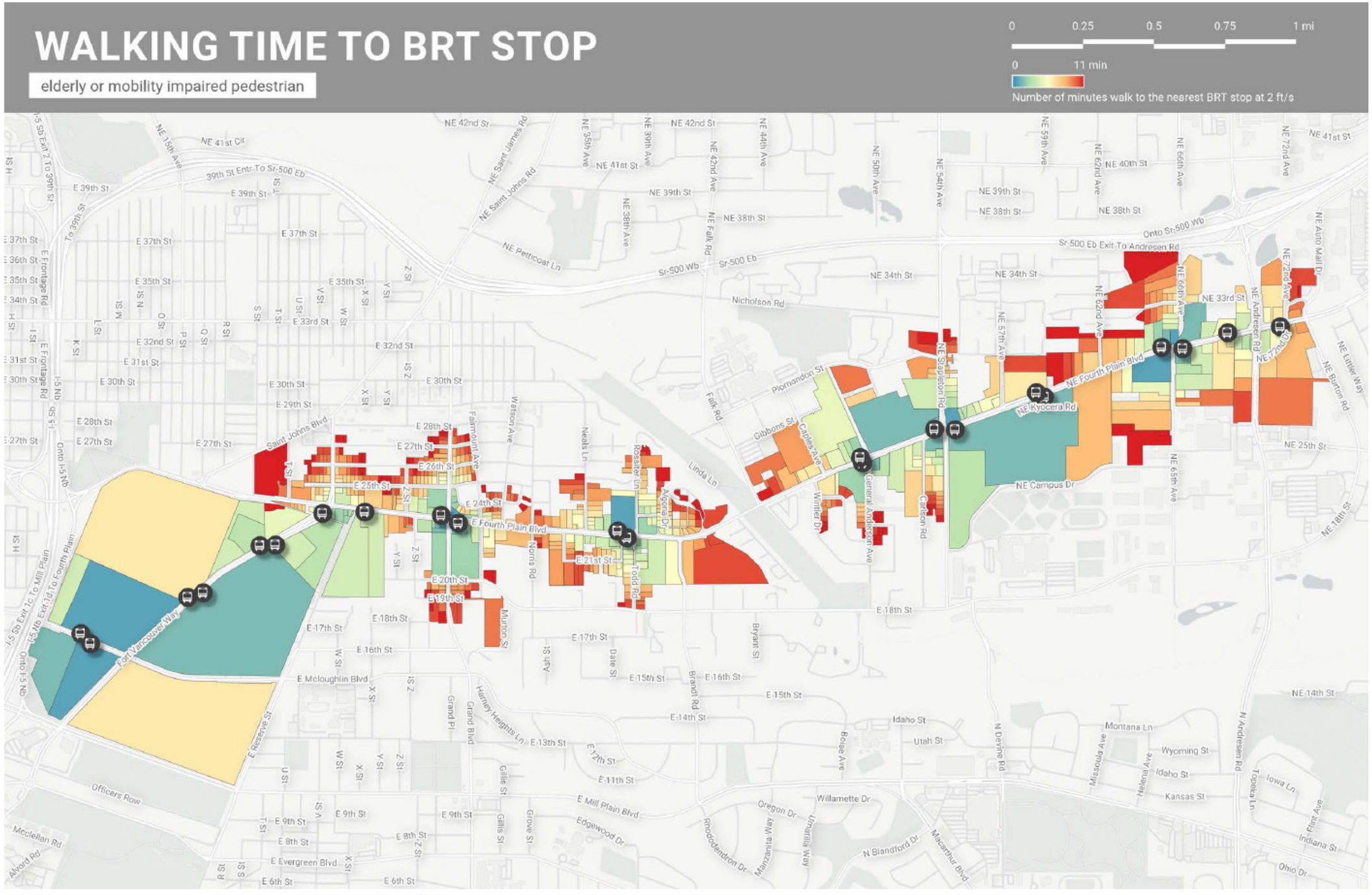

Figure 4: Elderly or Mobility Impaired Pedestrian Walking Time to BRT Stop

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Comparative Results

The following maps were a result of the comparative analysis to highlight the differences school age-children experience versus the average pedestrian and the differences elderly or mobility impaired adults experience versus the average pedestrian. For each parcel, travel time to BRT stations was calculated based on the average pedestrian walk speed of 4.0 ft/s but using the accessible network of each respective user type.

The travel time for the school-age child and for the elderly or mobility impaired pedestrian was compared to the average pedestrian and expressed as a percentage, known as the percentage deviation. The percentage deviation indicates how much additional distance is needed by a school-age child or elderly or mobility impaired pedestrian to access a parcel compared with the average pedestrian. For example, a parcel with a percentage deviation score of 30% for a school-age child indicates that a school-age child would have to walk 30% farther than an average pedestrian to access the parcel, perhaps because of a difficult crossing that is accessible for an average pedestrian but not considered usable for the school-age child.

Difference: School-age Children vs. Average Pedestrian

To highlight the difference in accessibility between school-age children and average pedestrians, Figure 5, shows the percentage deviation for all parcels in the study area. Darker shading indicates a higher percentage deviation for school-age children. Red-tinted parcels are completely inaccessible for a school-age child. A summarized analysis is as follows:

1. St. Johns Boulevard creates a barrier to the northwest corner of the study area.
2. Along NE Stapleton Road, from Fourth Plain Boulevard to E 18th Street, there are no crossing opportunities. This lack of crossing opportunities, which spans almost a half mile (2,300 feet), creates a major barrier for school-age children. Additionally, NE Stapleton Road is the western border and provides the primary access to the sports fields of Fort Vancouver High School.

Difference: Elderly or Mobility Impaired vs. Average Pedestrian

To highlight the difference in accessibility between elderly or mobility impaired pedestrians and average pedestrians, Figure 6, shows the percentage deviation for an elderly or mobility impaired pedestrian. Darker shading indicates a higher percentage deviation for the elderly or mobility impaired pedestrian. A summarized analysis is as follows:

1. Similar to school-age children, the northwest neighborhood within the study area is hard to reach from the closest BRT station due to the distance and time it would take to travel.
2. The lack of sidewalks, curb ramps, and crossing opportunities across Neals Lane, NE 34th Street, NE 57th Avenue, E 13th Street, E 14th Street, E 18th Street, and NE 65th Avenue make large portions of the study area unreachable.

The findings from the pedestrian network analysis of Fourth Plain Boulevard were used to inform the analyses conducted in the following sections.

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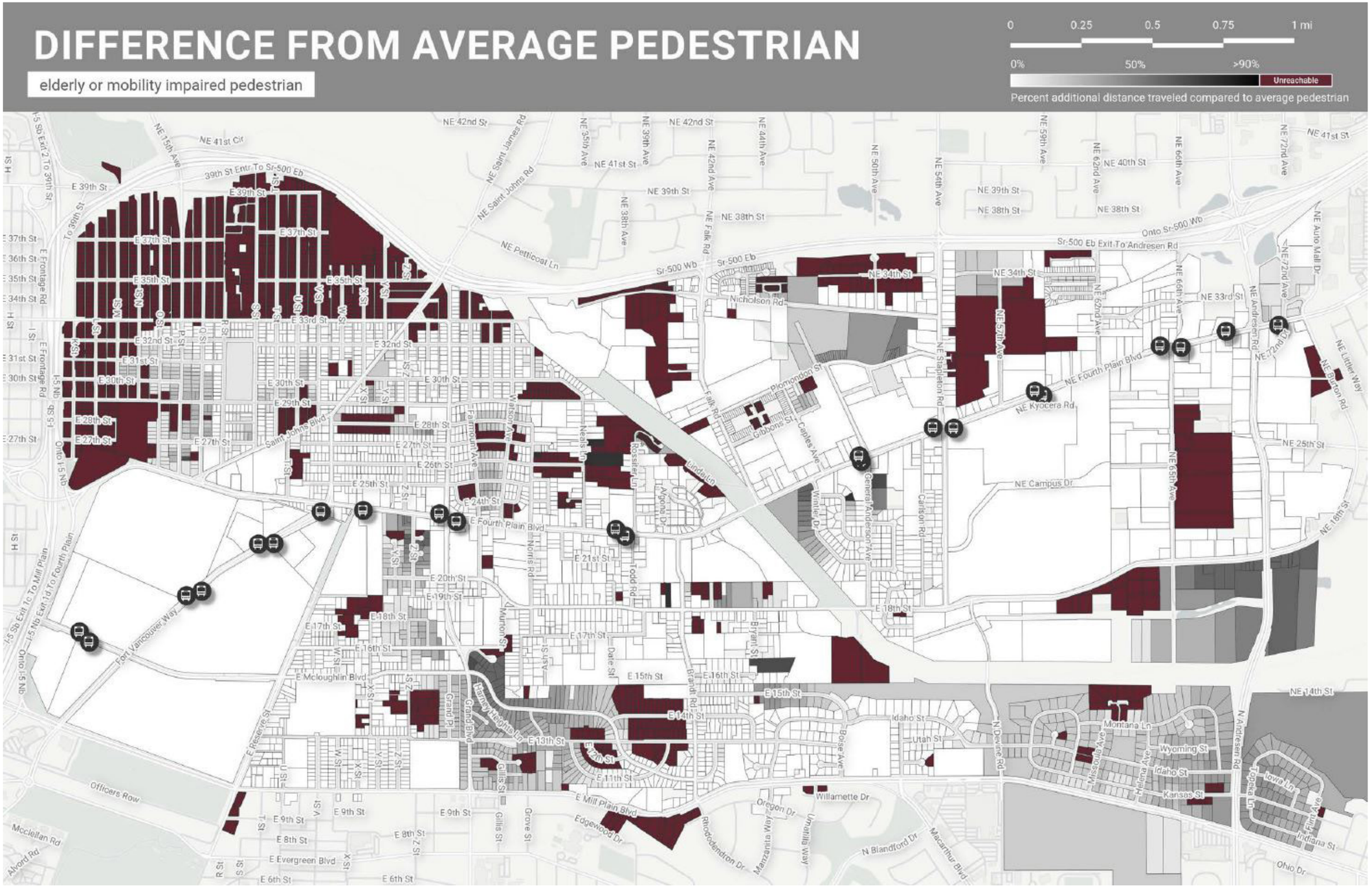

Figure 5: School-age Children vs. Average Pedestrian

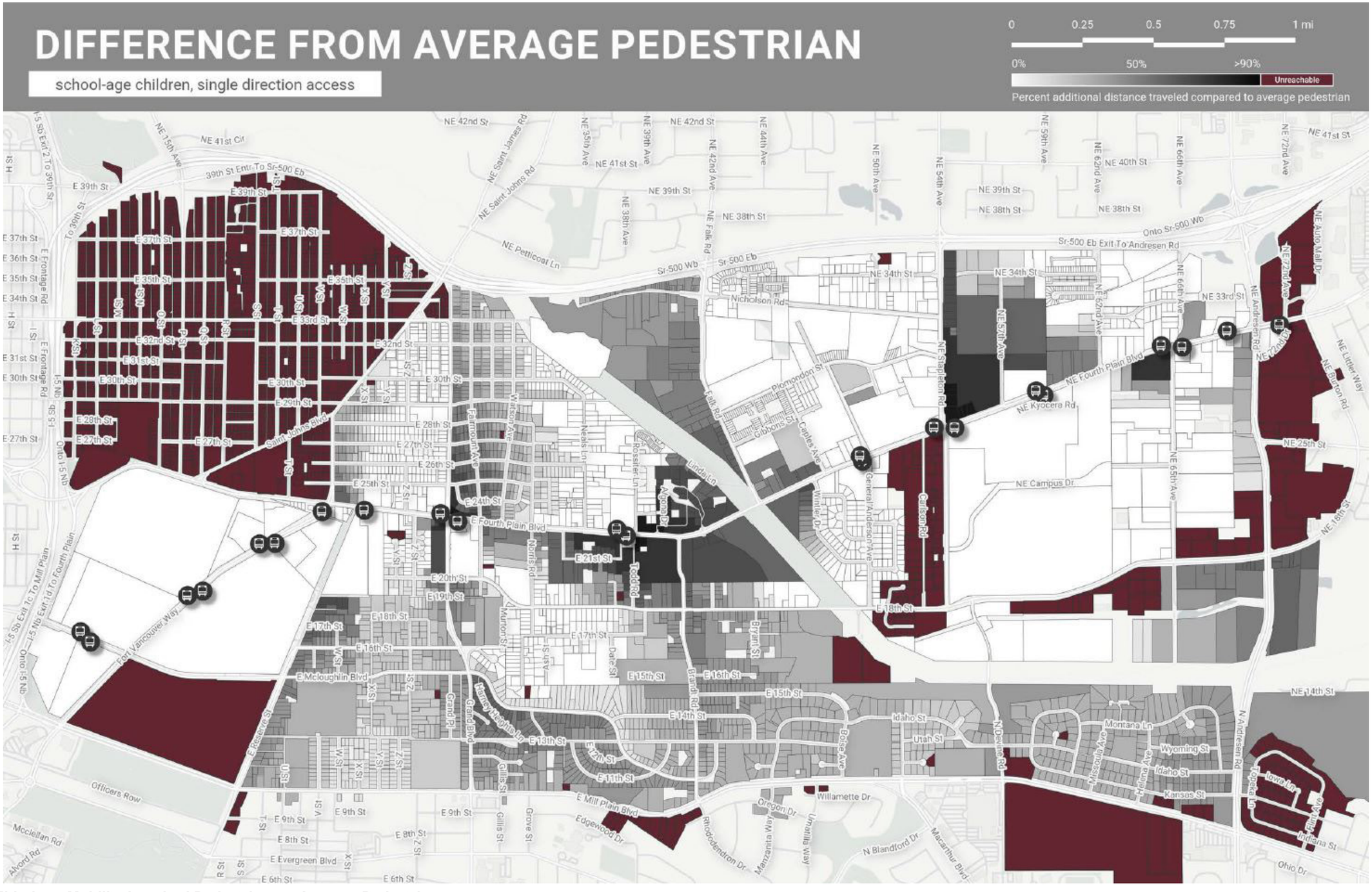

Figure 6: Elderly or Mobility Impaired Pedestrian vs. Average Pedestrian

CHAPTER 3

NEW PEDESTRIAN PATHS

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Toole Design Group (TDG) identified and evaluated nine potential pedestrian paths and three new crossings that, if developed, would increase access to Fourth Plain Boulevard for residents living in the surrounding neighborhoods, enhance Vancouver's pedestrian network, and provide improved overall mobility with increased connections to The Vine.

Potential Pedestrian Pathways

Nine potential paths were selected based on information presented in the 2015 Fourth Plain Forward report and the results of TDG's Pedestrian Network Analysis which identified key barriers to the existing pedestrian network. TDG developed an evaluation methodology to assess each potential path and presents the results of this assessment, descriptions of each path, and a final set of recommended paths for the City to pursue in this memo.

This section provides a summary of each of the nine potential pedestrian pathways examined for the Fourth Plain Forward Pedestrian Safety Access and Implementation Strategy (see Figure 7). A summary of each path can also be seen in the evaluation matrix presented in Table 2. A table of the parcels, property owners, and land uses that would be directly impacted by each potential path is provided in Appendix A.

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POTENTIAL PEDESTRIAN PATHWAYS

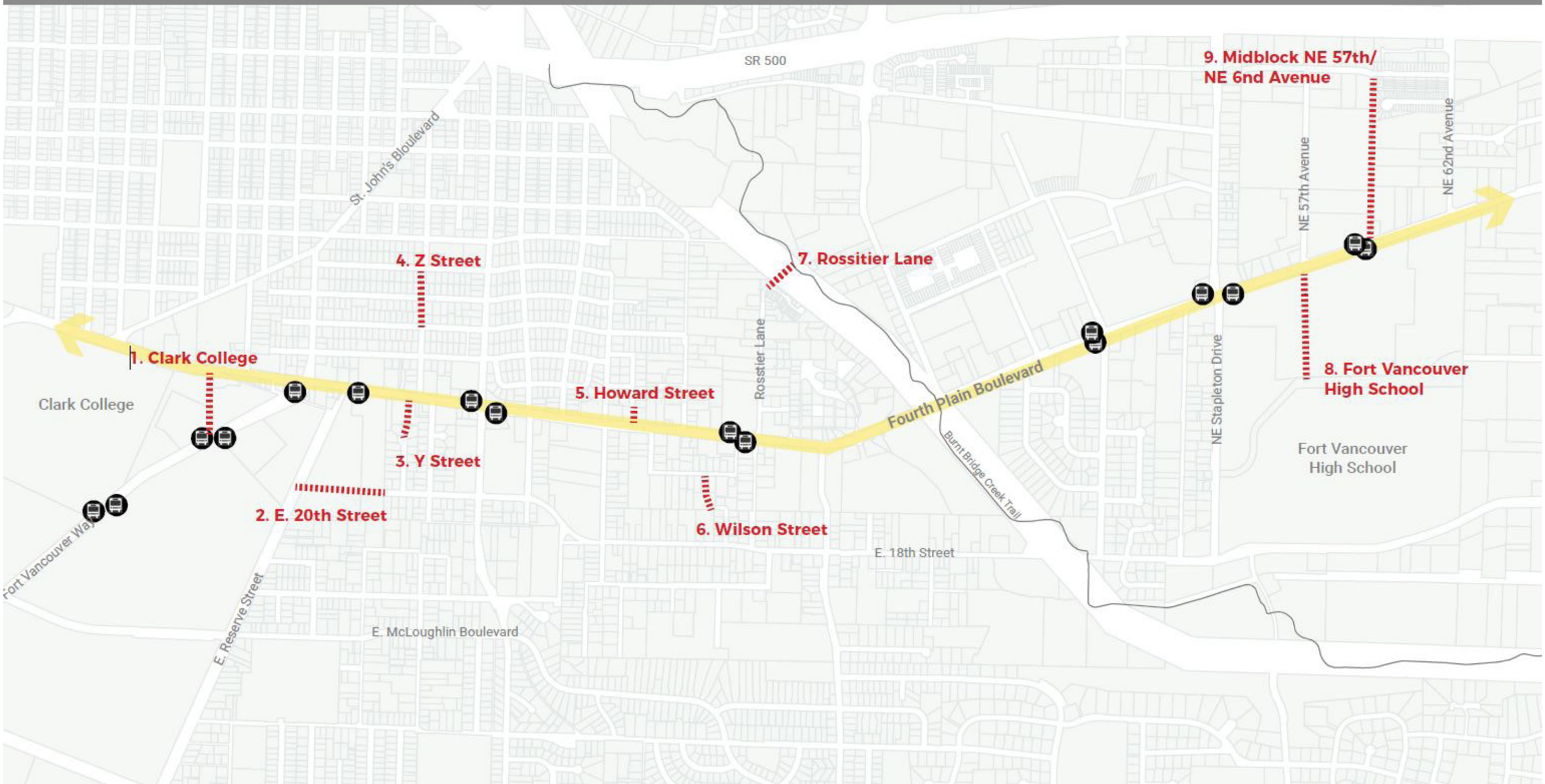

Figure 7 Map of Potential Pedestrian Pathways

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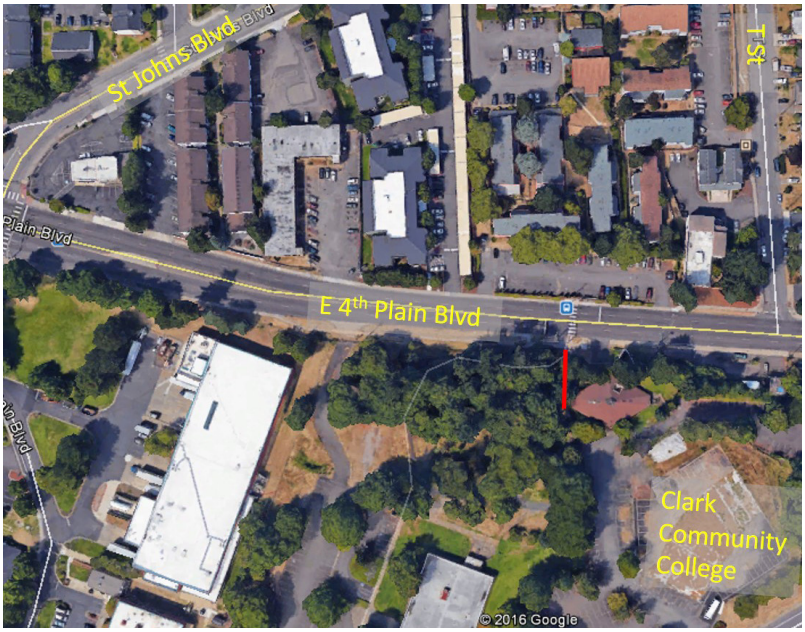
1. Clark College

The existing Clark College campus provides numerous vehicular connections to Fourth Plain Boulevard but the pedestrian connection from the campus to Fourth Plain is incomplete. The Clark College pedestrian pathway would provide a pedestrian link from the Clark College campus parking lot directly to a crosswalk with a Pedestrian Hybrid Beacon and nearby bus stop for lines six and 39 on Fourth Plain Boulevard. This route would provide a safe and easily accessible connection for students at Clark College and also provide a way for students and residents of near neighborhoods to safely travel to and from destinations north and south of Fourth Plain Boulevard. As such, this connection would increase the pedestrian access for students and residents living the Rose Village and West Minnehaha neighborhoods. This connection can be completed with very minimal construction due to the current pedestrian amenities on the property and existing availability of space.



Aerial photo of Clark College potential path, courtesy of Google Earth

Note: The analysis completed for this location was based on existing features, included the new development on the Clark College campus. However, the aerial photo used above is outdated and is not consistent with the existing features.

Connection to pedestrian hybrid beacon on Fourth Plain Boulevard

Clark College potential path (Facing North)

2. E 20th Street

This path would connect the western end of 20th Street to the existing pathways on and surrounding the Clark College campus. If developed, the 20th Street path would provide a continuous parallel pathway for residents living near Fourth Plain Boulevard. The barriers associated with this pathway include an incline and the need to acquire property. In addition, cyclists appear to use 20th Street as an east-west route and would likely take advantage of this new connection as well – design and signage would need to be considered to mitigate any cyclist-pedestrian conflicts. Lastly, it is important to note that the western end of 20th Street does not currently have sidewalks, so the eastern end of this path would not directly connect to the existing pedestrian network without additional sidewalks improvements on 20th Street.

The property where the proposed path would be located is currently planned for redevelopment that will include a water station facility and Water Works Park. The plan includes pedestrian pathways that connect east west from E 20th Street to Clark College and north to Fourth Plain Boulevard. For overall connectivity to Fourth Plain Boulevard and The Vine BRT, it is important that the pedestrian pathways planned for this site are included in any redevelopment of the property.

Aerial photo of 20th Street potential path, courtesy of Google Earth

Incline on potential path to Clark College (Facing Southwest)

Connection from potential path to skate park and Fourth Plain Boulevard (Facing North)

3. Y Street

Adding a pedestrian connection from Y Street to Fourth Plain Boulevard would allow residents living along Y Street direct pedestrian access to Fourth Plain Boulevard and eliminate their need to travel to Fourth Plain Boulevard via Z Street or through the skate park. Currently there is a private driveway and fence blocking the connection from Y Street to the parking lot of a business (Taqueria El Antojo) on Fourth Plain. While initially identified as a potential low access area for residents of Y Street through the Pedestrian Network Analysis, a site visit revealed that residents can access Fourth Plain Boulevard via Z Street or through the skate park and that this connection does not represent as high of a need as other areas. In addition, the number of residents who would benefit from this connection is relatively low compared to other proposed paths.

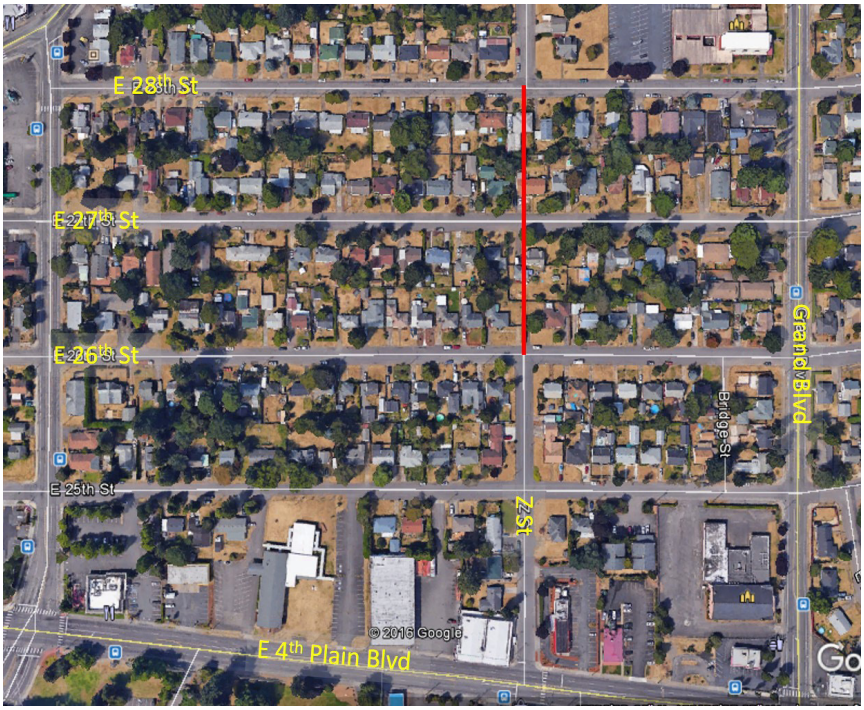
Aerial photo of Y Street potential path, courtesy of Google Earth

Residential parking lot between Y Street and commercial property (Facing North)

Fence between residential parking lot and commercial parking lot on Fourth Plain Boulevard (Facing North)

4. Z Street

The proposed Z Street pedestrian path would serve as a north-south connection for residents traveling east-west along 26th, 27th, and 28th Streets. Currently, the area proposed for the path is all residential with existing single family homes. This new connection would run alongside property lines and require acquisition of property or easements from eight private property owners. Residents living between Grand Boulevard and Fort Vancouver Way and between along 25th Street and 33rd Street would directly benefit from this pedestrian route since these parallel streets are quite long and Z Street is not a complete north-south route. This connection would also provide a safer path for children than the north-south routes currently available along Grand Boulevard and Fort Vancouver Way.



Aerial photo of Z Street potential path, courtesy of Google Earth

Residential property at site of potential Z Street path (Facing North)

Residential property at site of potential Z Street path (Facing North)

5. Howard Street

The Howard Street connection is a very short potential path that would provide a pedestrian link between the southern end of Howard Street and Fourth Plain Boulevard. This path would likely involve slight encroachment into one residential property and acquisition of edges or easements of one or two commercial properties located on Fourth Plain Boulevard. There is evidence to suggest that this path is already being used by pedestrians due to a hole in a fence at the back of the parking lots of the properties on Fourth Plain Boulevard. The properties along Fourth Plain Boulevard that would be involved in creating this pedestrian path are prime for redevelopment. This pedestrian path should be considered as part of any redevelopment on these sites.

Aerial photo of Howard Street potential path, courtesy of Google Earth

Back of commercial property connecting Howard Street to Fourth Plain Boulevard (Facing South)

Residential property and hole in fence at site of potential Howard Street path (Facing South)

6. Wilson Street

The Wilson Street connection would provide a pedestrian connection between Wilson Street and 21st Street. This new pedestrian path would provide a north-south route allowing residents from Wilson Street and others traveling on 18th Street access to Fourth Plain Boulevard. Todd Road is currently used by many pedestrians in this area to access Fourth Plain Boulevard. Todd Road does not have sidewalks, has on-street parking, and a reasonable amount of through-traffic, making it an uncomfortable environment for pedestrians, especially those with physical disabilities, children, and the elderly. A Wilson Street connection would give residents currently using Todd Road a more comfortable, and presumably safer, option. The current uses of this potential path are private yards and driveways. As such, the development of this path would require property acquisition or easements from two or three property owners.

Aerial photo of Wilson Street potential path, courtesy of Google Earth

Residential property bordering site of potential Wilson Street path (Facing North)

7. Rossiter Lane

The Rossiter Lane connection would provide an additional Fourth Plain Boulevard connection for residents living between Falk Road and Burnt Bridge Creek and give residents living along Rossiter Lane direct access to the Burnt Bridge Creek Trail. This connection would require acquisition or easements from one property owner and would have additional costs due to the necessity of constructing a bridge over Burnt Bridge Creek.

At this point, the cost of building a bridge over Burnt Bridge Creek, which connects Rossitier Lane with the Burnt Bridge Creek Trail, has not been determined. However, building a bridge over a creek and wetlands does have significant considerations. These considerations include additional state and local review processes, required fill for the embankment for bridge structures, any mitigation required due to the additional fill, and avoiding impact to areas with a high quality habitat.

Aerial photo of Rossiter Lane potential path, courtesy of Google Earth

Site of potential Rossiter Lane path (Facing North)

8. Fort Vancouver High School

The high school path would formalize the existing link between Campus Drive and the intersection of NE 57th Avenue and Fourth Plain Boulevard. This path would be easy to connect to the existing sidewalk network and is already receiving high use as shown by the worn dirt path (see photos below). Formally constructing and accepting liability for this path would allow this path to be accessible to high school students and staff of all physical abilities. This pathway would serve as an efficient route for students and faculty who need to access the nearby The Vine station on Fourth Plain Boulevard.

In addition to paving this path, the addition of pedestrian lighting would likely increase the perceived safety and use of the path, however additional research is needed to determine if perceptions of danger are a real barrier to use. The site is currently owned by Kyocera International Incorporated and is zoned as Office Commercial Industrial. As such, this pedestrian network improvement would involve acquiring land or an easement from only one property owner and would likely be highly feasible for the City.

Aerial photo of Fort Vancouver High School potential path, courtesy of Google Earth

Site of potential Rossiter Lane path (Facing North)

Site of potential Fort Vancouver High School path (Facing South)

Connection of potential Fort Vancouver High School path to Campus Drive (Facing Southwest)

9. Midblock between NE 57th Avenue and NE 62nd Avenue

This connection would run north from Fourth Plain Boulevard (in between Grocery Outlet and Don Pedros Mexican Restaurant) to the residential properties on NE 34th Street and would provide a direct connection to the existing pedestrian network and The Vine station on Fourth Plain Boulevard. Due to the high number of cul-de-sacs in this area, the residents living in this area must currently walk to either NE 57th Avenue or NE 62nd Avenue to access Fourth Plain Boulevard. For some residents, this means walking as far as one half of a mile to reach The Vine station on Fourth Plain Boulevard – if built, this path would reduce that commute to less than one quarter of a mile.

In addition, the lack of sidewalks or pedestrian paths on the east-west streets in this area and high vehicle speeds on NE 57th Avenue and NE 62nd Avenue make walking along these streets difficult for residents of different ages and abilities. The development of this path would require acquiring property or easements from numerous property owners, however there are many apartment complexes along this route, so the number of residents who will benefit would be substantial. The Pedestrian Network Analysis identified this area as relatively high need due to the lack of north-south and east-west paths and sidewalks in this area. The properties along Fourth Plain Boulevard that would be involved in creating this pedestrian path are prime for redevelopment. This pedestrian path should be considered as part of any redevelopment on these sites.

Aerial photo of Midblock 57th and 62nd Avenue potential path, courtesy of Google Earth

Site of potential Midblock 57th and 62nd Avenue path (Facing South)

Site of potential Midblock 57th and 62nd Avenue path (Facing South)

Evaluation Criteria

Table 2 summarizes the three criteria - impact, feasibility, and connectivity - used to evaluate the nine potential pedestrian pathways. Ratings for each criteria were developed using information gathered from the Pedestrian Network Analysis, field visits to each site, and parcel ownership data. The criteria are described below:

Impact

This measures the likelihood of neighboring residents experiencing a reduced travel time to Fourth Plain Boulevard in combination with the anticipated number of people or residential properties that are likely to benefit directly from the proposed pathway.

Feasibility

This measure evaluates the practical feasibility for developing the individual link. This was determined by examining the amount, types, and condition of land that would likely need to be acquired and improved for the path. Publicly owned properties were assumed to be more feasible for acquisition or easements than privately owned property. In addition, a path was ranked more feasible if acquisition or easements would be needed from one or two property owners versus five to ten property owners.

Connectivity

This measures whether or not the proposed pathway would provide a direct or nearly direct connection to Vancouver's existing transportation network, including crosswalks, pedestrian signals, and transit stops (bus and BRT). Proposed paths that do connect to the existing transportation network increase the overall connectivity throughout the area.

Recommended Pathways

TDG recommends three new pedestrian paths be prioritized for development by the City. These three pathways include Midblock NE 57th and 62nd Avenue, Fort Vancouver High School, and E 20th Street.

Midblock NE 57th and 62nd Avenue

The Midblock NE 57th and 62nd Avenue pathway will be the most difficult of the three, due to the length and accesses needed, but may provide the largest impact in terms of providing a new connection and reaching communities that have extremely limited pedestrian access to Fourth Plain, shown both during the site visit and through the Pedestrian Network Analysis. The majority of residential properties along the proposed route are multifamily, which suggest that this pathway would provide access to a greater number of households than some of the other pathways evaluated which only connect single family residences to Fourth Plain Boulevard.

While NE 62nd Avenue does have sidewalks from NE 34th Street to Fourth Plain Boulevard, NE 62nd Avenue is a busy and high speed street and may not be safe for children to walk along. In addition, the east-west running streets perpendicular to the proposed pathway do not connect and have driveways, making them risky for pedestrians.

Fort Vancouver High School

The Fort Vancouver High School pathway is already being used on a daily basis, and will likely continue to be used, whether or not the City develops this pathway. Formal access and development of this site by the City is needed so that this pathway can be safely accessed by all abilities of pedestrians and to ensure access to this pathway remains in the future. The primary beneficiaries of this pathway are students and staff working at the high school, however it is possible that the aesthetics of this path will encourage other nearby residents to use this path instead of walking along North Stapleton Road.

E 20th Street

The E 20th Street pathway would create an alternative east-west pedestrian route for residents walking near Fourth Plain Boulevard and provide an additional north-south connection to Fourth Plain Boulevard. The completion of this path requires minimal access on two parcels, one of which the City already owns. The second parcel is owned by Avery Assets and is currently under construction, making this a unique opportunity to develop this pathway before construction of the property is complete. Currently there is limited pedestrian access for residents traveling west-bound on E 20th Street and residents living on E 18th Street near Clark College due to a large fence. If select locations on the East and South sides of the fence were opened up to the public and the existing paths and openings were developed to meet accessibility standards residents would have access to an additional safe and direct route to Fourth Plain Boulevard.

Path Number & Name	Existing Condition	Current Land Use	Major Barriers	Acquisition needed (# parcels, ownership)	Estimated Path Distance (Ft)	Impact	Feasibility	Connectivity	Priority Ranking
1. Clark College	Short, pre-existing connection that could be easily reestablished.	Public Facility	None	1 parcel, privately owned	80	Medium	High	Medium	6
2. E 20th Street	Near skate park, path crosses private property, connects to Clark College. No sidewalks immediately near proposed path on 20th Street. One affected property is under construction.	Mixed-Use	Site access, incline	2 parcels, private and publicly owned	750	High	Medium	High	3
3. Y Street	Private driveway w/ fence and no trespassing signs behind parking lots for businesses on Fourth Plain Boulevard.	Residential and Commercial	Site access	2-4 parcels, privately owned	325	Low	Medium	Low	7
4. Z Street	Numerous single family lots occupy the space of the potential path.	Residential	Large number of property owners, unclear if any unused space is available	8 parcels, privately owned	500	High	Low	High	5
5. Howard Street	Existing informal connection from southern end of Howard St to northern end of commercial parking lot on Fourth Plain Boulevard.	Residential and Commercial	Site access	1-3 parcels, privately owned	150	Low	High	Low	9
6. Wilson Street	Residential properties, unclear if space is being used by residents or not. Pedestrians currently use Todd Road to access Fourth Plain Boulevard, but Todd Road which has no sidewalks.	Residential	Site access, unclear if any unused space is available	1-4 parcels, privately owned	175	High	Medium	High	4
7. Rossiter Lane	Path must cross creek, existing connections on eastern side of creek to Burnt Bridge Creek Trail.	Residential	Creek	1 parcel, privately owned	450	Low	Low	Medium	8
8. Fort Vancouver High School	Already well-utilized as a pedestrian path but needs paving. The path would connect to existing pedestrian network (signalized intersection on Fourth Plain Boulevard and sidewalks on Campus Drive).	Light Industrial and Office Commercial Industrial	None	1 parcel, privately owned	950	High	High	Medium	2
9. Midblock NE 57th and 62nd Avenue	Commercial parking lots on Fourth Plain Boulevard, behind parking lots are residential properties (mostly apartments) which closely border the proposed route. Despite existing density of developments, space for a path exists.	Commercial and Residential	Large number of property owners	9 -17 parcels, privately owned	1,580	High	Medium	High	1

Table 2. Potential Pedestrian Pathway Evaluation Criteria

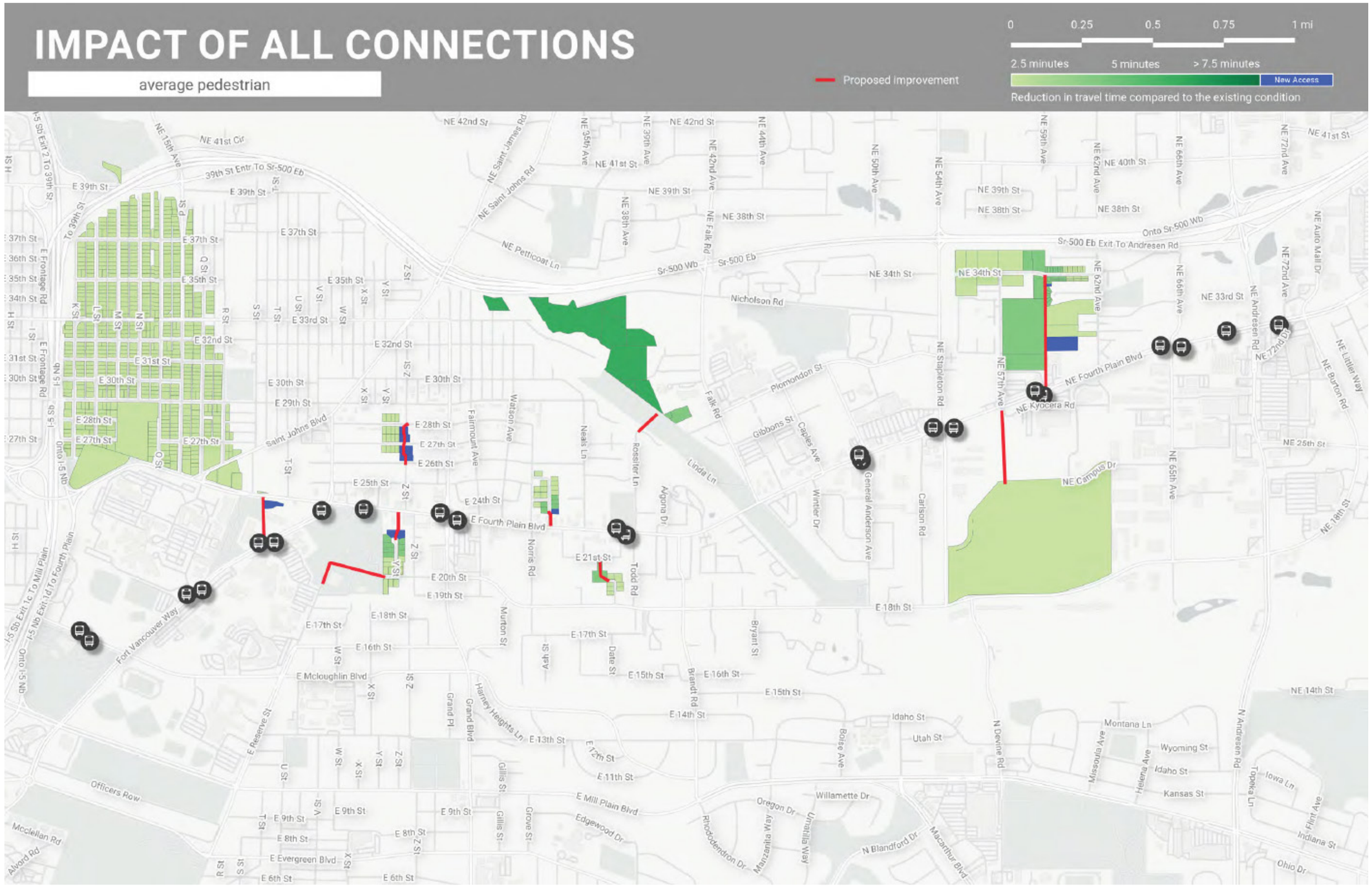


Figure 8 Impact of All Potential Pedestrian Connections

Pedestrian Network Analysis

Using the same methodology as presented in Section 2, TDG conducted a second Pedestrian Network Analysis to measure the effectiveness of the potential improvements evaluated within this section. Nine potential pedestrian connections were evaluated.

The results of the analysis are displayed in a map to highlight the improved reach of the pedestrian network from The Vine BRT stations for average pedestrians. The walk shed maps are arranged based on the time improvement the average pedestrian would experience if the pedestrian connector or new crossing was constructed. Properties colored from light to dark green can be reached with an improvement of 2.5 to 7.5 minutes and properties with new access are colored in blue, based on the pedestrian connector or new crossing. Parcels that would not experience an improvement of at least 2.5 minutes were not included in the map.

Impact of Potential Pedestrian Connections

The mapped results for average pedestrians can be found in Figure 8 and a summarized analysis is as follows:

1. A pedestrian connection crossing Clark College, from Fourth Plain Boulevard to Fort Vancouver Way, would improve travel time for people living in Rose Village walking to the Vine by 2.5 minutes. Prior to this connection, the closest Vine station is along Fourth Plain Boulevard instead of Fort Vancouver Way.
2. A pedestrian connection from the end of Rossiter Lane to Burnt Bridge Creek Trail improves walking time by at least 5 minutes for a large amount of properties located on the north side of the study area. This area is currently not developed or very dense. If those properties continue to be developed, a new pedestrian connection should be constructed at that time.
3. A pedestrian connection from the intersection of NE 57th Avenue and Fourth Plain Boulevard to Fort Vancouver High School provides direct access and a three minute travel improvement from the Vine.
4. A pedestrian crossing from The Vine station located midblock between 57th and 62nd Avenues to 34th Street improves travel time for many properties adjacent. Further, the properties that do experience improved travel times are primary dense multi-family and row housing.

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CHAPTER 4

NEW AND EXISTING PEDESTRIAN CROSSINGS

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TDG conducted an analysis of conditions for pedestrians crossing Fourth Plain Boulevard. Anecdotally, the City of Vancouver has heard input from the public that crossing Fourth Plain Boulevard presents a challenge for many users. Within the past two years, the addition of new Pedestrian Hybrid Beacons near The Vine Bus Rapid Transit (BRT) stops has increased the number of improved pedestrian crossing locations, but additional improved crossings may still be needed. The following sections summarize existing conditions and evaluate how well the relatively new Hybrid Beacons are performing. Recommendations for minor improvements to existing crossings are provided, as well as recommendations for additional improvements at three new crossing locations.

This section provides a summary of each of the six potential enhanced crossings and three potential new crossings examined for the Fourth Plain Forward Pedestrian Safety Access and Implementation Strategy (see Figure 9).

Enhanced Crossings

The existing Hybrid Beacons along Fourth Plain Boulevard follow the standards for Hybrid Beacons per the Manual for Uniform Traffic Control Devices (MUTCD) Sections 4F.01.03, 4F.02.01-03, and 4F.02.08. These standards require that the Hybrid Beacons include a marked crosswalk, at least two three-section signal heads with yellow and red indications at each approach, a stop line at each crosswalk approach, and pedestrian signal heads at each end of the crosswalk. Additional signing and striping for the marked crosswalk is standard "to warn and control traffic at locations where pedestrians enter or cross a street." The Hybrid Beacon must be pedestrian actuated.

Unless noted otherwise, each of the existing Hybrid Beacons include the following standard crosswalk treatments:

- "Stop Here for Pedestrians" sign (R1-5 Series) with a stop line 30-80' behind the crosswalk
- "Pedestrian Crossing" sign (W11-2) with directional arrows at crosswalk
- "Pedestrian Crossing" sign (W11-2) with "AHEAD" (W16-9P) in advance of each approach
- "Crosswalk STOP on Red" sign (R10-23) mounted on the mast arm with two beacon signal heads
- Ladder crosswalk

Figure 10 shows the typical layout for the existing Hybrid Beacons along Fourth Plain Boulevard.

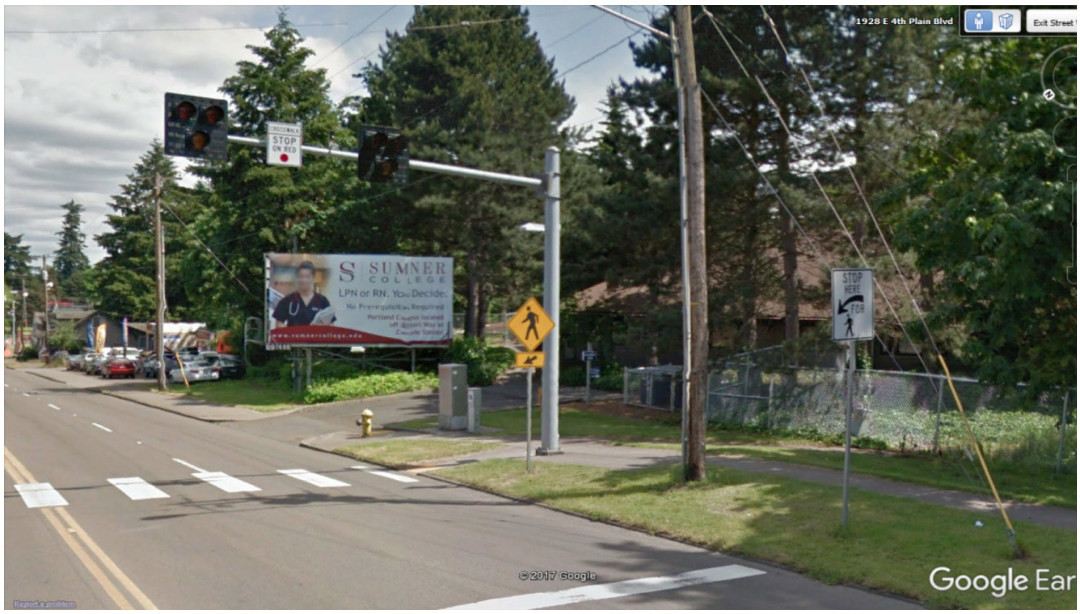

Figure 10: Google Streetview image of existing Hybrid Beacon on Fourth Plain Boulevard, between Saint Johns Boulevard and T Street

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POTENTIAL ENHANCED AND NEW CROSSINGS

Figure 9 Map of Potential Enhanced and New Crossings

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Existing Conditions

Table 3 summarizes existing conditions at each of the Hybrid Beacons along Fourth Plain Boulevard. Variations from the standard configuration described above are listed in addition to details on the roadway cross-section, access to transit, and potential improvements. Curb ramps with tactile domes are present at each of the Hybrid Beacon locations for the crossing of Fourth Plain Boulevard.

Table 3: Summary of Existing Conditions at Hybrid Beacons along Fourth Plain Boulevard

Existing Hybrid Beacon Location	Crossing Design	Roadway Cross Section	Access to Transit
E1 Central Park North	Standard, except "AHEAD" placard on advanced warning sign missing in eastbound direction	Crossing Distance: 45.5' Two lanes in each direction	Bus stops with shelters present in both directions adjacent to the crosswalk
E2 Z Street	Standard	Crossing Distance: 64' (27' curb to island) Two lanes in each direction; Center Turn Lane with Left Turn Lanes; Refuge Island	Bus stops without shelters present in both directions adjacent to the crosswalk
E3 Fairmont Avenue	Standard	Crossing Distance: 64' (28' curb to island) Two lanes in each direction; Center Turn Lane with WB Left Turn Lane; Refuge Island	The Vine BRT stops located 260' (EB) and 485' (WB) to west of crosswalk
E4 Neals Lane	Standard, except no advanced warning sign in westbound direction	Crossing Distance: 61' Two lanes in each direction; Left Turn Lane to West, Two-Way Center Turn Lane to East	No bus stops present at intersection
E5 Rossiter Lane/ Todd Road	Standard, except "Stop Here for Ped" sign and "AHEAD" placard on advanced warning sign missing in eastbound direction	Crossing Distance: 68' Two lanes in each direction; Center Turn Lane/Left Turn Lane	The Vine BRT stops located at crosswalk (EB) and 180' west of crosswalk (WB)
E6 5900 Block	"Stop Here for Ped" sign not located at stop line. No "Pedestrian Crossing" sign at crosswalk. Advanced "Pedestrian Crossing" sign located upstream of crosswalk.	Crossing Distance: 68' (28' curb to island - Offset/Two-phase crossing) Two lanes in each direction; Landscaped median island	The Vine BRT stops just downstream of crosswalk in both directions

Identified concerns

In this section we identify design concerns and provide recommendations to improve the existing Hybrid Beacons if needed. Based on the evaluation, potential concerns can be broken into three categories:

- Proximity to driveways
- Conflict with The Vine BRT station
- Crossing feature missing

There are many driveways and side streets along Fourth Plain Boulevard, making it difficult to find ideal locations for crossings. The existing Hybrid Beacons are placed well given the existing conditions, though based on a preliminary evaluation and as confirmed in the field, there are some key conflict points that could be addressed. The issue is primarily when driveways egress onto Fourth Plain Boulevard directly upstream of the crosswalk. This configuration is present at nearly all existing crossings. During a field visit it was observed that as a pedestrian was crossing northbound at the Z Street crossing, two vehicles entered the intersection downstream of the stop line – one from the Walmart driveway to the southwest and one from Z Street to the northwest. Both drivers stopped for the pedestrian before the crosswalk, but it was obviously an uncomfortable conflict for all three users.

At the Rossiter Lane/Todd Road crossing, the newly constructed The Vine station has impacted the intended operations of the Beacon and crosswalk. The stop bar for the eastbound direction was originally placed approximately 50 feet behind the crosswalk and was accompanied by a “Stop Here for Pedestrian” sign (R1-5 series). With the construction of the The Vine station, the sign has been removed and the stop line is in the middle of the The Vine station, meaning a vehicle stopped for a crossing pedestrian blocks access to The Vine station. This situation was observed during a field observation.

The newest Hybrid Beacon, installed in conjunction with The Vine station at the 5900 Block of Fourth Plain Boulevard, has a different signage plan than all other Hybrid Beacon crossings. The “Stop Here for Pedestrian” sign is not located at the stop line and there is no “Pedestrian Crossing” sign with directional arrows at the crosswalk.

The Neals Lane and Rossiter Lane/Todd Road crossings both have crossing distances exceeding 60’ and have no pedestrian refuge island present. Based on the surroundings at these two crossings, the lack of pedestrian refuge island is assumed to be due to the proximity to the intersection and/or existing driveways.

Pedestrian Hybrid Beacon Operational Performance

The performance of the Hybrid Beacons along Fourth Plain Boulevard was assessed based on already existing study data and field observations. Major questions of interest include:

- Do drivers respond to the Beacons when activated and stop for pedestrians crossing the street?
- After stopping for a Beacon displaying a solid red indication; do drivers proceed on the alternating red indication when pedestrians are at a safe distance?
- Do drivers stop when approaching a Beacon displaying an alternating red indication?

The City recently completed a study that provides findings that address these questions[1]. The primary purpose of the study was to compare two different modes of operation for operating the Hybrid Beacon displays. Specifically, the study evaluated the effect of an alternating versus a simultaneous flashing red pattern on driver compliance and operational efficiency. The results of this study provide important findings that relate to the safety performance of Hybrid Beacons in the Fourth Plain Corridor.

1. “An Analysis of Pedestrian Hybrid Beacon Flashing Patterns on Efficiency and Driver Compliance.” City of Vancouver, Washington. 2017.

Initial Compliance for Solid Red indication

The study found that initial driver compliance for a solid red beacon ranged from 91.7% to 95.1% depending on the scenario described in the table below. In all of the scenarios shown below the initial indication to the driver was the same. A solid red display that follows steady yellow.

Table 4: Initial Compliance Data for Simultaneous and Alternating Scenarios[2]

	Simultaneous	*Alternating*
Average	92.0%	90.2%
Median	95.1%	91.7%
Range	81.4% - 98.2%	81.3% - 96.4%
Standard Deviation	6.3%	6.2%
Mann-Whitney Test	No statistical difference exists	
Staged Population Data		
	Simultaneous	*Alternating*
Average	93.3%	92.1%
Median	93.5%	92.1%
Range	80.3% - 98.3%	88.2% - 98.0%
Standard Deviation	5.76%	2.94%
Mann-Whitney Test	No statistical difference exists	

This range of compliance rates is lower than those observed in national research studies[3], where the average yielding rate across five sites was observed as 97% for staged pedestrian crossing and 99% of general pedestrian population crossing. This difference suggests that some improvement in the driver compliance rates for Hybrid Beacons in Vancouver may be possible.

Driver Compliance for Alternating Flashing Red

After the initial solid red display, Hybrid Beacons display alternating flashing red. When approaching an alternating flashing red display at a Hybrid Beacon, drivers are required to stop at the stop bar. After stopping, drivers may proceed when it is safe to do so as defined by Washington State Law.

Figure 11 below describes the requirements of Washington State Law.

2. Reprinted from “An Analysis of Pedestrian Hybrid Beacon Flashing Patterns on Efficiency and Driver Compliance.” City of Vancouver, Washington. 2017, p19.

3. “Improving Pedestrian Safety at Unsignalized Crossings.” National Cooperative Highway Research Program, 2006.

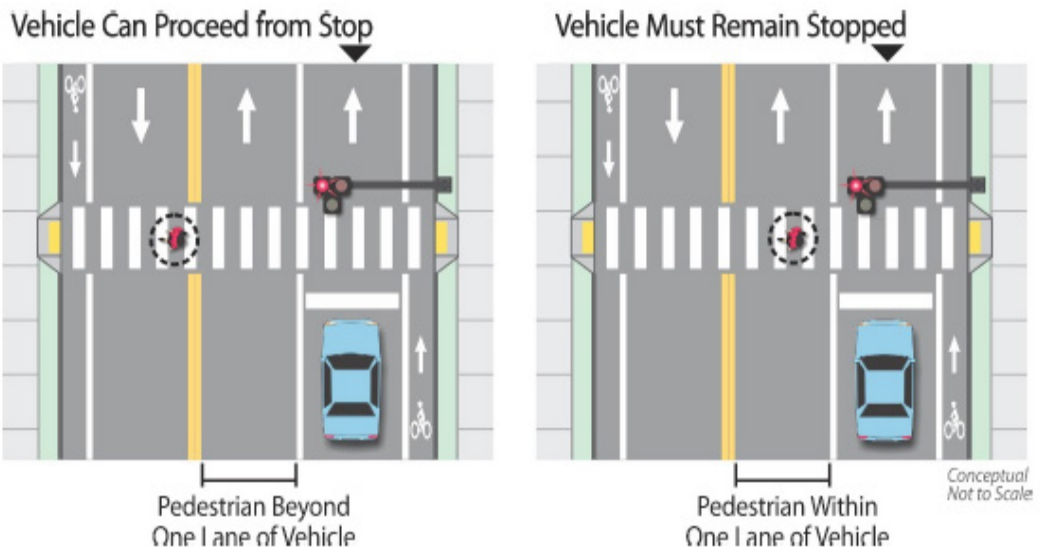

Figure 11: Conceptual diagram of Washington State Law for Pedestrian Hybrid Beacon Compliance[4]

Table 5: Driver Flashing Compliance for General and Staged Crossings[5]

	General	*Staged*
Average	72.1%	66.5%
Median	72.3%	69.3%
Range	51.6% - 91.2%	55.6% - 76.5%
Standard Deviation	13.2%	6.71%
Mann-Whitney Test	No statistical difference	

Driver compliance clearly deteriorates when the Hybrid Beacon display is in flashing red mode compared to solid red. Approximately 30% of drivers are not compliant when they approach a Hybrid Beacon in flashing mode. While pedestrians may not have been present when the non-compliant motorists were observed; pedestrians who are completing their crossing during the flashing mode may justifiably feel at risk due to the high rate of non-compliance.

Planned and Potential Improvements

During the evaluation of existing crossings, TDG staff discussed the operations of the existing Hybrid Beacons with City of Vancouver engineering staff. In a phone call on February 14, 2017, staff indicated that they plan to replace the existing overhead mast arm signs with a new design which has interim approval in the MUTCD. Figure 12 shows the current and proposed signage.

4. Reprinted from “An Analysis of Pedestrian Hybrid Beacon Flashing Patterns on Efficiency and Driver Compliance.” City of Vancouver, Washington, 2017, p.17.

5. Reprinted from “An Analysis of Pedestrian Hybrid Beacon Flashing Patterns on Efficiency and Driver Compliance.” City of Vancouver, Washington, 2017, p.16.

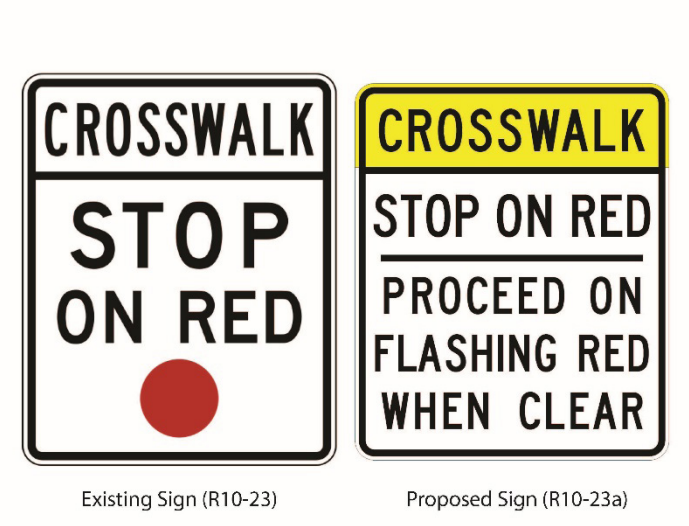

Figure 12: Existing and proposed overhead mast arm sign

During field observations and conversations with engineering staff, it was discovered that the Hybrid Beacons were running in a coordinated mode. This means that instead of being able to respond to the pedestrian call immediately, the Hybrid Beacons were waiting up to 60 seconds before signaling to vehicles that a pedestrian was present. As of Thursday, February 23, 2017, the beacons were reset to run independently and are now responding immediately to a pedestrian actuation.

Changing the Hybrid Beacons to run independent is expected to have a noticeable benefit for pedestrians as they will no longer have to wait until the programmed time in the phasing cycle. Replacing the overhead mast arm sign is expected to have a positive impact on the driver experience and delay. A major benefit of Hybrid Beacons is that when pedestrians are not present, vehicles can proceed through the crossing without causing significant delay. Currently, many drivers remain stopped throughout the flashing sequence of the beacon. The new sign helps convey that drivers may proceed when the crosswalk is clear.

In addition to the above changes, TDG has developed a set of proposed improvements for the existing Hybrid Beacons. These recommendations are minor, but if implemented throughout the corridor, they would provide a systematic refurbish of traffic controls at the Hybrid Beacons and it is expected that the perceived experience for all users will improve.

The first recommended improvement is to replace the existing “Stop Here for Pedestrians” and “Pedestrian Crossing” signs with slightly newer and enhanced versions. Having a symbolic stop sign on the “Stop Here for Pedestrians” sign improves driver recognition and reinforces the location of the stop bar.

Figure 13 shows an example of the existing and proposed signage. Adding a 2” wide reflective panel on the face of the “Pedestrian Crossing” sign post as described in sections 2A.15 and 2A.21 of the MUTCD would increase the visibility for drivers.

Figure 13: Existing and proposed signage for all Pedestrian Hybrid Beacons

The second recommendation is to mark double white lane lines for approximately 100 feet upstream of the stop line in each direction. These lane lines are to convey to the driver that they should not change lanes as they approach the crosswalk. This will help provide an added safety measure for the potential double threat that is present with more than one lane in each direction, and is of special concern when a pedestrian chooses to cross without activating the Hybrid Beacon.

The final recommendation is to construct a pedestrian refuge island at the crossings of Neals Lane and Rossiter Lane/Todd Road. Though not necessary from an engineering standpoint, these refuge islands enhance the experience for pedestrians and assist in conveying to drivers that people crossing may be present.

Conclusion

The first two recommended improvements consist of minor signing and striping fixes. These could be included in the ongoing process to replace the current signs on the overhead mast arms that engineering staff is currently working on.

The construction of the pedestrian refuge islands is more difficult as they are a higher cost and could potentially require closing or restricting existing access to driveways along Fourth Plain Boulevard. A feasibility study would need to be conducted to determine if these islands could be constructed and what access control measures may be needed.

New Crossings

In addition to evaluating the existing Pedestrian Hybrid Beacons, TDG identified three locations for potential new crossings to be implemented. To determine the feasibility and type of design, an analysis of the three locations has been conducted using methodology developed in the National Cooperative Highway Research Program (NCHRP) Report 562[6]. This methodology is consistent with, and was the basis for, the MUTCD Guidelines for Pedestrian Hybrid Beacons. See Appendix A for Schematic Designs of the new crossings.

6. “Improving Pedestrian Safety at Unsignalized Crossings.” National Cooperative Highway Research Program, 2006.

The NCHRP 562 analysis takes into consideration speed, distance, and volume information of both vehicles and pedestrians to determine what level of treatment, if any, a crossing location may require. Table 6 summarizes the crossing locations and assumed values or thresholds for NCHRP 562 inputs.

Table 6: Summary of conditions and assumptions for NCHRP 562 crosswalk analysis

Location	Roadway Cross Section	Access to Transit	Pedestrian Volume Threshold	Vehicle Volume per Hour	
				Data*	Threshold
N1 Midblock between Fort Vancouver Way and Z Street *(Vancouver Central Park)*	Crossing Distance: 56’ Two lanes in each direction with two-way center turn lane	EB The Vine BRT stop at crosswalk; WB The Vine BRT stop located 700’ to west. Bus stops (lines 3,4,39) located 300-700’ in each direction.	14	1393	1025
N2 Watson Avenue	Crossing Distance: 64’ Two lanes in each direction with two-way center turn lane	Bus stops (lines 3,4,39) located 100’ (WB) and 200’ (EB) to east.	14	1375	900
N3 Laurel Place	Crossing Distance: 64’ Two lanes in each direction with two-way center turn lane	Bus stops (lines 4,39) located 550’ (WB) and 450’ (EB) to west. The Vine BRT stops in each direction located 800’ to east.	14	1491	900
**Vehicle volume data comes from the Southwest Washington Regional Transportation Council (RTC). The best available year and location for traffic counts was used to provide a baseline for the NCHRP analysis.*					

Several assumptions were used for all of the proposed crossing locations:

- Utilize NCHRP 562 Worksheet 2; applicable for use “where a major transit stop exists”
- Vehicle speed of 30 miles per hour (posted)
- Pedestrian speed of 3.5 feet per second
- Standard pedestrian start-up and end clearance time of 3 seconds
- High vehicle compliance

Traffic Volume Data

Vehicle volume data is available through the Southwest Washington’s Regional Transportation Council. The RTC has been collecting traffic count data along arterials since 1980. Data from the intersections of Fourth Plain Boulevard at Fort Vancouver Way (2015), Fourth Plain Boulevard at Grand Boulevard (2014), and Fourth Plain Boulevard at Brandt Road (2013) were used for the crossings at Water Works Park, Watson Avenue, and Laurel Place, respectively.

Table 7 indicates the vehicle volume used for the analysis as derived from the RTC data as well as the minimum vehicle volume required to warrant a Hybrid Beacon at each location.

Pedestrian volume data is not easily available without conducting detailed counts. NCHRP 562 Worksheet 2 uses a minimum of 14 pedestrian crossings during the peak hour to trigger the need of a traffic control

device for a crossing. To get a sense of pedestrian volumes on Fourth Plain Boulevard, Vancouver's transit agency, C-Tran, provided boarding and alighting data for the newly installed The Vine BRT stations.

Table 7: Summary of C-Tran The Vine BRT ridership, Feb. 13-24, 2017

The Vine BRT Stop	Nearby New Crossing	Direction	Boardings (per day)	Alightings (per day)	Total Rides (per day)	Total Rides (peak hour)
Fort Vancouver Way	Vancouver Central Park	Westbound	63	101	**164**	**16**
		Eastbound	123	72	**195**	**20**
Grand Boulevard	Watson Avenue	Westbound	93	114	**207**	**21**
		Eastbound	106	108	**214**	**21**
Todd Road	Laurel Place	Westbound	88	90	**178**	**18**
		Eastbound	82	95	**177**	**18**
Unadjusted ridership data from February 13-24, 2017, weekdays only						
Courtesy of Roger Hanson, C-Tran Senior Planner						

Using the data provided by C-Tran, it was determined that approximately 10% of daily boardings and alightings occurred during the peak hour. Assuming half of the riders utilize the crosswalk to get to or from the station, eight to ten pedestrians cross Fourth Plain Boulevard during the peak hour.

It should be noted that The Vine BRT opened in January 2017, just a month and a half prior to the data being requested. In that month and a half, the area has seen unprecedented winter storms and rainy weather. The two weeks of ridership data summarized in Table 5 represents only a snapshot of potential and expected ridership. To date, this is the most applicable proxy for determining pedestrian volumes for existing conditions.

It is a reasonable assumption that the volumes shown above provide a very low minimum for the total number of pedestrians using Fourth Plain Boulevard. These numbers do not account for riders of the existing bus lines along the corridor or those not using transit at all. They are not representative of the peak time of year for pedestrian volumes. It is reasonable to expect that the minimum of 14 pedestrians will be met for each of the proposed crossings.

Pedestrian Hybrid Beacon Evaluation Results

The three crossings were evaluated for to determine the appropriate traffic control treatment using the data summarized above as inputs to the NCHRP 562 methodology. The results of this evaluation found that all three proposed crossing locations meet the criteria for a Pedestrian Hybrid Beacon. This result was confirmed using the guidance provided in the 2009 MUTCD Chapter 4F. However, the level of expected pedestrian activity is not sufficient to warrant a full pedestrian or traffic signal at any of these locations per MUTCD Chapter 4C.05.

Design Recommendations

Conceptual schematic designs for each of the three crossings can be found in Appendix A. The proposed treatments include installing a high visibility crosswalk with the signage described in the previous section, a Hybrid Beacon per MUTCD and City of Vancouver standards, a stop bar for each approach and 4" double while lane lines for 100' leading up to the crosswalk to discourage drivers from changing lanes when approaching the crosswalk.

Pedestrian refuge islands are proposed for the midblock crossing at Vancouver Central Park and the Wat-

son Avenue crossing. Due to the location of adjacent driveways at Laurel Place, a pedestrian refuge island is not presently proposed. A feasibility study similar to that recommended for the existing Beacons without refuge islands would be required to determine constructability and potential access control measures.

Turning Analysis

Part of choosing a location for new crossings is to examine the existing turning movements into and out of adjacent driveways or side streets to determine which, if any, need to be restricted with the implementation of a crosswalk.

Generally, access will not be restricted with the implementation of the proposed crosswalks. The exception being the eastbound movement into the private access road just to the east of Watson Avenue. Figure 14 identifies the turning movements in and out of adjacent accesses for each of the three new crossing locations. Dashed lines represent movements which will not be allowed upon implementation.

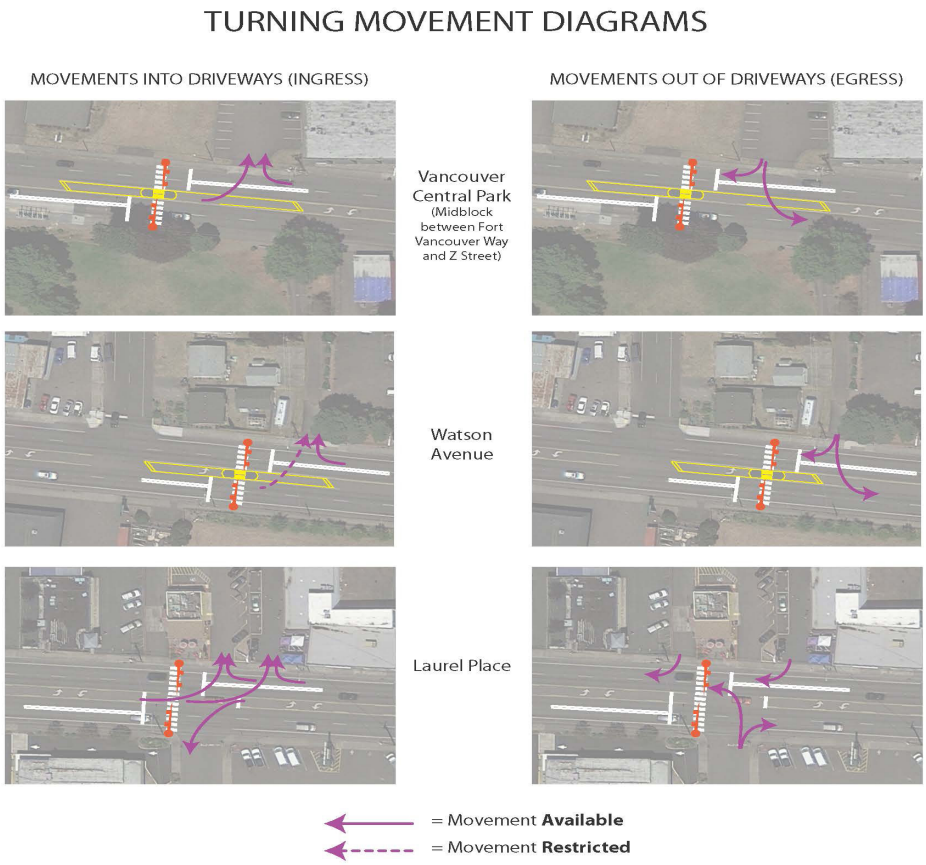

Figure 14: Turning movement analysis at proposed new crossing locations

Segment Improvements along Fourth Plain Boulevard

Safe crossing locations along Fourth Plain Boulevard are crucial to developing a pedestrian-friendly neighborhood and corridor. But crossings are not the only piece effecting the pedestrian experience. The final part of this task involved TDG exploring the conditions for pedestrians traveling along Fourth Plain Boulevard.

Fourth Plain Boulevard has the potential to be a thriving pedestrian and transit corridor. Barriers to that potential have been identified and can be categorized into three distinct features: driveways, curb ramps, and continuous accessible sidewalks. Throughout the corridor, these features range from poor, to adequate, to excellent; depending on the location and adjacent land uses. But they are the backbone to making an area inviting and safe for all users.

Driveways

Fourth Plain Boulevard has many businesses along the corridor including retailers, services, restaurants, and community organizations. Having an active commercial corridor is excellent, but often comes with frequent driveways resulting in increased conflicts between users. Many blocks of Fourth Plain Boulevard have close to 40% of their length taken up by driveways.

In many cases, driveways could be reduced in size while still providing crucial access to small and local businesses. This would decrease the overall space occupied by driveways while simultaneously slowing the movement of vehicles traveling in and out of them. Further, driveways could be consolidated through partnerships between property owners and easements. Consolidating driveways would reduce the number of drives pedestrians have to cross as well as improved access management.

For people using mobility devices, driveways present further challenges as users must traverse through them with a cross-slope or inadequate ramps. Reducing the size and fine-tuning designs with accessibility in mind would improve the experience greatly.

Curb ramps

As discussed previously, curb ramps are present at all existing Pedestrian Hybrid Beacons and full signalized intersections. Some are not up to current standards, but most are adequate to get a pedestrian – walking or rolling – across the roadway.

Crossing side streets and larger commercial accesses do not necessarily provide the same accommodations. For example, on the south side of Fourth Plain Boulevard, at the Z Street Hybrid Beacon, a mobility impaired pedestrian traveling east on Fourth Plain Boulevard would be forced to re-route as ramps are not currently present to cross Z Street. That person would have to either cross Fourth Plain Boulevard at the Z Street Hybrid Beacon and travel east on the north side of Fourth Plain Boulevard, or they would have to travel south to cross Z Street using the adjacent businesses' driveways.

Many existing curb ramps along Fourth Plain are diagonal meaning they provide one ramp for travel in both directions. This puts users directly into the roadway in a different direction than they intend to travel. Directional ramps are much more accessible and comfortable for all users. City of Vancouver provides a standard detail for "Double Directional Ramp Placement" (T02-05A).

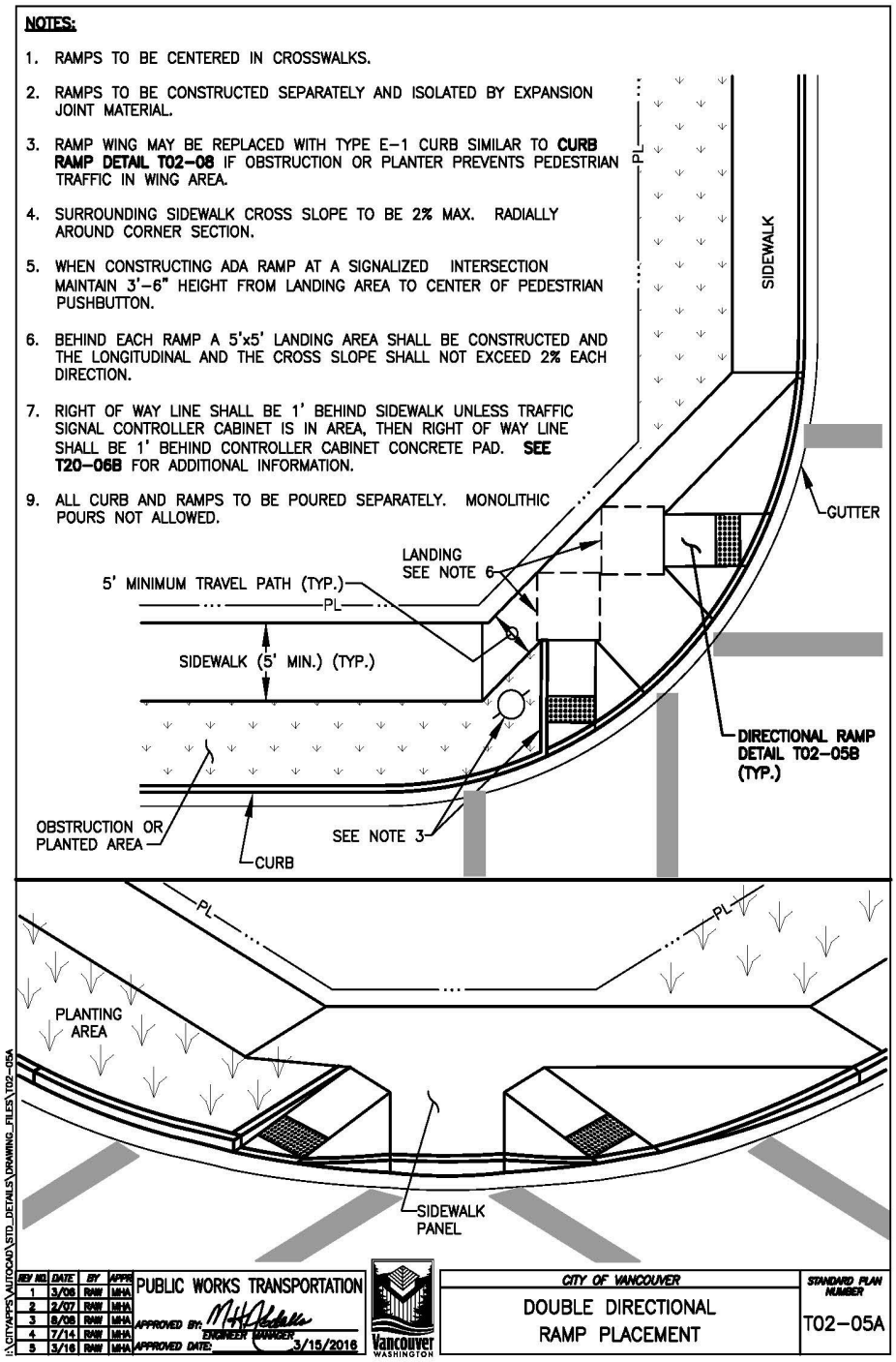

Figure 15. Recommended standard detail for future development and retrofits

Sidewalks

Signs, utility poles, signal poles, and many other fixtures are inevitable on a corridor like Fourth Plain Boulevard. It is important to ensure that these are not obstructing the travel way for pedestrians.

Figure 16 shows an extreme example located just east of the proposed new crossing at Water Works Park.

Figure 16: Example of pedestrian through way being obstructed. (Image from Google Streetview)

Recommendations

Adequate driveways, curb ramps, and continuously accessible sidewalks are a challenge to implement in a corridor like Fourth Plain Boulevard as there are so many instances of these features not being at the desired condition. Without a full access management or control plan, it would not make sense to identify specific driveways, corners, or sections of sidewalk that could use improvements.

TDG recommends that as future capital projects and development occur on and around Fourth Plain Boulevard, the City have a policy and plan in place to focus on identifying and fixing these features. New curb ramps should be directional and include tactile domes, and signs, poles or other street fixtures should remain outside of the traveled way for pedestrians. Further, on Fourth Plain Boulevard, new driveways should be as narrow as feasible and there should be an effort made by the City to consolidate driveways. Consolidating driveways, a form of access management, improves overall safety for both vehicles and pedestrians and reduces congestion. Perceived impacts to adjacent commercial buildings is often the biggest issue when implementing driveway consolidation. The City's effort should include education on the benefits of driveway consolidation to adjacent business and property owners.

Pedestrian Network Analysis

Using the same methodology as presented in Section 2, TDG conducted a second Pedestrian Network Analysis to measure the effectiveness of the potential improvements evaluated within this section. Three new crossings on Fourth Plain Boulevard were evaluated.
The results of the analysis are displayed in maps to highlight the improved reach of the pedestrian network

from The Vine BRT stations for average pedestrians. The walk shed maps are arranged based on the time improvement the average pedestrian would experience if the pedestrian connector or new crossing was constructed. Properties colored from light to dark green can be reached with an improvement of 2.5 to 7.5 minutes and properties with new access are colored in blue, based on the pedestrian connector or new crossing. Parcels that would not experience an improvement of at least 2.5 minutes were not included in the map.

Impact of Potential Improved Crossings

The mapped results for average pedestrians can be found in Figure 17. The methodology used for the Pedestrian Network Analysis uses The Vine BRT stations as origins and destinations. Due to this methodology, the results of the Pedestrian Network Analysis do not show any travel time improvement for two of the three potential improved crossings (Watson Avenue and Laurel Place). However the third, Vancouver Water Works will improve travel time around 3 minutes for people accessing The Vine station located just west of the potential improved crossing.

Conclusion

Through this analysis, TDG prioritized pedestrian connections and new crossings per impact, feasibility, connectivity, and the results of the Pedestrian Network Analysis. The findings from this analysis, in combination with local knowledge from City staff were used to identify two pedestrian connections and two new crossings to prioritize for further feasibility studies and cost estimates.

Based on the findings of the previous section, Section 4 provides an additional evaluation on the feasibility of constructing pedestrian refuge islands at the existing Hybrid Beacons that do not already have them:

- VA/Clark County Public Health (mid-block between T Street and St. John's Boulevard),
- Neals Lane, and
- Todd Road/Rossiter Lane.

Additionally, this memorandum will explore the feasibility of constructing an island at the newly proposed crossing at Laurel Place as well as potential enhancements for existing islands along Fourth Plain Boulevard. Preliminary design schematics for the proposed refuge islands and a detail sheet can be found in the appendix to the memorandum.

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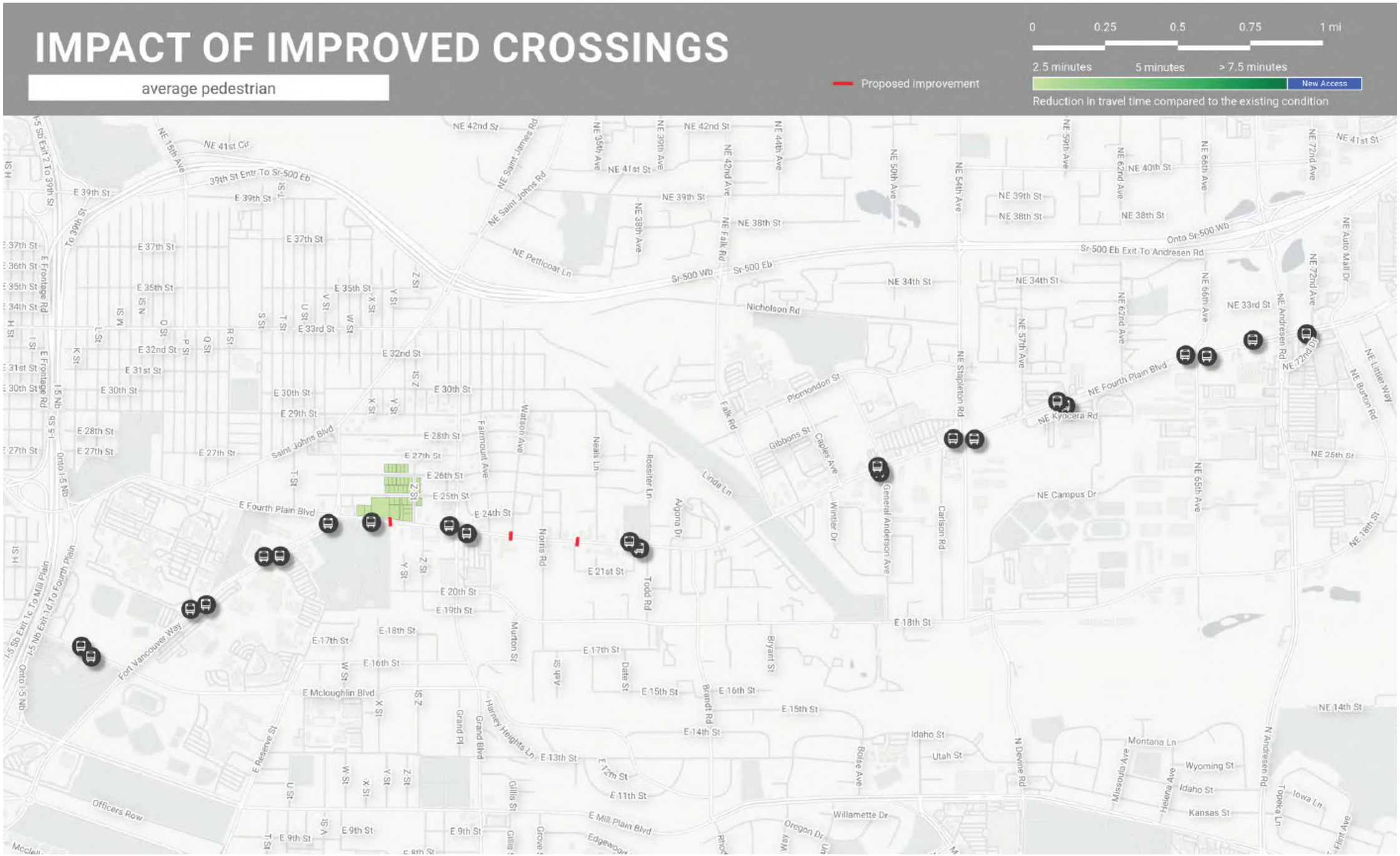

Figure 17 Impact of Potential Improved Crossings

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New Pedestrian Refuge Islands

Pedestrian refuge islands assist in conveying to drivers that people crossing may be present. Each of the proposed new pedestrian islands should be installed in conjunction with the previously recommended improvements to the Hybrid Beacon, as described in Section 3. See Appendix B for Schematic Designs of the crossings with new pedestrian refuge islands.

- Replace R10-23 with R10-23a; “CROSSWALK STOP ON RED, PROCEED WHEN CLEAR”.
- Replace R10-6a with R1-5b; “STOP HERE FOR PEDESTRIANS” with a symbolic stop sign.
- Add 2” wide reflective panel on the face of the “PEDESTRIAN CROSSING” sign post.
- Install 4” Double White Lane Lines for 100’ leading up to the stop line to restrict lane changes.

As noted in the previous section, these recommendations are minor, but when implemented throughout the corridor and with the addition of pedestrian refuge islands, it is expected that the experience for all users will improve.

Refuge Island Design Considerations

The design of pedestrian refuge islands can range significantly depending on location, existing road conditions, surrounding land uses, and the types of users that are anticipated. Along Fourth Plain Boulevard, the intention is to assist in providing comfort and clarity to all users as they travel on the corridor. Within the study area, Fourth Plain Boulevard typically has a five-lane cross section: two travel lanes in each direction and a two-way center turn lane. Bike lanes are present on the corridor from Grand Boulevard to Algona Drive and Caples Avenue to 62nd Avenue.

Given the conditions along the corridor, and to be consistent with existing refuge islands, each of the proposed islands are recommended to be placed within the existing two-way center turn lane. Based on a review of best practices, the following design guidelines are proposed:

- The island should have minimum dimensions of approximately 6’ by 20’ and should be no less than 150 square feet.[7]
- The crossing through the refuge island should be at grade and include 2’ tactile strips to assist mobility and visibility impaired users and be ADA compliant.
- A vertical element, such as a bollard or post, should be placed on the intersection side of the refuge island; a sign should be installed if visibility can be maintained.
- The refuge island should have a 6” vertical curb painted with retroreflective yellow paint to provide additional visibility to oncoming and turning vehicles.
-

Conceptual design schematics and a detail sheet can be found in Appendix B to this memorandum.

7 “Designing Walkable Urban Thoroughfares: A Context Sensitive Approach” Institute of Transportation Engineers, Congress for the New Urbanism, 2010.

VA/Clark County Public Health

This existing Hybrid Beacon is located at the western end of the project study area in between St. John's Boulevard to the west and T Street to the east. It is the only existing Beacon on Fourth Plain Boulevard that does not have a five-lane cross section, meaning no two-way center turn lane or center median island is present. It is located near Clark College's northern parking lot.

For a pedestrian refuge island to be feasible at this location, either the roadway width would need to increase, or the lane configuration would need to change. This cross section could be restriped similar to Fourth Plain Boulevard west of I-5, which contains one travel lane in each direction and a two-way center turn lane.

Neals Lane

This existing Hybrid Beacon is located towards the middle of the study area at Neals Lane in between Laurel Place to the west and Todd Road/Rossiter Lane to the east. The cross-section is currently two travel lanes in each direction with a left turn lane making up the fifth lane in the eastbound direction and a two-way center turn lane making up the fifth lane in the westbound direction. Bike lanes are provided in both directions. The Beacon and crosswalk are on the eastern leg of the T-intersection.

On the south side of the intersection there is a multi-unit commercial building with two large driveways providing access to the businesses. The western driveway is approximately 40' in width and is directly opposite Neals Lane to the north. The eastern driveway is approximately 40' in width. The existing Hybrid Beacon and crosswalk is located between these two driveways. A local auto repair shop is in the northwest corner of the intersection and has an approximately 50' wide driveway.

Figure 18 shows the proposed refuge island at the Neals Lane Hybrid Beacon and identifies movements in and out of the nearby driveways. The approximate driveway locations are shown in light blue.

As shown in the diagram, the westbound left turn into the western driveway on the south side of the road is the only turning movement that will be impacted by the installation of the pedestrian refuge island. Alternative options for this movement would be for the westbound vehicle to either turn into the eastern driveway or to conduct the left-turn from the southern westbound travel lane, as shown with the black arrow in Figure 18.

It is assumed that the minor leg of this intersection and the three driveways are all expected to have relatively low volumes. The movement that is impacted will be minor and have little effect on the operations and safety of the crossing.

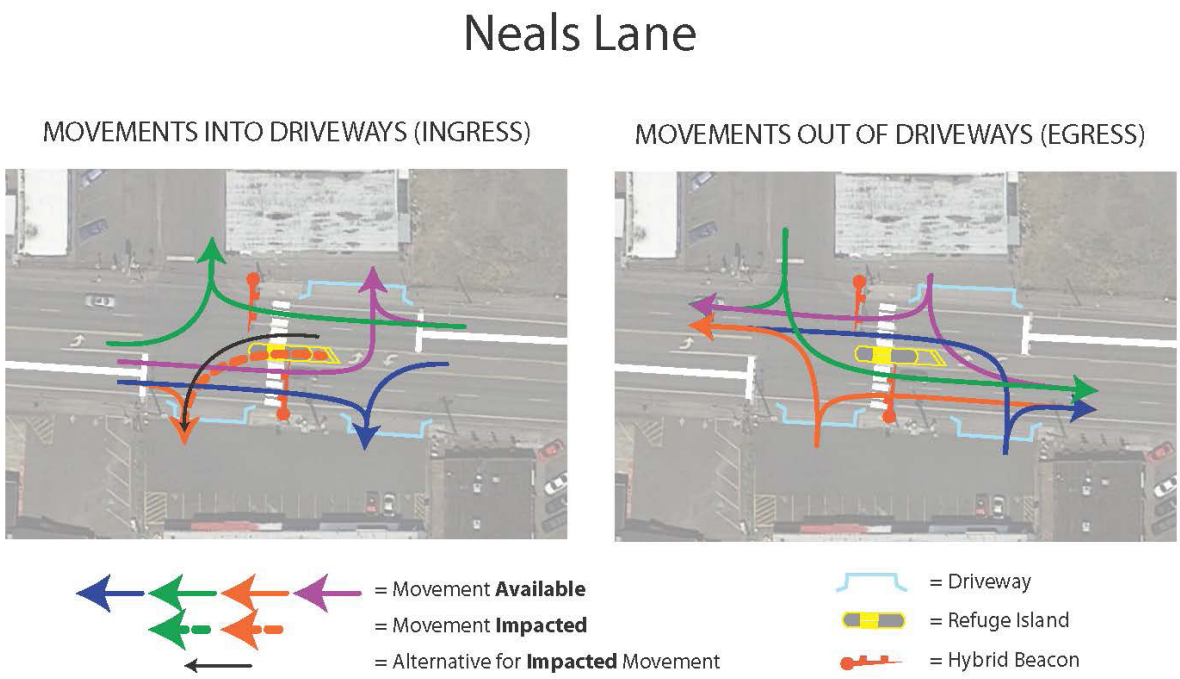

Figure 18. Diagram showing available and restricted turning movements with a refuge island present

Todd Road/Rossiter Lane

This existing Hybrid Beacon is located to the east of the Neals Lane Beacon. It is in between Wilson Avenue to the west and Hazelwood Drive to the east. The cross-section is currently two travel lanes in each direction with a left turn lane making up the fifth lane in the eastbound direction and a two-way center turn lane making up the fifth lane in the westbound direction. Bike lanes are provided in both directions. The Beacon and crosswalk are on the western leg of the intersection and The Vine BRT station is approximately 20 feet to the west.

There is a restaurant on the southwest corner of the intersection, and the southeast corner has a medical testing center and a law office. To the northwest is Evergreen Park and the northeast corner has a large multi-family dwelling. The north leg of Rossiter Lane is a dead end. There are no driveways in the immediate vicinity of the crosswalk and Figure 19 shows the approximate locations of those near the intersection.

In addition to the enhancements described for each of the existing and proposed Hybrid Beacons, it is recommended that the stop bar in the eastbound direction be moved 15' east. Currently, the stop bar is located directly in the middle of the BRT station, approximately 55' back from the crosswalk. This stop bar was present prior to the BRT station construction and the placement is consistent with other crosswalks and Hybrid Beacons crossing Fourth Plain.

However, the current location causes a conflict when a vehicle in the right lane approaches or is stopped at the Beacon on red at the same time a BRT bus arrives and is unable to pull all the way in to the station. Additionally, the stop bar is not visible in one travel lane due to the construction of the concrete pad for the BRT station. We recommend that the existing stop bar be removed and a new stop bar be added at the minimum distance of 40 feet between the signal head and the stop bar, per Section 4D.14 of the MUTCD.

Figure 19 shows the proposed refuge island at the Todd Road/Rossiter Lane Hybrid Beacon and identifies movements in and out of the nearby driveways. The approximate driveway locations are shown in light blue. The existing and proposed stop bars can be seen on the west leg of the intersection.

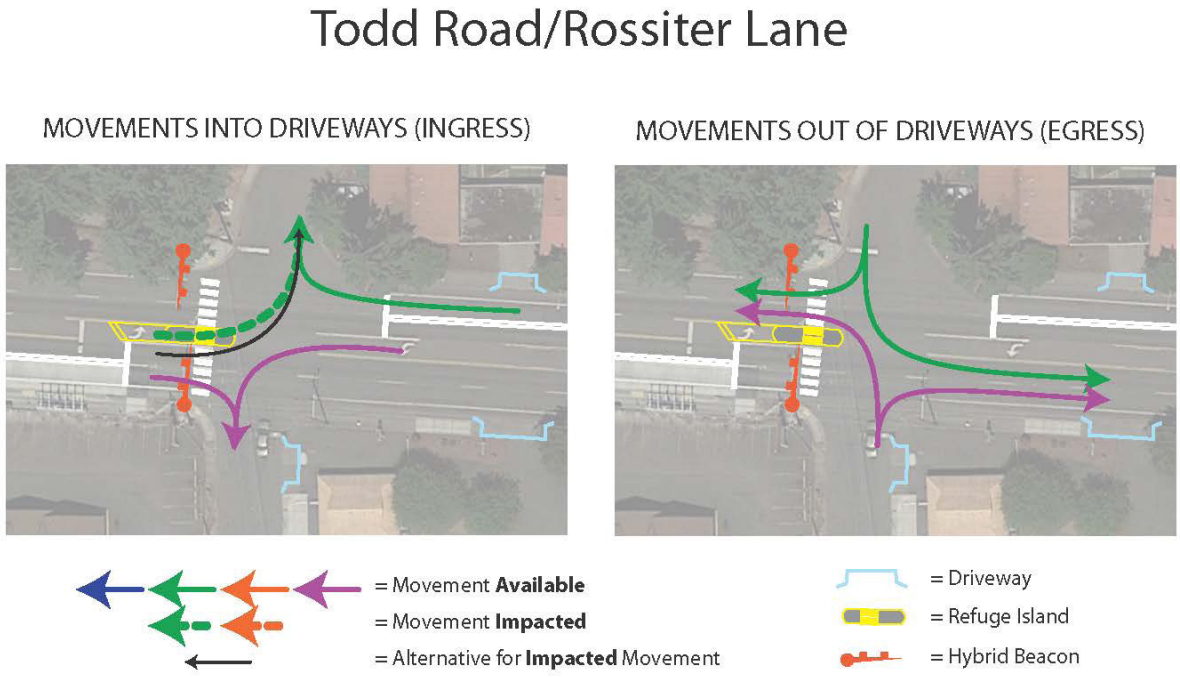

Figure 19. Diagram showing available and restricted turning movements with a refuge island present

As shown in the diagram, the eastbound left turn onto Rossiter Lane on the north side of the road is the only turning movement that will be impacted by the installation of the pedestrian refuge island.

Though there will be some traffic on this dead-end street due to multiple residences, the number of vehicles making this movement is expected to be low. This will require some turning vehicles to queue in the through lane when making their left turn. However, the frequency of this occurrence will be very low, and we expect little impact to the overall operations and safety of the intersection.

Laurel Place

As noted previously, the Laurel Place Hybrid Beacon was proposed as a potential new crossing location on Fourth Plain Boulevard. It is located west of the Neals Lane Beacon, between Norris Road to the west and Neals Lane to the East. It is a T-intersection, and there is no northern leg. The cross-section is currently two travel lanes in each direction and a two-way center turn lane making up the fifth lane. Bike lanes are provided in both directions. The Beacon and crosswalk are proposed to be installed on the west leg of the intersection.

There is a drive-through restaurant, Muchas Gracias, on the north side of the T-intersection which has two driveways to accommodate the in and out movements of the drive-through. To the west of Muchas Gracias there is a local market which also provides circular access around the building via two driveways for the in and out movements, respectively. To the east of Muchas Gracias is a small multi-unit commercial complex, which has a single driveway serving both the in and out movements. There are no driveways on the south side of Fourth Plain Boulevard in the immediate vicinity of the crossing, but two large driveways are present on Laurel Place.

Figure 20 shows the proposed refuge island and Hybrid Beacon at Laurel Place and identifies movements in and out of the nearby driveways. The approximate driveway location of those impacted are shown in light blue.

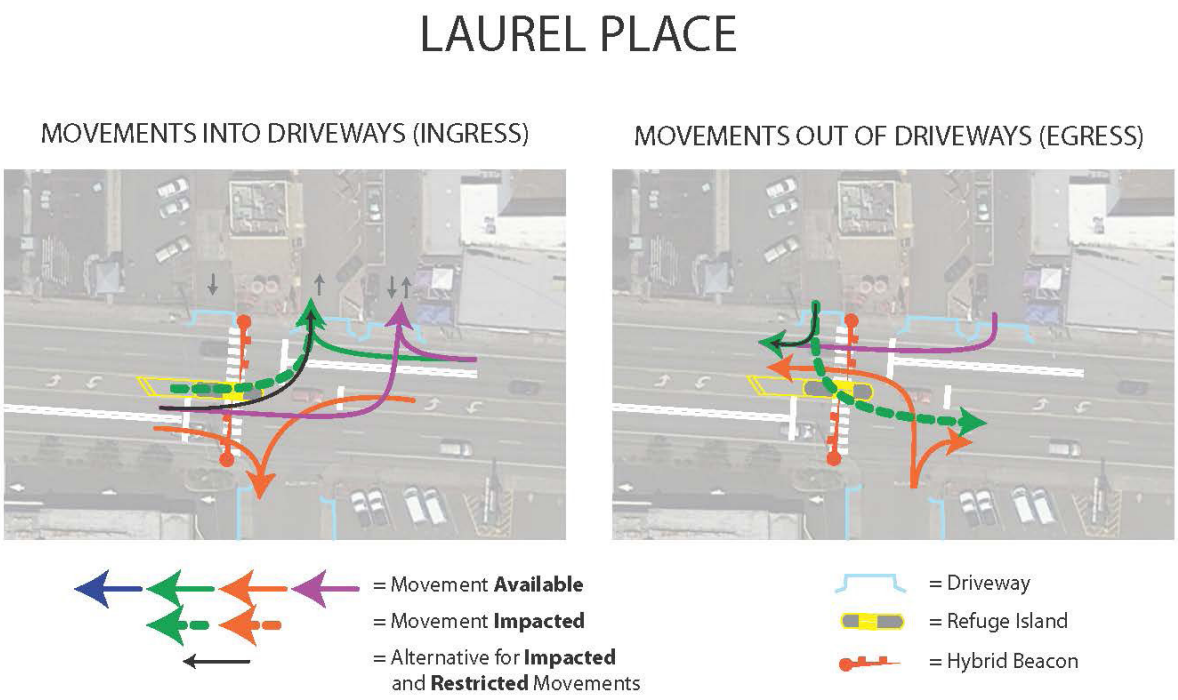

Figure 20. Diagram showing available and restricted turning movements with a refuge island present

As shown in the diagram, there are two movements that would be impacted by the proposed refuge island: the eastbound left turn into the Muchas Gracias ingress driveway, and the southbound to eastbound left turn out of the Muchas Gracias egress driveway.

Similar to the impacted left-turns at the previous two intersections, this movement is expected to have relatively low movements and can be accommodated by making the turn from the northern eastbound lane.

The second movement that is impacted by the implementation of the refuge island would need to be restricted to right-turn only. The island occupies the space needed to execute the turn and vehicles would be forced to maneuver around the island, causing significant safety implications to pedestrians as well as other vehicles on the road. By requiring vehicles to turn right, this movement no longer conflicts with the crossing. The proposed changes to the driveway operation should be reviewed with the business owner to ensure that the resulting traffic circulation pattern will support their business needs.

Conflict Concerns

At each of the locations, the proposed refuge island would require a small number of vehicles to make left-turns from the inside travel lane instead of the turn lane. This could result in one left-turning vehicle obstructing the view of the other, or in the two vehicles crossing paths while executing the left-turn. Though as noted above, each of these locations are expected to have low volumes for the left-turning movements and the frequency of either of these conflicts occurring is low.

Currently, the same condition is present at two of the existing pedestrian refuge islands: Z Street and Fairmount Ave. There have not been any documented issues at these intersections and they appear to be operating acceptably. The safety and comfort enhancements for the pedestrian experience are significant with the implementation of refuge islands. It is recommended that city staff weigh these safety benefits against the potential risks for turning vehicles when making a decision whether to install new pedestrian refuge islands at these locations.

Enhanced Pedestrian Refuge Islands

In addition to the new pedestrian refuge islands described above, the existing islands should also be brought up to the same best practice standards:

Z Street and Fairmount Avenue

The existing Z Street and Fairmount Avenue refuge islands are each currently approximately 35 feet by 7.5 feet, including the crosswalk. This exceeds the recommended minimum dimensions. Additionally, at each location, a vertical sign post is located at both ends of the island, the crossing is already at grade with ADA tactile strips, and there is a vertical 6” curb.

The most important improvement to these crossings would be to paint the curb with retroreflective yellow paint to provide additional visibility to oncoming vehicles. The site should be monitored regularly to ensure that the signs remain intact and the curb does not become significantly damaged. Those two upkeep issues can reduce the safety impacts of the refuge island if not maintained.

Figure 21. Existing pedestrian refuge island at Z Street; Image courtesy of Google Earth

Figure 22. Existing pedestrian refuge island at Fairmount Avenue; Image courtesy of Google Earth

5900 Block

The existing refuge island at the 5900 Block midblock crossing is slightly different than the typical application described throughout this memorandum. This island is part of a larger raised center median that occupies the center lane for approximately 280' outside of a commercial complex and at the location of The Vine BRT station.

This median and crosswalk cut-through was built in conjunction with the BRT station. There is an offset crossing cut through the island to assist with providing pedestrians better sight lines while crossing both directions of travel.

The best practice standards described above do not apply in full to this location. An at-grade crossing with ADA tactile strips and a 6" vertical curb is present. An additional push button serves as the vertical element and provides people crossing the opportunity to execute the crossing in two phases if needed.

This location has no recommended improvements, as it is relatively new and meets best practices for design.

Figure 23. Existing raised median and offset crossing at the 5900 Block Hybrid Beacon

Landscaping

It is recommended that when feasible, the proposed pedestrian refuge islands should include landscaping within the island. Landscaping has flexible siting requirements, and assists with storm water management [8] .

The minimum width for landscaping to be feasible is four to five feet. As noted in this report, we recommend a minimum width of six feet for a pedestrian refuge island. Any landscaping should be designed to maximize sight triangles at crossing locations and provide good visibility for both the pedestrian and the driver. Any vegetation should be under three feet tall and not require significant maintenance. Low growing hardy evergreen shrubs are a commonly used for this application.

When landscaping in the public right of way is added, it increases the sense of place and the overall aesthetic of the area. When implemented with the rest of the improvements recommended with this project, landscaping in the refuge islands would be yet another tool to improve the user experience for people along Fourth Plain Boulevard.

8. "Urban Street Design Guide", National Association of City Transportation Officials. 2016.

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CHAPTER 5

PEDESTRIAN SCALE STREET LIGHTING

Research has shown that darkness is related to a disproportionate amount of crashes and fatalities, particularly those that are a result of collisions between vehicles and pedestrians. In fact, it is estimated that pedestrians are between three and seven times more vulnerable in the dark than during daylight hours[9]. Proper street lighting can reduce pedestrian crashes up to 50%, making lighting an important factor in any environments where conflicts may occur[10,11,12] . While it's not known how much lighting influences pedestrian crashes on Fourth Plain Boulevard, it is important to note that six out of the nine pedestrian crashes that occurred (and were reported) on the corridor between 2013 and 2015 happened at night.

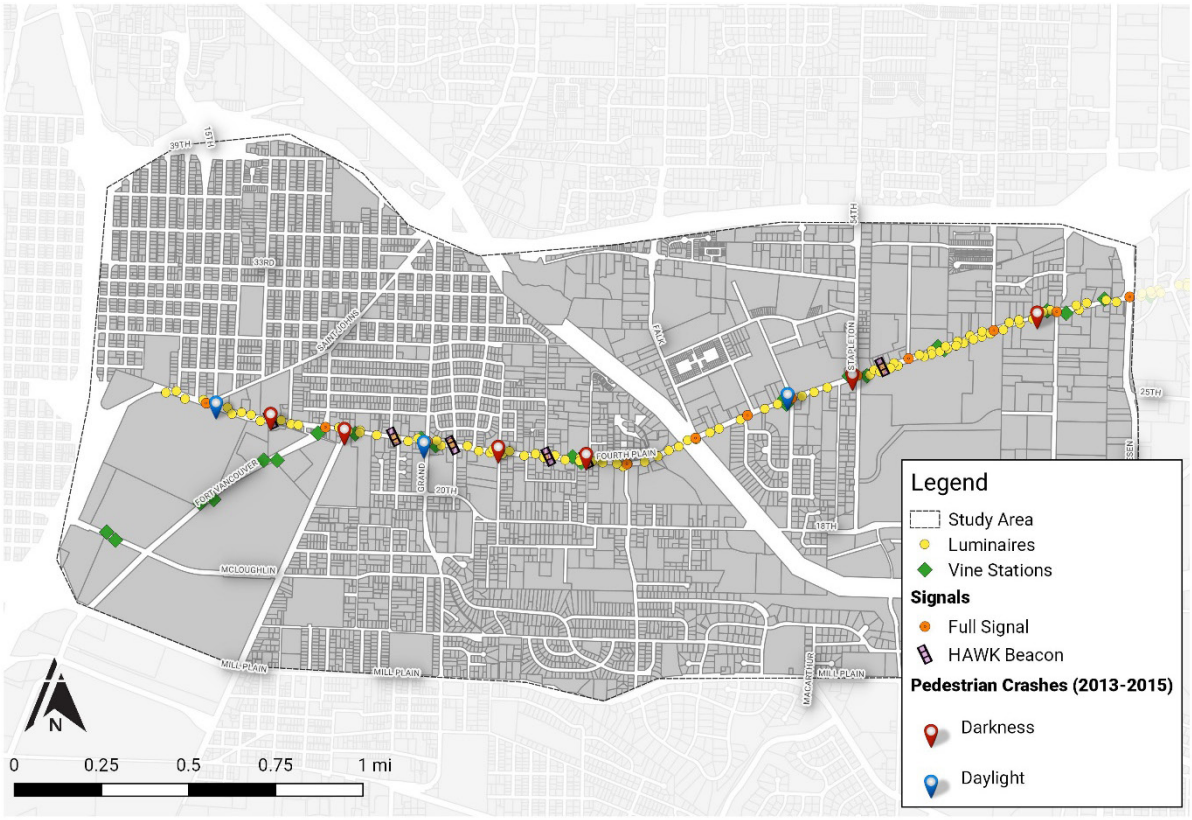

Figure 24. Locations and time of day of pedestrian crashes along Fourth Plain Boulevard in Vancouver, WA between 2013 and 2015

On urban arterial roads, such as Fourth Plain Boulevard, a review of studies has shown that in 42 out of 49, improved lighting resulted in increased safety; 14 of these studies showed statistically significant effects. In fact, 'good lighting' has resulted in urban routes with fewer and less sever crashes; crashes on urban roadways can be reduced by nearly 30% due to lighting, with pedestrians benefiting the most (a 45% reduction in pedestrian crashes)[13].

9. Sullivan, J.M., and Flannigan, M.J. (1999) Assessing the Potential Benefit of Adaptive Headlighting Using Crash Databases, Report No. UMTRI-99-21. University of Michigan Transportation Research Institute.

10. Schwab, R.N., Walton, N.E., Mounce, J.M., and Rosenbaum, M.J. (1982) Synthesis of Safety Research Related to Traffic Control and Roadway Elements-Volume 2, Chapter 12: Highway Lighting. Report No. FHWA-TS-82-233. Federal Highway Administration.

11. Commission Internationale de l'Éclairage. (1992) Road Lighting as an Accident Countermeasure. CIE No. 93. Vienna, Austria: Commission Internationale de l'Éclairage

12. Elvik, R. (1995) "Meta-Analysis of Evaluations of Public Lighting as Accident Countermeasure." Transportation Research Record 1485, TRB, National Research Council, Washington, D.C., pp. 112-123.

13. Tanner, J.C. (1958) "Reduction of Accidents by Improved Street Lighting." Light and Lighting, 51, pp. 353-355.

Given that most pedestrian/vehicle collisions occur at intersections, properly lighted intersections are vital to any pedestrian safety efforts along a street or corridor [4,14,15,16]. Unsurprisingly, lighted intersections have been shown to have fewer crashes than unlighted intersections due to the increased visibility for all aspects and areas. While lighting along a corridor does improve safety, it has been shown to have a lower impact on safety and collisions than may be expected; run-off road crashes are mostly due to factors such as fatigue and intoxication, for which lighting may not be an effective counter-measure[17].

Any lighting, including lighting not at intersections, can impact the security of users beyond safety related to collisions. Studies that have tried to relate increased lighting to crime reduction have shown impacts (23-30% reductions), but other factors (increased police presence and unreported crimes) make these conclusions difficult to confirm[18]. What research has definitively shown, though, is the positive impact increased lighting can have on lowering the fear of crime[19]. This effect on perceived security and its relationship to encouraging individuals to walk or use as area may by justification in itself to improve lighting.

In summary, lighting is an instrumental component in creating a corridor that provides real and perceived safety for its users, regardless of mode. On Fourth Plain Boulevard, this would mean that drivers would have adequate visibility to see other drivers, bicyclists, and pedestrians along the corridor and, most importantly, at crossing locations. Proper lighting should also give people walking and biking a feeling of comfort and safety knowing that they can be seen by other roadway users and have an improved sense of security as they go to and from destinations along the corridor.

This section will:

- Provide an overview of pedestrian visibility concepts
- Summarize current lighting conditions along Fourth Plain Blvd
- Recommend lighting improvements aimed to improve real and perceived safety for all users

Pedestrian Visibility Concepts

According to the Federal Highway Administration, pedestrian visibility is “the distance at which a driver can see a pedestrian well enough to be able to respond appropriately to the pedestrian’s presence.” Visibility is tied to contrast – the lighting designer’s task is to maximize the contrast between the pedestrian and the visual background behind the pedestrians. The starker the contrast, the more visible the pedestrian.

There is a suite of factors that contribute to the difference in contrast most notably roadway lighting, headlamp lighting, pedestrian clothing, and the characteristics of the background. Of these factors, the roadway lighting is the one that a lighting designer can control and can make the most consistent difference in increasing visibility along a roadway.

14. Box, P.C. (1970) Relationship Between Illumination and Freeway Accidents. IERI Project 85-67 Illuminating Research Institute, New York April, pp. 1-83.

15. Bruneau, J.F., Morin, D., and Pouliot, M. (2001) “Safety of Motorway Lighting.” Transportation Research Record 1758, TRB, National Research Council, Washington, D.C., pp. 1-6.

16. Isebrands, H., Hallmark, S., Hans, Z., McDonald, T., Preston, H., and Storm, R. (2004) Safety Impacts of Street Lighting at Isolated Rural Intersections: Part II, Year 1 Report. Center for Transportation Research and Education. Iowa State University, Ames, IA.

17. Rea, Mark S., et al. Review of the Safety Benefits and Other Effects of Roadway Lighting. June 2009. http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP05-19_LitReview.pdf

18. Farrington, D.P., and Welsh, B.C. (2002) Effects of Improved Street Lighting on Crime: a Systematic Review. Home Office Research Study 251. London: Home Office Research, Development and Statistics Directorate.

19. Painter, K. (1996) “Street Lighting, Crime and Fear of Crime: a Summary of Research,” in T.H. Bennett (ed.) Preventing Crime and Disorder: Targeting Strategies and Responsibilities, 22nd Cropwood Round Table Conference, Cambridge, UK: University of Cambridge.

When discussing pedestrian visibility, there are a few technical concepts that are essential to understanding:

- **Illuminance:** Illuminance is the amount of light that falls on a surface per unit area.
- **Vertical Illuminance.** Vertical illuminance is the illuminance on a vertical surface.
- **Luminance**. Luminance is the light emitted from a surface. For road environments, it's a description of how bright an object appears from a particular viewpoint.

The following sections are a summary of the FHWA's Information Report on Lighting Design for Midblock Crosswalks. All figures in this section are from this report[20].

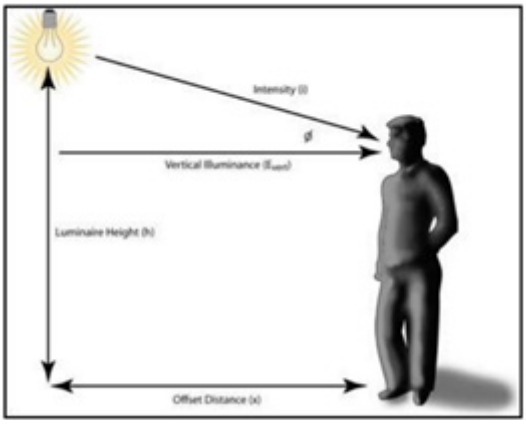

Figure 25. Visual depiction of vertical illuminance (Source: FHWA)

Lighting Considerations

As previously mentioned, a lighting designer's goal is to create contrast between the object that they desire to be seen (pedestrian) and the background (roadway beyond the crosswalk). To achieve this goal, the following four factors need to be considered:

Vertical Illuminance: Research has shown that good vertical illumination is needed to provide adequate detection distance (Figure 25).

Lighting Selection. Selecting the appropriate lights and height is critical to ensure adequate crosswalk lighting and to produce adequate horizontal distribution of light (if all the light is directed downward, the pedestrian will not be illuminated for oncoming drivers).

Lighting Placement. While it is common to install street lights directly over crosswalks, this placement provides high luminance of the crosswalk while not adequately illuminating the pedestrian. FHWA recommends street lights be placed prior to the crosswalk in the direction of travel in order to provide adequate vertical illumination (Figure 26).

20. Federal Highway Administration (2008) Informational Report on Lighting Design for Midblock Crosswalks. Publication No. FHWA-HRT-08-053. https://www.fhwa.dot.gov/publications/research/safety/08053/08053.pdf

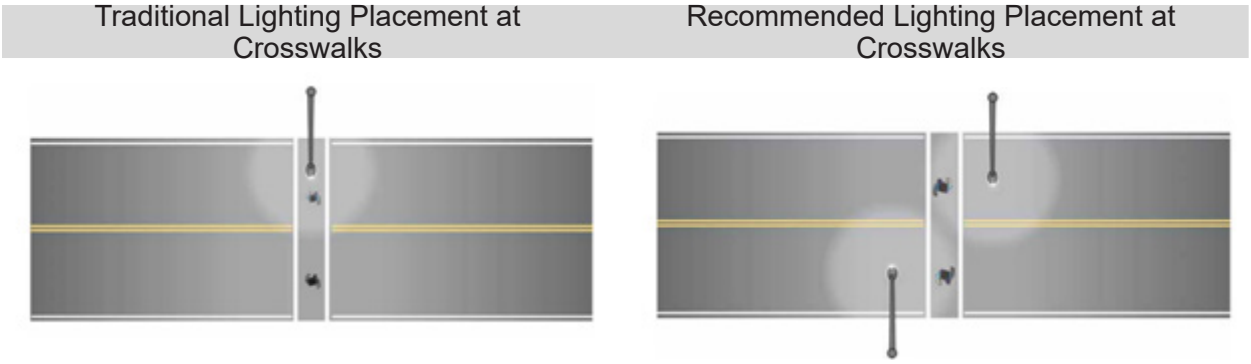

Figure 26. Lighting recommendations at crosswalks (Source: FHWA)

It is also important to consider the distance between street lights before and after the crosswalk to maintain the desired contrast levels. FHWA recommends that the next light after a crosswalk should be located at least 10 times farther away to mitigate any change in background luminance.

Crosswalks at Intersections. FHWA recommends that the amount of light at an intersection should equal the sum of the amount of light level provided for each intersecting roadway.In addition, FHWA recommends that lighting occur at the entrances of the intersection to provide vertical illumination of pedestrians and other intersection users, which is different than what is traditionally done (Figure 27).

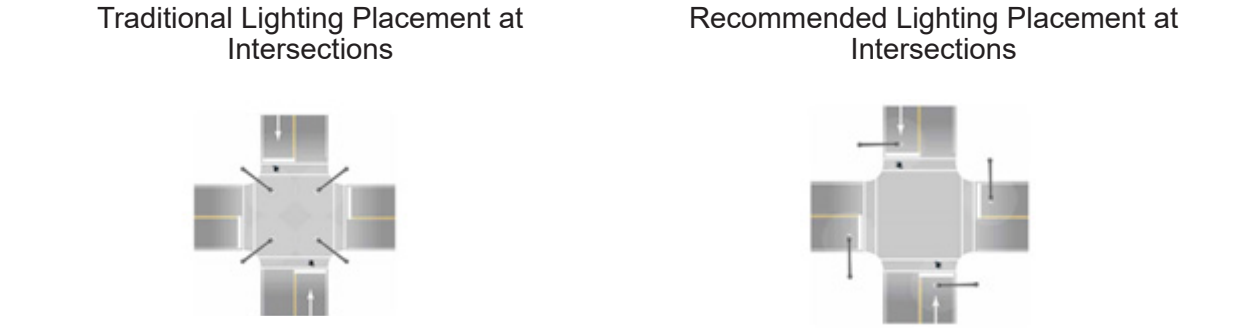

Figure 27. Recommended lighting placement at intersections (Source: FHWA)

Lighting for Corridors

While most of the conflict along corridor occurs at intersections and crossings, it is still necessary to consider the lighting along the corridor as a component in the overall walkability of the area. The quality of lighting along a corridor is generally tied to two factors: the height of the street light and the spacing between the lights.

Street Light Height: As improved technology has allowed for brighter street lights, light height has increased. Higher lights can increase visibility for vehicles and parked cars, but can make someone walking hard to see because of the large scale. Lowering the lights will increase visibility of the pedestrian streetscape and will also require more lights to achieve the same illumination, in turn lighting the human-scale environment more thoroughly.

Light spacing. Consistent light covering is key to creating smooth illumination along a corridor and prevent users from encountering intervals of darkness. This is especially important along sidewalks, because of the feeling of vulnerability of pedestrians (both real and perceived).

As an example, the Project for Public Spaces offers this example to show the difference between simply meeting standards and producing a desirable environment: A typical DOT lighting scheme for an average street 40′ in width (two traffic and two parking lanes) would have 25′ to 40′ street lights every 125′-150′, staggered on either side of the street. An alternative to this vehicle-oriented scheme is to reduce the height of the lights to 13′ and place them every 50′ and opposite each other. The staggered approach may result in fewer lights needed due to illumination overlap and the lower lights will improve the pedestrian feel of the corridor[21].

Existing Conditions on Fourth Plain

Lighting along Fourth Plain Boulevard is, generally, a series of cobra-head, single-arm lights. Their spacing varies along the corridor depending on intersection spacing, existing power poles, HAWKs and/or BRT stations. The figure shows the locations of lights along Fourth Plain Boulevard tied to images of the roadway for reference. Per the City of Vancouver website, the City complies with the standards for roadway lighting generated by the Illuminating Engineering Society.

In general, there are three arrangements of lights in the corridor:

21. Project for Public Spaces (viewed 7/5/17) https://www.pps.org/reference/streetlights/#How far apart should lights be spaced?

Figure 28. Overview of roadway lighting conditions on the Fourth Plain project corridor

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Table 8. Types of lighting on Fourth Plain Blvd

Location of Lamps	Description	Image
Corridor	These lights are primarily for the benefit of drivers and provide illumination throughout the corridor. Given their opportunistic location on power poles in addition to City owned poles, they are not evenly spaced throughout the corridor.	
Intersection	At large, signalized intersections, the signal mast arms also have an attached lights. This results in the lamp being directly over the crosswalk.	
HAWK Signals	At HAWK Signals, cobra lights are attached to adjacent power poles as available. In addition, each HAWK mast arm includes a pedestrian scale light to illuminate the pedestrian waiting area.	

Recommendations for Fourth Plain

While the City is most likely meeting its lighting standards along Fourth Plain Boulevard, there are opportunities for improved illuminance to benefit pedestrian safety along the corridor. The major recommendations fall into three categories: lighting types, height, and spacing; lighting for pedestrian crossings; and conditions and standards.

Recommendations for Lighting Types, Height, and Spacing

It is recommended that the City consider using metal halide (MH) lights in place of high-pressure sodium (HPS) at high conflict locations along Fourth Plain and at HAWK Crossing. HPS is a usual choice for most roadway applications because of its high efficiency and long lifespan, but MH lights produce a white/bluish white that provides for better illumination versus the amber light of HPS. In addition, MH may provide a safety benefits due to the color of light improving driver peripheral vision.

LEDs have yet to be thoroughly vetted for pedestrian safety and impacts, although many cities are doing large LED replacements to meet energy saving and sustainability goals. It should be noted that the change from HPS lights, which have a light that is pink or orange tinted, to LEDs, which produce a white light, is often seen as harsh for pedestrians and can increase glare. It is recommended that a mockup of various colors and brightness of LEDs be conducted along the corridor for public feedback before any large-scale replacement takes place. Davis, CA, conducted a mockup of LED levels and colors after a large installation, which resulted in adjusting the color and the lamp brightness. If the city had conducted this mock-up before their installation, they could have saved over $350K on adjustments and reinstallations.[22]

While an ideal pedestrian environment would have lights as low as 13,' it would be unreasonable to expect that height (and the resulting needed number of lights) along the entire Fourth Plain Corridor. Instead, an evaluation of high pedestrian use areas could help assess and decide where lower and more tightly spaced lights would be most effective in helping pedestrians feel safer and be more visible.

- **Short-term recommendation:** Replace lights at approaches to HAWK beacons with MH lights
- **Long-term recommendation:** At higher pedestrian use areas, replace HPS lights with MH and lower lights to 15', and add additional lights where needed to meet desired lighting levels.

Recommendations for Pedestrian Crossings

Building on the recommendations above, if the City is wary of converting too many of its existing HPS lights to MH, changing the lights at and near crossing locations to MH would be a good first step. The white light from the MH lights provide a higher level of facial recognition and roadway comfort for users, and, if used in a mostly HPS corridor, can provide additional contrast opportunities at pedestrian crossings. The lamp change could be further complemented by lowering the lights to a maximum of 15ft within 100ft of crossings.

In addition, it is recommended that the City adjust lighting placement at pedestrian crossings per the FHWA research and place the lights prior to the crossing to gain vertical illuminance for the pedestrian. If needed, it is also recommended to consider extended mast arms to provide lighting for more of the crossing.

Lastly, it is recommended that the waiting areas at the HAWK signals be evaluated for driver visibility. At some of these locations, poles, electrical boxes, or other infrastructure may block drivers from seeing a pedestrian waiting for the signal. It is recommended that City staff evaluate these locations for potential improvements.

22 International Dark-Sky Association. City's LED Retrofit Shows Need for Careful Lighting Choices. http://www.darksky.org/citys-led-retrofit-shows-need-for-careful-lighting-choices/ Viewed on 7/10/17

- **Short-term recommendations:** Convert lights at crossings to MH
- **Long-term recommendations:** Lower lights at crossings to 15 ft, reposition lights prior to crossings versus on top of crossings, reevaluate standards for street corridors with high pedestrian traffic

Recommendations for Conditions and Standards

For the general corridor, the cobra style lights are appropriate. Modeling the luminance produced by these lights could provide a more detailed picture of whether the City is meeting its lighting standard and if there are any locations that need a different type or light or more frequent placement along the corridor.

- **Short-term recommendation:** Gather necessary light type and height data needed to model corridor illuminance
- **Long-term recommendation:** Model the corridor prior to and after any major improvements to compare illumination with desired standards

It is recommended that the City consider "intelligent street lighting" (also known as "adaptive street lighting") which can brighten to a desired level as a pedestrian passes near the light. This increase in lighting would help the pedestrian feel safer as well as create greater visual contrast for drivers in the corridor. Adaptive street lighting is starting to be used more nationally and is especially common on college campuses where night time lighting is needed, but at infrequent intervals.[23] A case study on adaptive lighting can be seen in the sidebar.[24]

Adaptive Lighting

Case Study

University of California-Davis established the Smart Lighting Initiative in their quest to reduce electricity consumption from lighting by 60% from 2007 levels. Initially, the campus transitioned over 1,500 streetlights, post-tops, and wall packs to LEDs.

Beyond the LED transition, the campus adjusted their lighting to comply with California's latest energy efficiency codes which required fixtures that consume 75 watts or more and are 24' or lower should be controlled with a motion sensor, in effect making all pedestrian-scale lighting sensor-controlled.

23 State Partnership for Energy Efficient Demonstrations. Adaptive LED Street and Area Lighting. Selecting, financing, and implementing best-practice solutions. http://cltc.ucdavis.edu/sites/default/files/files/publication/FINAL_DRAFT_BC_Adaptive_Area_Lighting_140613.pdf Viewed on 7/6/2017

24 University of California, Davis. Campus-Wide Networked Adaptive LED Lighting. http://cltc.ucdavis.edu/sites/default/files/files/publication/final_case-study-uc-davis-scaled-deployment-networked-ext-07-2014.pdf. Viewed on 7/6/2017.

Evaluation and Next Steps

Moving forward, it is important to be able to measure improvements both in infrastructure and safety outcomes. Currently, the City is limited on its ability to model the illumination in the corridors due to a lack of data regarding existing lighting infrastructure. Specifically, the City would need to collect the locations of lights, installation height, and lighting type (manufacturer). Once this data is collected, an analysis could be completed to model the existing lighting conditions of the corridor. As lighting is changed, and/or updated, the model could be reproduced to show the improvements in illumination.

The reason for improving the illumination in the corridor is user safety. Ideally improvements in lighting would correspond to a reduction in collisions. It is important for the City to continue to monitor information on collisions (especially bike and pedestrian collisions, which are often unreported), including the crash location, reason for crash, and whether the crash happened during daylight hours. This information can help City staff strategize on lighting improvements to make the corridor a safer experience for all users.

CHAPTER 6

PUBLIC OUTREACH BEST PRACTICES FOR HAWK SIGNALS

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Hybrid beacons were installed at locations where the highest number of pedestrian collisions historically occurred on Fourth Plain Boulevard with the intent to improve safety and comfort for pedestrians crossing Fourth Plain Boulevard. Since driver compliance is essential to the effectiveness of hybrid beacons, outreach and public education play a key role in creating successful user experiences with hybrid beacons.

This section presents a review of the City's existing outreach efforts, evaluates their effectiveness for both drivers and pedestrians, and identifies gaps and opportunities for enhancements. In addition, this section provides a summary of best practices from across the country on HAWK beacon educational campaigns and, using this information, proposes an educational campaign strategy that could be implemented for Fourth Plain Boulevard.

Existing Conditions and Use Behaviors

The City of Vancouver installed five HAWK beacons along Fourth Plain Boulevard in 2014, which significantly increased the number of pedestrian crossing opportunities along the corridor. HAWK beacons are a new traffic control device to most drivers and pedestrians, and they may not see them activated very often, therefore, there is often a "learning" phase, where compliance is low and users might be confused as to what to do during the different phases of HAWK beacon.

These behaviors are expected for HAWK beacons, given their relatively small amount of use in Vancouver and nationwide. In talking to staff from other cities where there are HAWK beacons, it was found that the more beacons there were, and the longer they were in use within a City, the more compliance and understanding of how to respond to the different phases of the beacon improved. In addition, driver confusion was often mitigated or corrected if another driver knew what to do (e.g., the drivers stay stopped at the flashing red phase until one other driver treats it as a stop sign; then all others respond similarly).

Existing Education and Outreach

TDG staff spoke with Loretta Callahan and Brooke Porter, two of the City of Vancouver Public Work's Public Involvement Specialists, on their outreach work along Fourth Plain Boulevard. The City began outreach around the HAWK beacons before the City installed the HAWK near Clark College. For this effort, the City created sandwich boards, handed out informational pamphlets to neighbors and neighborhood businesses, worked with Clark College to educate employees and students, and published an article in the student paper.

As additional signals were upgraded, a more extensive outreach process began. Efforts included in-person conversations with business owners along the corridor and neighborhood liaisons, and distribution of the informational brochure in English, Spanish, and Russian. The informational flyer was also given to the DMV and local schools.

The City created an instructional video on how HAWKs are used (https://www.youtube.com/watch?v=ImgJKQxaZ20), and worked with the local media, both print and television to spread the word on the new HAWK locations and how to use the signals as both a pedestrian and a driver.

In addition, Public Works collaborated with the motorcycle police unit to conduct an enforcement action. While the officers did communicate on legal behavior for HAWK beacons when they pulled over drivers, they also gave citations for traffic violations.

All the City's public outreach on the corridor, besides the enforcement action, occurred prior to the HAWK beacon's installation. Yet, even with these materials, the compliance rate is lower than desired and the community still does not have confidence that users know how the signals work. In a following section, we will propose strategies for community outreach to educate the residents, business owners, community members, and other users of the corridor.

Best Practices

TDG contacted the following Cities to learn about their outreach programs related to signal improvements and, if available, HAWK beacons. While there are many more cities that have implemented HAWK beacons, we believe the cities represented here provide a good basis for understanding outreach opportunities needed for situations and communities like those along Fourth Plain Boulevard in Vancouver.

City of Tucson, AZ

Tucson, AZ is nationally recognized as the birthplace of the HAWK signal, having invented and installed the first signal in 2000. Even with the history, there remains some confusion by a small number of drivers about the "flashing red" part of the cycle; often drivers will remain stopped through the flashing red instead of stopping and then proceeding when safe. According to Dr. Richard Nassi, the creator of the HAWK signal and Tucson's retired Transportation Administrator, it took time (not necessarily education efforts) for the drivers to realize that they may move when the red lights are flashing, but the more experienced, usually commuter drivers, caught on and "encouraged" the others to move when it was safe.

Dr. Nassi also noted that the large number of HAWKs (114) throughout the City and the time that drivers have had to learn about how they operate (17 years) are the key factors in the high compliance rate they currently have.

Tucson has incorporated information on HAWK signals into a variety of outreach campaigns:

- **HAWK Crossings Video (2007).** This video visually and audibly explains the use of a HAWK. https://www.youtube.com/watch?v=ReNk2T5ay1c

- **Crossings: Special Pedestrian/Bicycle Beacon Signals (2009)**. This brochure covers a variety of pedestrian beacons (PELICAN, TOUCAN, and HAWK) and has a summary of the Children's Safety Program. https://www.tucsonaz.gov/files/transportation/Crossings_brochure_3-09.pdf

- **Media Spots, television and radio.** Worked with local reporters to explain the reasons and proper behaviors for HAWK signals.

City of Portland, OR

The City of Portland has a reputation for creative and community-oriented education strategies. It should be noted, however, that the City has yet to do a campaign strictly around a HAWK beacon; all efforts have been focused on other infrastructure improvements or a broader pedestrian safety message. Of their suite of outreach methods, we believe the following would be most appropriate for HAWK beacons:

- **Transportation Safety at Community Events.** Recruit volunteers to host a transportation safety table at community events (movies in the park, concerts in the park, street fairs, sidewalk sales, etc.).

- **Online Pedestrian Safety Quiz.** Encourage people to take a pedestrian safety quiz (see example at http://www.LookBeforeCrossing.org). When people complete the quiz, they become eligible to receive a free transportation-related prize.

- **Community Transportation Safety Trainers.** Identify community members that are interested in being a Transportation Safety Trainer. Participants learn about transportation safety by attending a "train-the-trainer" class and get training materials for conducting their own trainings. These new trainers then serve as ambassadors to their respective community.

A key part of many of the City's outreach work is the connection with the community and giving the community members the teaching tools to be an educational "ambassador" to their community. We think this can and should be a key part of Vancouver's outreach strategy about HAWK beacon education – there are already existing communities around Fourth Plain Boulevard (e.g., Clark College, Fourth Plain

Neighborhood Associations, Fourth Plain Business District) which could be optimal partners in education efforts. All these organizations already have existing communication means and outreach channels that would be well-suited for transportation education efforts.

City of San Jose, CA

The City of San Jose has two HAWK signals installed at Martial Cottle Park and a BRT stop in 2015 and 2016, respectively. Most of the outreach, thus far, has been done at the HAWK signal near the park since the BRT is not operational yet and, as such, has low pedestrian usage.

The City's outreach staff begun communications using the City's website and social media, but found that the most effective messaging occurred on or near the HAWK site. Two weeks before the HAWK signal began operation, the City placed a message board near the beacon displaying "HAWK pedestrian signal coming soon." While the staff was initially skeptical about the messaging, since it was doubtful that most users of the street knew what a HAWK signal was, it resulted in many users researching what a HAWK was or contacting the City with questions, and ended up being an enormously successful outreach strategy.

The message boards stayed up for two weeks after the beacons were activated, first with the messaging of "new pedestrian signal ahead" and then with directions for what to do on the flashing red interval. Given the continued confusion of the flashing red, a hard sign was added to the signal communicating to drivers that they can "stop, look, and proceed."

A City outreach staffer also did a thorough job of canvasing the neighborhood, doing "knock and talks" with residents and business owners within a six-block radius. He also set up a table near the HAWK beacon with information on Vision Zero to attract attention, but also had information on the new signal. Over the course of a couple weeks of the signal's activation, the staffer was available at the signal with information at various times of the day (morning, rush hours, evening, etc.) in order to reach those that travel throughout the day and not just 9-5. This strategy was under the assumption that most of the people that use the crossings are regulars and would be reached with this approach.

The City also worked through established Neighborhood Association communication channels, local schools and PTAs, and business associations near the sites. These conversations were a strategy to get knowledge into the community and give community leaders the information needed to pass on to others. NextDoor was also used as a communication channel to reach those that may not get information from a more formalized network.

City of Champaign, IL

Champaign, IL currently only has one HAWK signal, which was installed in 2009 at a mid-block crossing to help facilitate a safer crossing between a bus stop and a developmental service center. Because it is the only HAWK in the City, and most of the anticipated users were going to be from clients of the DSC, they were instrumental in the design and outreach process. The City also worked directly with entities that have significant groups of people traveling through the corridor (a Kraft product manufacturing plant, a community college, residents, and a drivers' services facility) to spread the message in person.

The City wrote a news release, produced an online video, and did media interviews, as requested. The news releases were thought to be the most successful in communicating what to do when the signal was activated, although it was harder to communicate/convince users that once the beacon is flashing red, they can stop and process. It was noted that if unsure, drivers usually remained stopped through the flashing, erring on the side of caution.

Gaps and Opportunities for Enhancements for Fourth Plain

While the City of Vancouver did conduct an impressive and thorough outreach campaign at the onset of the HAWK installations within the corridor, there are additional strategies that may improve users' knowledge of the signals and increase compliance rates. Unfortunately, there have not been any conclusive studies

about how or what type of outreach strategies result in the largest compliance improvements. It can be assumed, however, that the more people understand and see the signals in operation, along with being exposed to correct "peer behavior" by other pedestrians and drivers, the more likely users' behaviors will improve.

The strategies proposed below highlight the following opportunities for additional outreach:

- **Timing.** All previous efforts (besides enforcement actions) were done prior to or nearly immediately after the HAWK beacons were installed in 2010. Given the time that has elapsed; turnover of residents, students, and general users of the corridor; and neighborhood concerns, it's recommended that outreach efforts are reestablished and potentially connected to future improvements and/or events within the corridor.

- **Outreach via Transit.** According to City of Vancouver staff, most pedestrians that use the HAWK beacons on Fourth Plain Boulevard are transit users, either of the bus or the newly operational The Vine BRT. There are opportunities to target transit users, having a "captive" audience at The Vine stations and on the buses. The Vine stations and vehicles would be prioritized as an outreach location given that bus vehicles on Fourth Plain Boulevard are used throughout the City.

- **Use of Existing Materials**. The City of Vancouver already has a handout and a video from previous outreach efforts. While there is always room for improvement, these materials are concise, clear, and consistent with educational materials on HAWK beacons throughout the country. We recommend that the City continue to use these materials to save resources and continue to communicate their standard messaging.

- **Temporary Events.** As previously mentioned, there have not been education "events" focused on the HAWK beacons since their installation. We would recommend that the City organizes "pop-up" events, utilizes message boards, or encourages volunteers (or staff) to directly communicate to users on site. There are a variety of methods for this approach, dependent on staff availability and resources available.

Proposed Strategies for Fourth Plain Boulevard

Learning about the past efforts of the City of Vancouver, as well as the efforts (successful and unsuccessful) from other jurisdictions, we recommend a suite of strategies that emphasizes targeting known users and nearby stakeholders, incentive-based learning opportunities, optimizing existing (or new) transportation media messages, and enforcement.

On-Site Outreach

Given the corridor's destinations – BRT, bus stops, businesses, and schools – we believe that most of those that pass or use the HAWK signals do so regularly. We recommend that the City utilize message boards to inform users about to-be installed HAWK signals (potentially using San Jose's strategy), how to use HAWK signals, and/or simply as a reminder that there are HAWK signals in the corridor.

On-site outreach is also useful for pedestrians and bicyclists that may use the HAWK signal. This outreach may be especially effective given the recent changes to the signal response time. It is also recommended that outreach for the pedestrians focuses on drivers being able to proceed (after stopping) during the countdown phase and at various times of the day to reach the most users.

Overall, we would recommend on-site outreach above all others. Given the corridor's character, it is likely that most pedestrians that use the area are regular users (students, business owners, neighbors, etc.), whereas many that drive through the corridor may never stop at a business or institution, making it more difficult to reach them at an event or local business.

Neighborhood Associations Outreach

There are eight neighborhood associations along the Fourth Plain Boulevard corridor. These neighborhoods have a variety of existing communication channels including, but not limited to, paper newsletters, websites, social media (Facebook, Twitter, etc.), and monthly meetings. We recommend that City staff continue to use these existing channels for in-person workshops about how the HAWK signals work in conjunction with other transportation information about the corridor.

In addition, we would recommend that the City offer incentives for learning about the HAWK signals through either in-person or on-line quizzes (especially through Facebook and NextDoor groups). These incentives could include City of Vancouver transportation maps or coupons to local businesses along Fourth Plain Boulevard. The residents will hopefully tell their neighbors about their experience and opportunity for incentives, allowing the HAWK message to "snowball" through the community.

Local Print

The HAWK signal locations and instructions on their use have already been in the local newspaper, but we recommend that more information on the HAWK signals is distributed in local print whenever corridor improvements or news about The Vine is spread. Neighborhood newsletters, Clark College's newspaper (*The Independent)*, and Vancouver school publications are instrumental to outreach in the local area since actual newspaper subscriptions may not be dependable for complete coverage.

For any local print, we would recommend the simple visual that the City already developed be used (http://www.cityofvancouver.us/sites/default/files/fileattachments/public_works/page/3001/hybridbeaconcard_general.pdf) and an online quiz with incentives be referenced, if possible. It is also recommended that the translated versions of the instructional visuals should be sent to local Spanish or Russian newspapers. There may be needs for the materials to be translated into Chinese and Vietnamese as well, depending on how the demographics in the corridor have changed since the first HAWK beacons were installed.

Trainings or Workshops

We would recommend any trainings or workshops be part of a greater transportation or public works education effort in order to draw people and increase interest. The following are identified as opportunities for where information could be spread:

- **Summer Concert and Movie Series**. The City of Vancouver Parks and Recreation organizes and hosts a variety of summer entertainment throughout the City. We would recommend that the Department of Public Works attends and/or tables at these events along the Fourth Plain Boulevard corridor to share information about the HAWK signals along with other improvements (The Vine, improved crossings, etc.). There may also be an opportunity to engage the Volunteer Ambassadors for the city events, as individuals who most likely have deep ties to the community and are comfortable engaging attendees in conversation. These events would be perfect places for quizzes and incentive-earing activities.

- **Schools.** Each school has gatherings, whether they be for orientation, PTA meetings, sports, or celebrations. We would recommend that the City investigate presenting at these existing meetings or work with school administration of Safe Routes to School programs to offer educational materials. Once again, this audience would most likely be encouraged by incentives.

  In addition, Clark College has an online orientation training for all students which includes a section on safety. We encourage the City to work with the College on incorporating broader transportation education into the orientation, including the use of HAWK signals. It is acknowledged that the City did work with the College and schools during their original outreach efforts. However, staff and especially students have a high turnover rate, so it would be preferred to communicate the message regularly.

- **Business Community** We recommend using these networks to talk about how local businesses can get involved in publicizing transportation improvements near them. This is especially the case on Fourth Plain Boulevard, as most of the HAWK signals are adjacent to businesses, which offers a unique opportunity for outreach to users.

Media Campaigns

As with local print, there have already been reports on the HAWK signals along Fourth Plain Boulevard. That said, additional reporting would be encouraged as possible. We recommend that the City regularly offer traffic safety messaging as part of a broader media strategy, and anticipate re-offering education on some of the less familiar technologies, such as HAWK signals. These campaigns can be offered in tandem with messaging about other corridor improvements (e.g., The Vine), new businesses along the corridor or other public works informational opportunities.

If the media campaign involves a safety video, the City should think strategically about opportunities for showing the video. Cursory ideas include movie theaters, drivers' education classes, libraries, or other publicly accessible areas with video capabilities.

Enforcement Actions

Crosswalk education and enforcement actions have been shown to be and are used as an effective way to communicate traffic laws to people driving and walking; the City has used enforcement efforts and confirms this result. We recommend that any future enforcement actions serve as a combined effort between the transportation/public works and police to promote collaboration on transportation safety and to initiate discussion about enforcement at HAWK beacons. It is important to remember that the primary objective of Enforcement Actions should be education, rather than solely issuing citations We recommend setting up signage before the enforcement location informing drivers that an enforcement action is ahead, as well as doing press releases to the appropriate media (see https://www.portlandoregon.gov/transportation/article/582838 for an example).

Estimated Cost & Implementation Steps for Outreach

The following table describes the resources needed, anticipated impact, and preferred schedule for the outreach strategies described above. We recommend these activities be considered in tandem with any infrastructure improvements that may be built as part of the Fourth Plain Forward Pedestrian Safety and Access Implementation Plan to draw attention to new improvements and take advantage of people's new awareness of Fourth Plain Boulevard.

Table 9. Estimated Cost and Implementation Steps for Recommended Outreach Strategies

Strategy	Staff & Expertise Needed		Relative Cost	Anticipated Effect	Schedule
On-Site Outreach	Public Involvement Officer	Expertise on reasons for HAWKs, usage, and placement	Low - medium	high	Should start 1-2 weeks before and continue for 1-2 week after the signals is activated
Neighborhood Association Outreach	Traffic Engineer or Planner	Expertise on reasons for HAWKs and placement	low	medium	Outreach should be done before construction to ensure understanding and awareness
	Public Involvement Officer	Contact, messaging, and writing for NA meetings, newsletters, and social media. Create and administer survey.			
Local Print	Traffic Engineer or Planner	Expertise on reasons for HAWKs and placement	low	low	Can offer a preview article about changes and purpose of the signals. A post-construction article is also recommended to provide tangible examples.
	Public Information Officer	Messaging and media releases. Interviews with local newspapers/ newsletters			
	Public Involvement Officer	Create and administer Survey			
	Translator	Translation services for newsletters/newspapers, as needed			
Trainings or Workshops	Traffic Engineer or Planner	Expertise on reasons for HAWKs and placement	medium	medium	While it would be preferred to communicate to groups prior to construction, the trainings would be most effective once the infrastructure is in place.
	Public Information Officer	Messaging and media releases. Interviews with local newspapers/ newsletters			
	Public Involvement Officer	Create and administer Survey			
	Translator	Translation services for newsletters/ newspapers, as needed			
Media Campaigns	Traffic Engineer or Planner	Expertise on reasons for HAWKs and placement	medium	medium	Should have a media release about upcoming changes. Schedule videos, interviews, etc. are recommended for post-construction.
	Public Information Officer	Messaging and media releases. Interviews with local newspapers/ newsletters			
	Public Involvement Officer	Create and administer Survey			
	Translator	Translation services for newsletters/newspapers, as needed			
Enforcement Actions	Transportation Outreach Staffer/ Walker	Serve as the pedestrian for actions	high	high	Prefer to give users time to see the signal before enforcement actions begin. One to two months post-startup is recommended.
	Traffic Enforcement Officers (3-4)	Warnings and citations			
	Public Information Officer	Messaging and media releases. Interviews with local newspapers/ newsletters			

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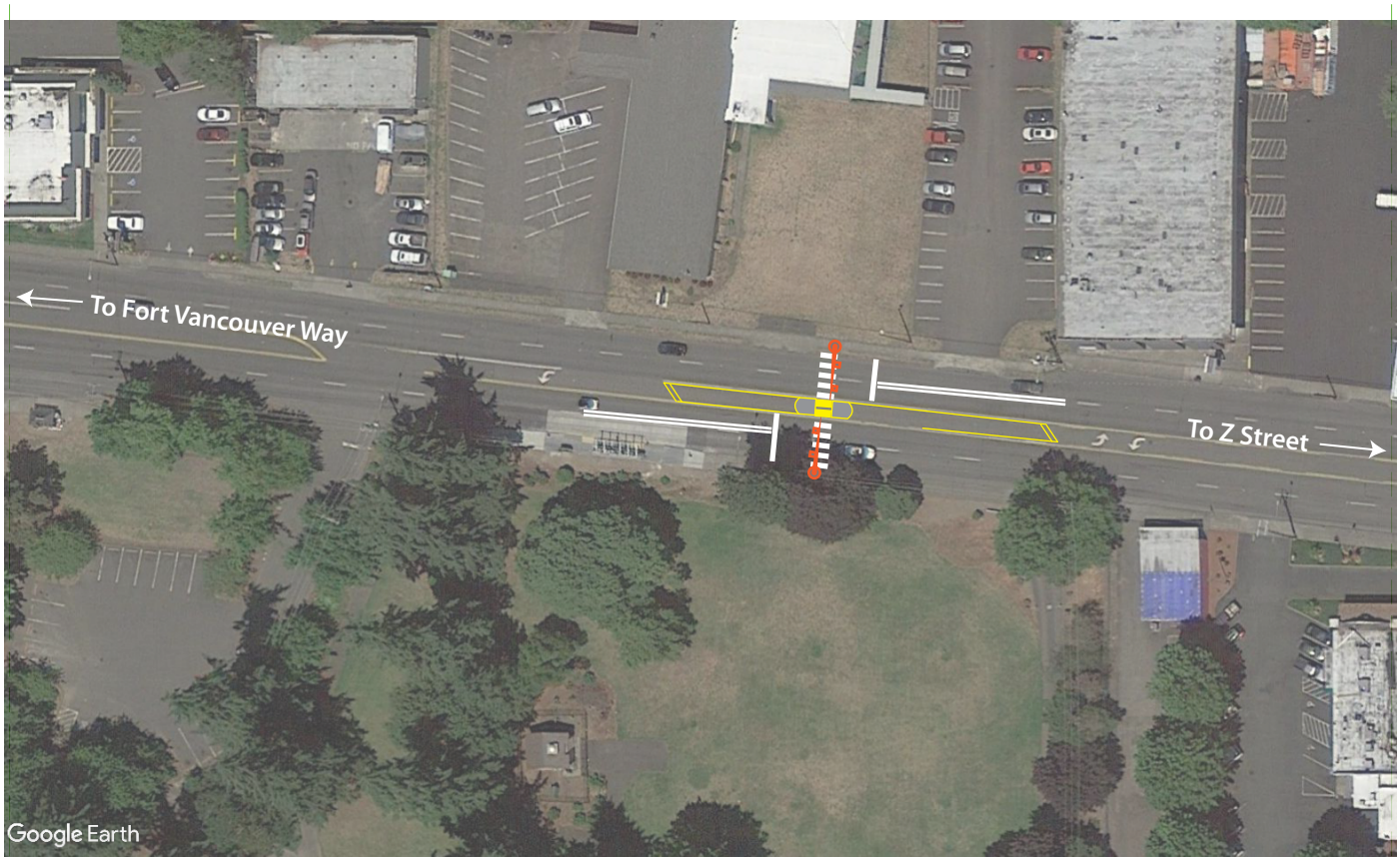
Appendix A

Midblock between Fort Vancouver Way and Z Street
SCHEMATIC DESIGN



0 25 50 100

N

NOTES:

1. Install High Visibility crosswalk 60 feet east of end of Vine Station
2. Install Pedestrian Hybrid Beacon per MUTCD and City of Vancouver standards
3. Install Stop Line 20 feet from crosswalk in each direction
4. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes at crosswalk
5. Install “STOP Here for Pedestrian” (R1-5c) at Stop Line location
6. Install “Pedestrian Crossing” (W11-2) with Directional Arrow at crosswalk
7. Install “CROSSWALK Stop on Red, Proceed when clear” (R10-23a) on overhead Mast Arm
8. Construct and install Pedestrian Refuge Island in Center Lane

319 WASHINGTON ST., SUITE 800, PORTLAND, OR 97204
PHONE: (503) 205-4607 FAX: (301) 927-2800
www.tooledesign.com

FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

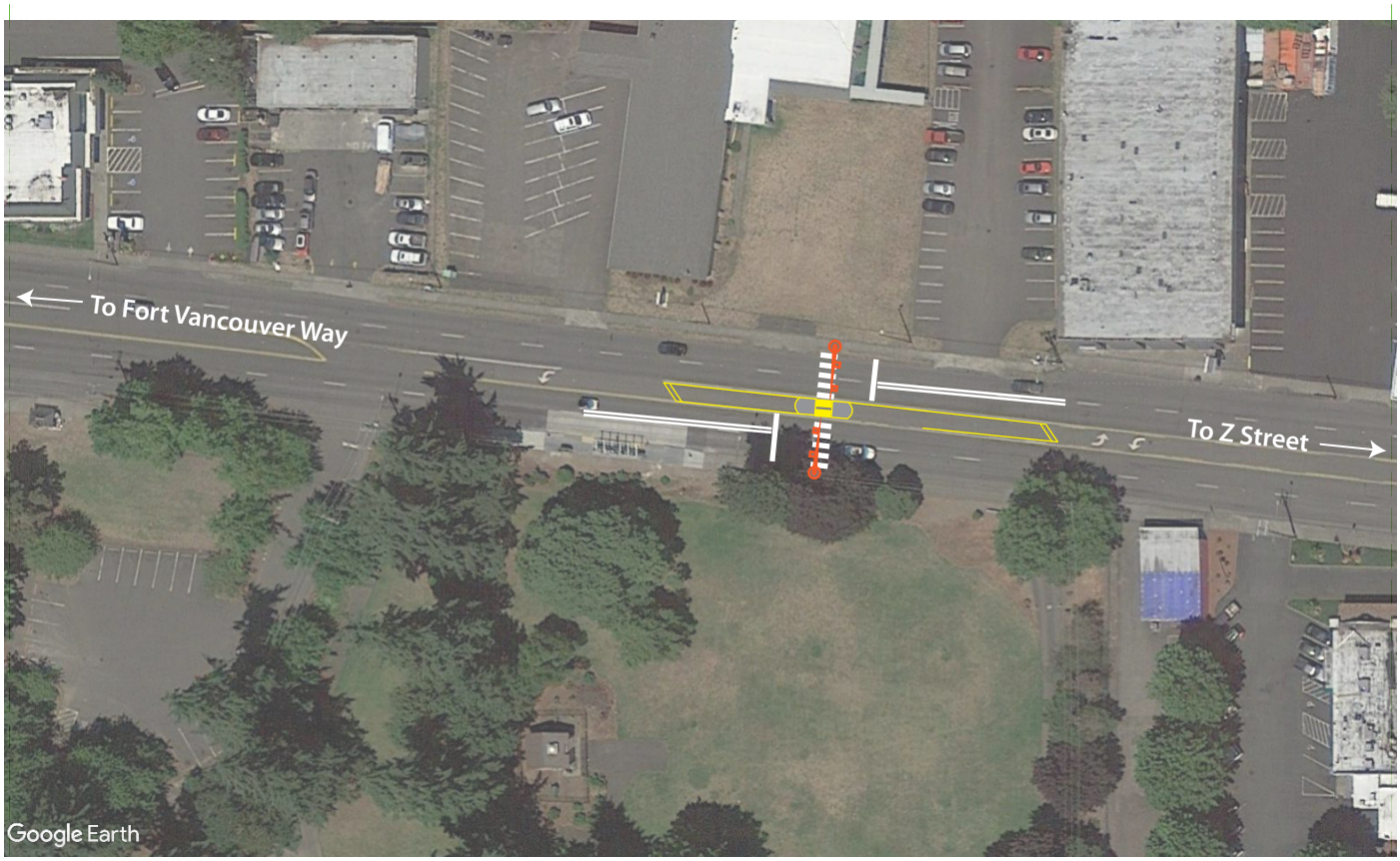
REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	FEB. 28, 2017

SHEET NAME: QUANTITIES & NOTES

DRAWING NUMBER C1.1

SHEET NUMBER 2 OF 4

Midblock between Fort Vancouver Way and Z Street
SCHEMATIC DESIGN



0 25 50 100

N

NOTES:

1. Install High Visibility crosswalk 60 feet east of end of Vine Station
2. Install Pedestrian Hybrid Beacon per MUTCD and City of Vancouver standards
3. Install Stop Line 20 feet from crosswalk in each direction
4. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes at crosswalk
5. Install “STOP Here for Pedestrian” (R1-5c) at Stop Line location
6. Install “Pedestrian Crossing” (W11-2) with Directional Arrow at crosswalk
7. Install “CROSSWALK Stop on Red, Proceed when clear” (R10-23a) on overhead Mast Arm
8. Construct and install Pedestrian Refuge Island in Center Lane

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	FEB. 28, 2017

SHEET NAME: QUANTITIES & NOTES

DRAWING NUMBER C1.1

SHEET NUMBER 2 OF 4

Watson Avenue
SCHEMATIC DESIGN

0 25 50 100

N

NOTES:

1. Install High Visibility crosswalk 100 feet east of Watson Ave (centerline)
2. Install Pedestrian Hybrid Beacon per MUTCD and City of Vancouver standards
3. Install Stop Line 20 feet from crosswalk in each direction
4. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes at crosswalk
5. Install “STOP Here for Pedestrian” sign (R1-5c) at Stop Line location
6. Install “Pedestrian Crossing” sign (W11-2) with Directional Arrows at crosswalk
7. Install “CROSSWALK Stop on Red, Proceed when clear” sign (R10-23a) on overhead Mast Arm
8. Construct and install Pedestrian Refuge Island in Center Lane

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	FEB. 28, 2017

SHEET NAME: QUANTITIES & NOTES

DRAWING NUMBER C1.2

SHEET NUMBER 3 OF 4

Laurel Place
SCHEMATIC DESIGN

0 25 50 100

N

NOTES:

1. Install High Visibility crosswalk at Laurel Place (west side of roadway)
2. Install Pedestrian Hybrid Beacon per MUTCD and City of Vancouver standards
3. Install Stop Line 20 feet from crosswalk in each direction
4. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes at crosswalk
5. Install “STOP Here for Pedestrian” sign (R1-5c) at Stop Line location
6. Install “Pedestrian Crossing” sign (W11-2) with Directional Arrows at crosswalk
7. Install “CROSSWALK Stop on Red, Proceed when clear” sign (R10-23a) on overhead Mast Arm

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	FEB. 28, 2017

SHEET NAME: QUANTITIES & NOTES

DRAWING NUMBER C1.3

SHEET NUMBER 4 OF 4

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Appendix B

CITY OF VANCOUVER
PEDESTRIAN REFUGE ISLANDS
SCHEMATIC DESIGN

INDEX

LOCATION MAP

Toole Design Group
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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

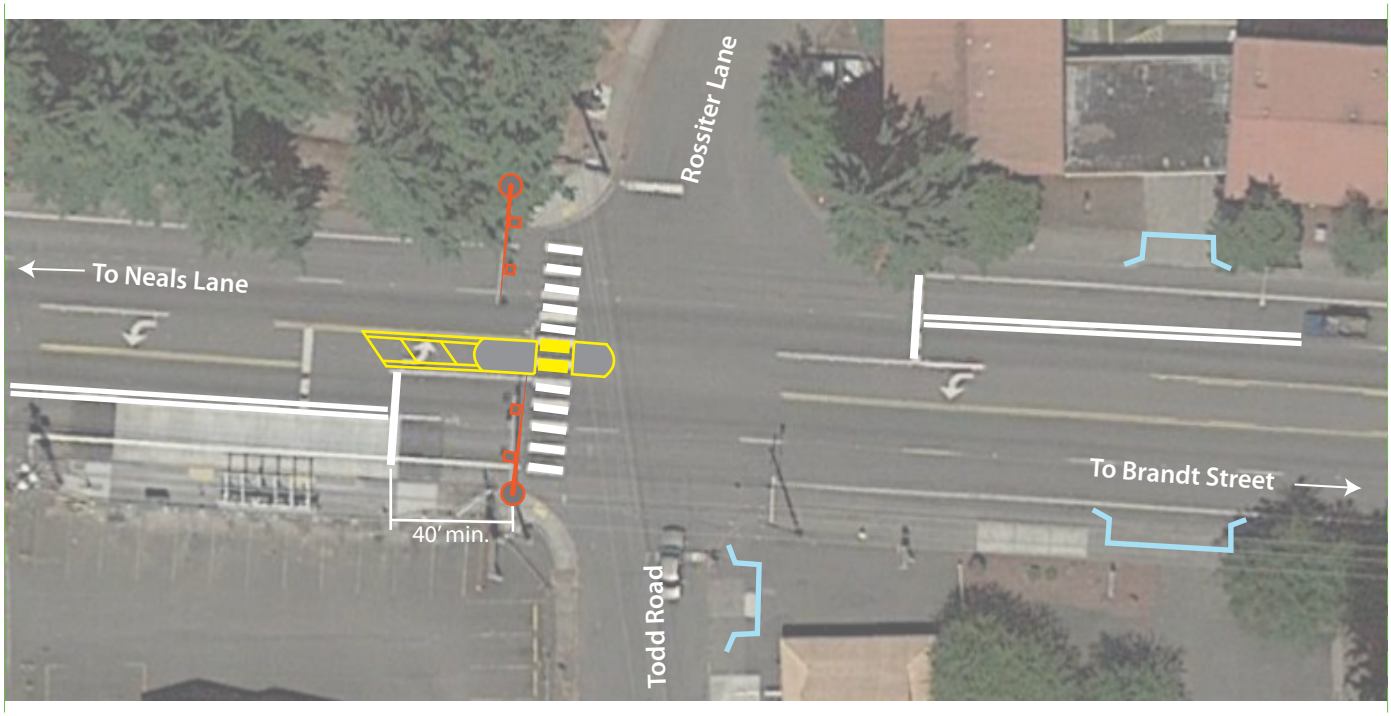
REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	FEB. 28, 2017

SHEET NAME: QUANTITIES & NOTES

DRAWING NUMBER C1.0

SHEET NUMBER 1 OF 4

Todd Road/Rossiter Lane
SCHEMATIC DESIGN



0 25 50

N

NOTES:

1. Crosswalk, stop bars, and the Pedestrian Hybrid Beacon are shown in approximate existing locations.
2. Update existing signage per recommendations described in *Fourth Plain Pedestrian Connections and Crossings Evaluation Memo* dated March 27, 2017
   - 2a. Replace R10-23 with R10-23a - "CROSSWALK Stop on Red, Proceed when clear"
   - 2b. Replace R10-6a with R1-5b - "STOP Here for Pedestrian" with symbolic stop sign
   - 2c. Add 2" wide reflective panel on the face of the "Pedestrian Crossing" sign post
   - 2d. Install 4" Double White Lane Lines for 100' leading up to Stop Line to restrict lane changes
3. Remove existing stop bar and add new stop bar 40' from the signal head
4. Construct and install Pedestrian Refuge Island in Center Lane; see Detail Sheet C2.0 on Sheet 5

Toole Design Group
319 WASHINGTON ST., SUITE 800, PORTLAND, OR 97204
PHONE: (503) 205-4607 FAX: (301) 927-2800
www.tooledesign.com

FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	AUG. 29, 2017

SHEET NAME: DESIGN SCHEMATIC
DRAWING NUMBER C1.1
SHEET NUMBER 2 OF 5

Neals Lane
SCHEMATIC DESIGN

0 25 50 100

N

NOTES:

1. Crosswalk, stop bars, and the Pedestrian Hybrid Beacon are shown in approximate existing locations.
2. Update existing signage per recommendations described in *Fourth Plain Pedestrian Connections and Crossings Evaluation Memo* dated March 27, 2017
   - 2a. Replace R10-23 with R10-23a - “CROSSWALK Stop on Red, Proceed when clear”
   - 2b. Replace R10-6a with R1-5b - “STOP Here for Pedestrian” with symbolic stop sign
   - 2c. Add 2” wide reflective panel on the face of the “Pedestrian Crossing” sign post
   - 2d. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes
3. Construct and install Pedestrian Refuge Island in Center Lane; see Detail Sheet C2.0 on Sheet 5

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	JUNE 29, 2017

SHEET NAME: DESIGN SCHEMATIC
DRAWING NUMBER C1.2
SHEET NUMBER 3 OF 5

Laurel Place
SCHEMATIC DESIGN

0 25 50 100

N

NOTES:

1. Crosswalk, stop bars, and the Pedestrian Hybrid Beacon are shown in approximate existing locations.
2. Update existing signage per recommendations described in *Fourth Plain Pedestrian Connections and Crossings Evaluation Memo* dated March 27, 2017
   - 2a. Replace R10-23 with R10-23a - “CROSSWALK Stop on Red, Proceed when clear”
   - 2b. Replace R10-6a with R1-5b - “STOP Here for Pedestrian” with symbolic stop sign
   - 2c. Add 2” wide reflective panel on the face of the “Pedestrian Crossing” sign post
   - 2d. Install 4” Double White Lane Lines for 100’ leading up to Stop Line to restrict lane changes
3. Construct and install Pedestrian Refuge Island in Center Lane; see Detail Sheet C2.0 on Sheet 5

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

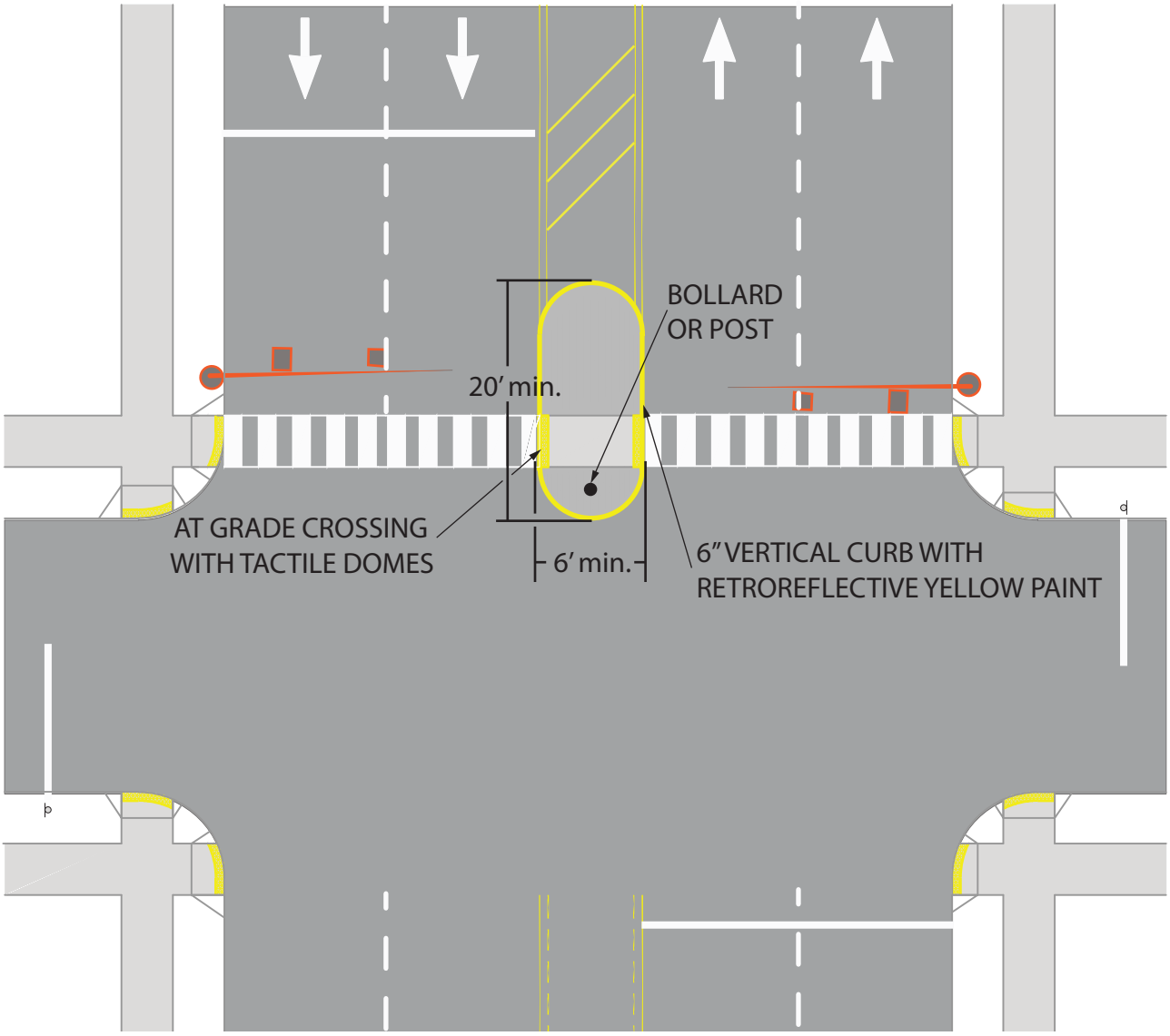
REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	JUNE 29, 2017

SHEET NAME: DESIGN SCHEMATIC

DRAWING NUMBER C1.3

SHEET NUMBER 4 OF 5

Pedestrian Refuge Island
DETAIL SHEET



NOTES:

1. Island should have minimum dimensions of 6’ by 20’ and should be no less than 150 square feet
2. Island crossing should be at grade with 2’ tactile strips; must be ADA compliant
3. A vertical element, such as a bollard or post, should be placed on the island; a sign should be installed if visibility can be maintained
4. The island should have a 6” vertical curb with retroreflective yellow paint

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FOURTH PLAIN FORWARD
City of Vancouver
Vancouver, WA

REV. 1:	XX
REV. 2:	XX
REV. 3:	XX
DESIGNED:	GS
DRAWN:	GS
CHECKED:	RB
DATE:	JUNE 29, 2017

SHEET NAME: DETAIL SHEET
DRAWING NUMBER C2.0
SHEET NUMBER 5 OF 5

Appendix C

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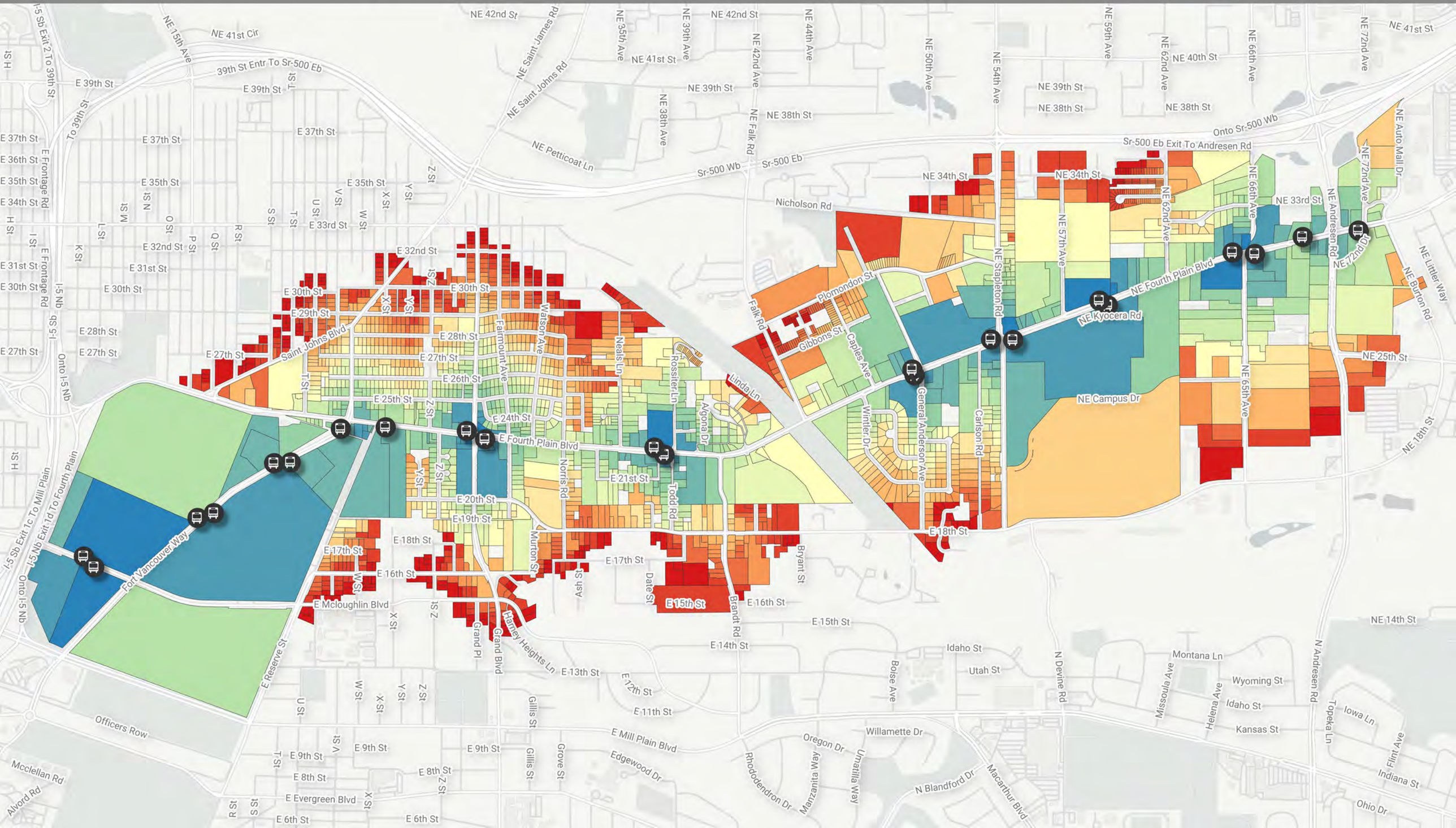
WALKING TIME TO BRT STOP

average pedestrian | existing conditions

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 4 ft/s



WALKING TIME TO BRT STOP

average pedestrian | all new ped connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 4 ft/s

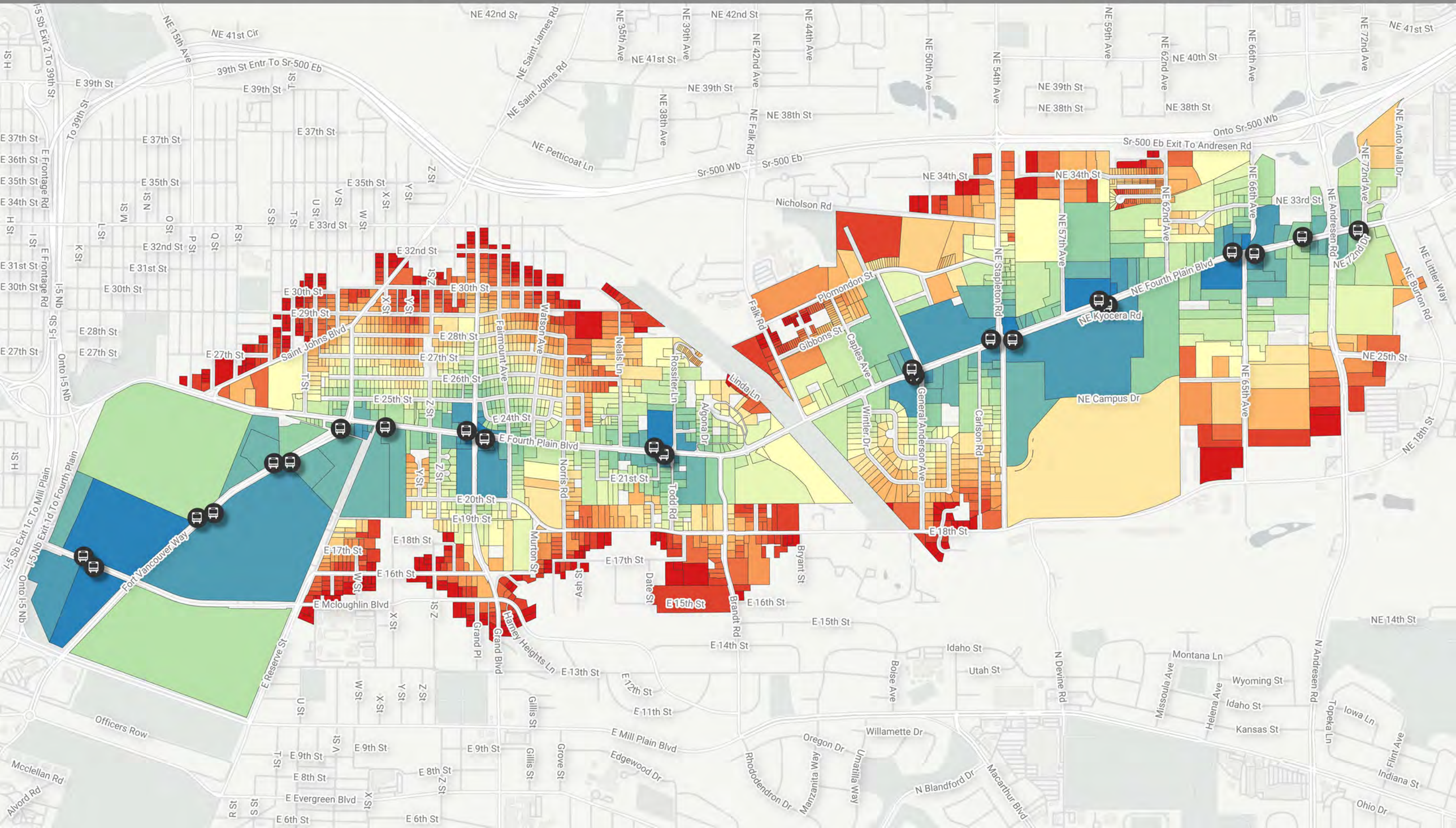
WALKING TIME TO BRT STOP

average pedestrian | key new connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 4 ft/s



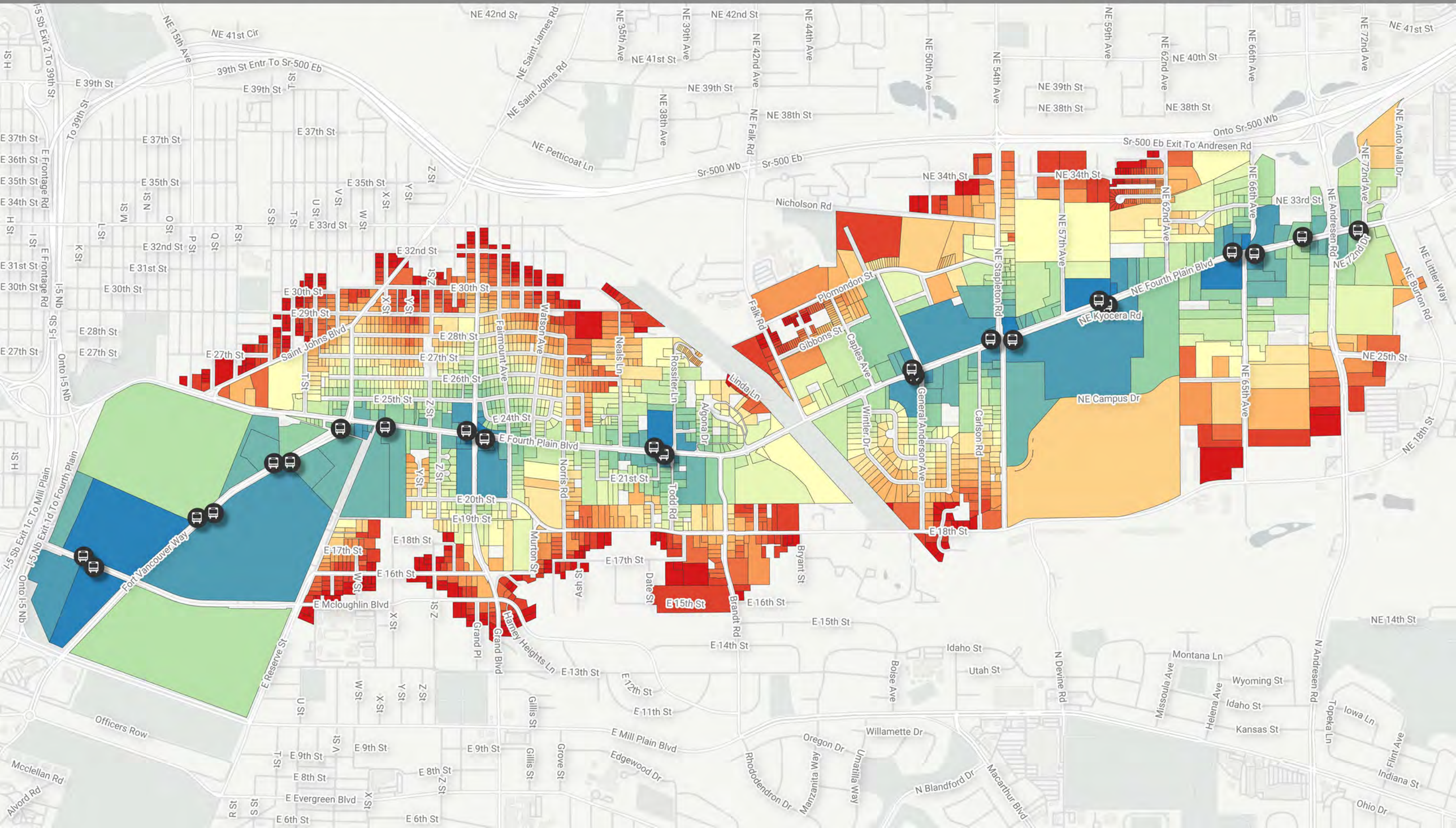
WALKING TIME TO BRT STOP

average pedestrian | new crossings

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 4 ft/s



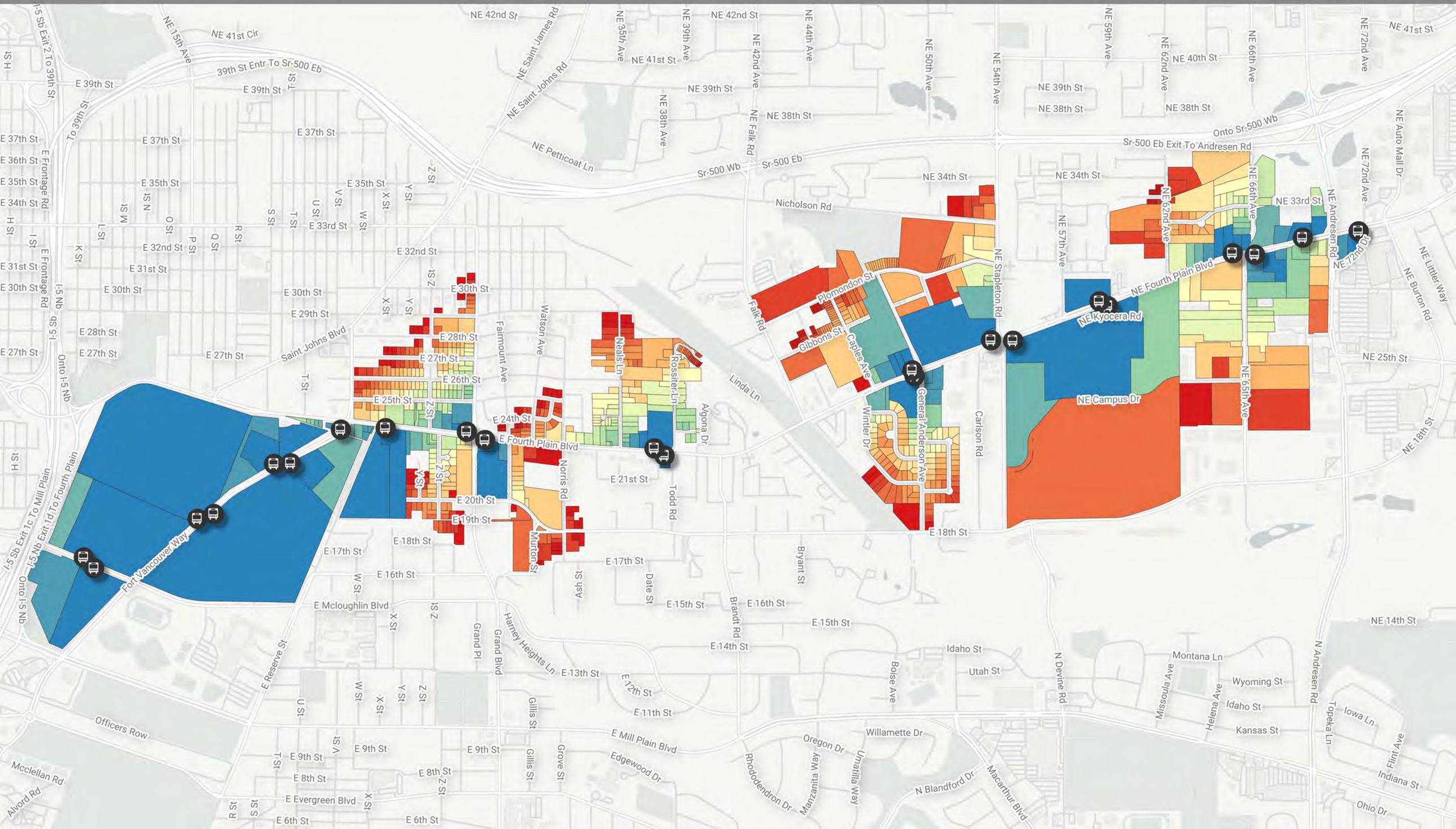
WALKING TIME TO BRT STOP

school-age children, single direction access | existing conditions

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop, either direction of service



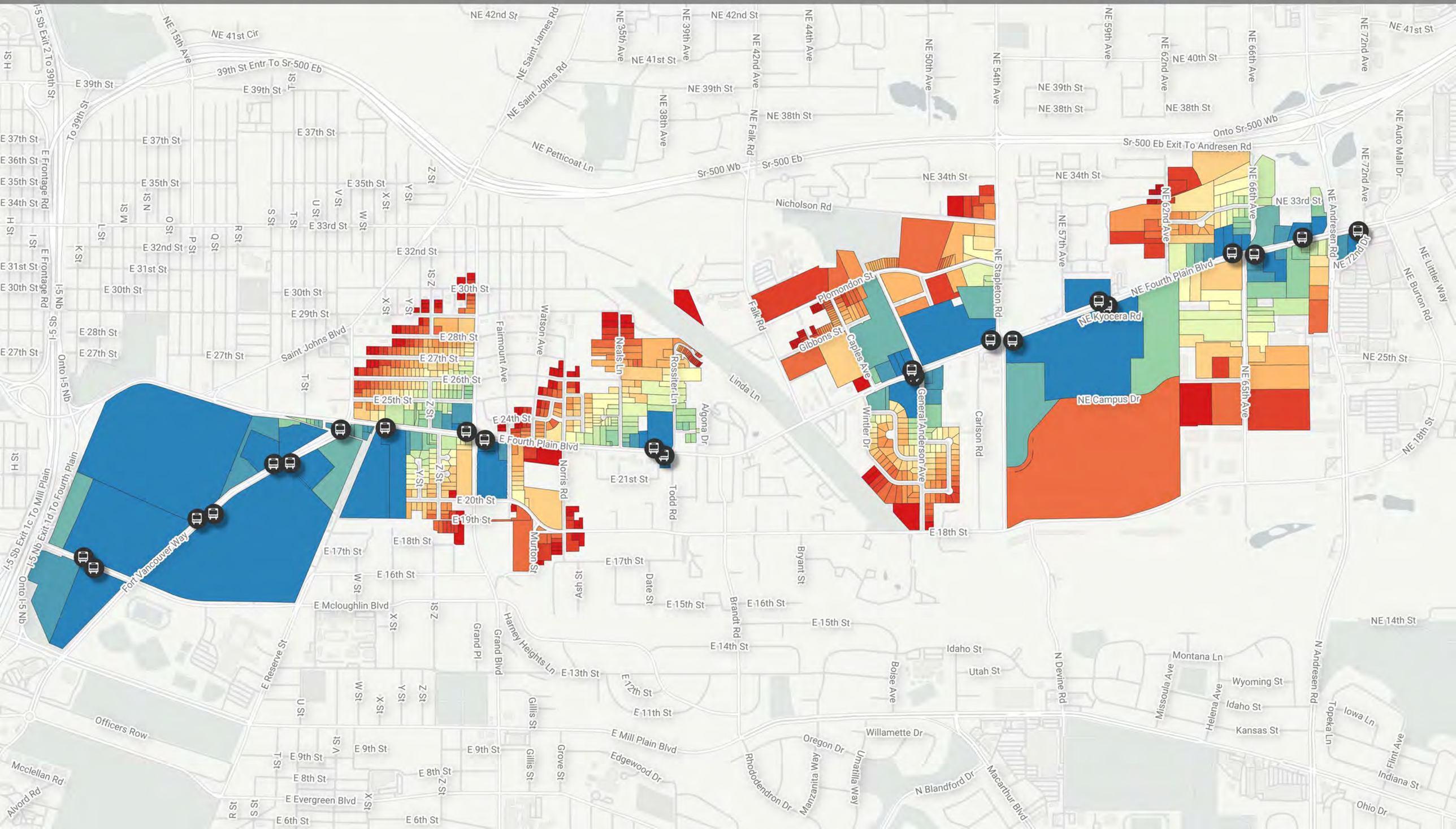
WALKING TIME TO BRT STOP

school-age children, single direction access | all new ped connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop, either direction of service



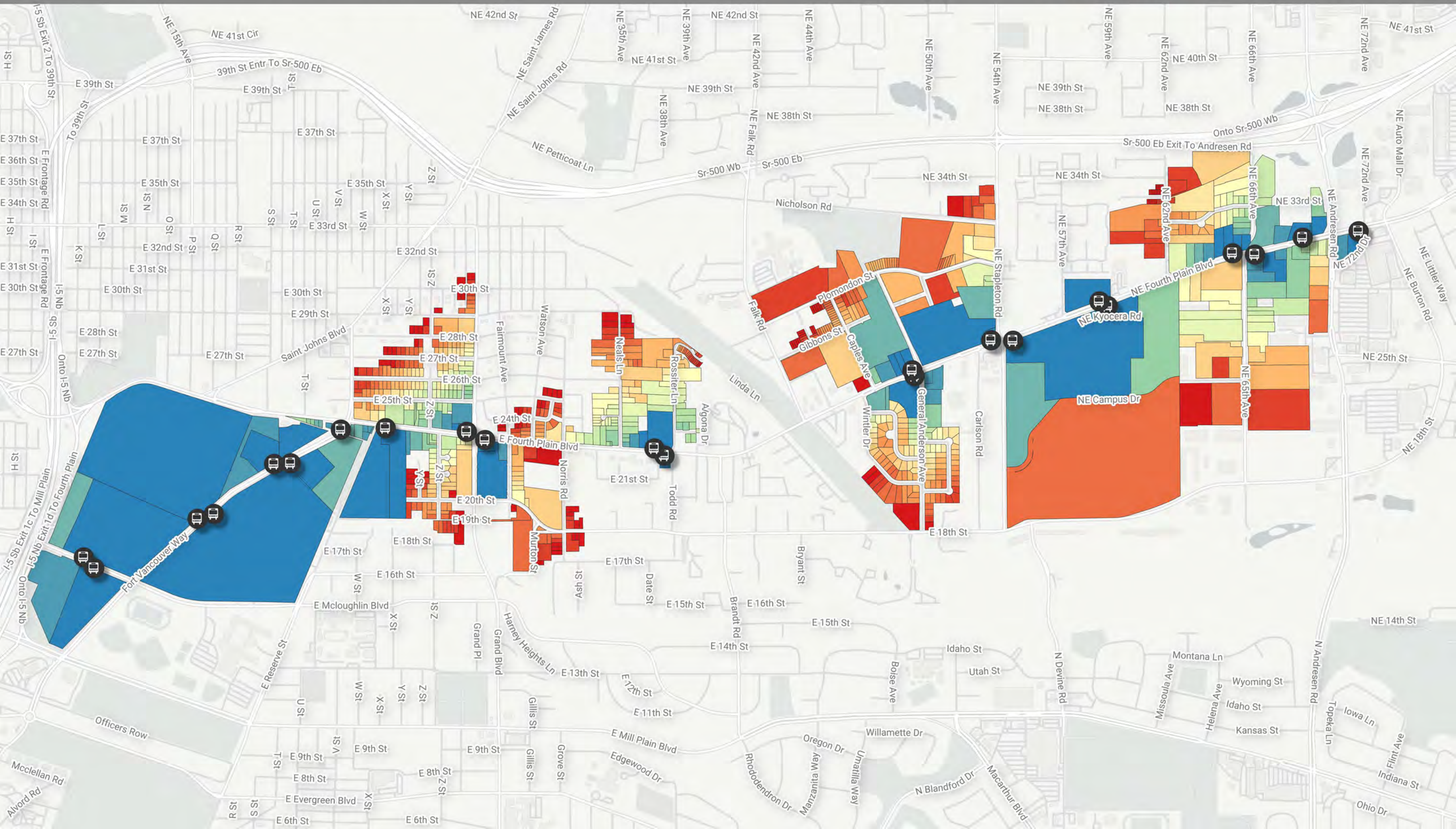
WALKING TIME TO BRT STOP

school-age children, single direction access | key new connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop, either direction of service



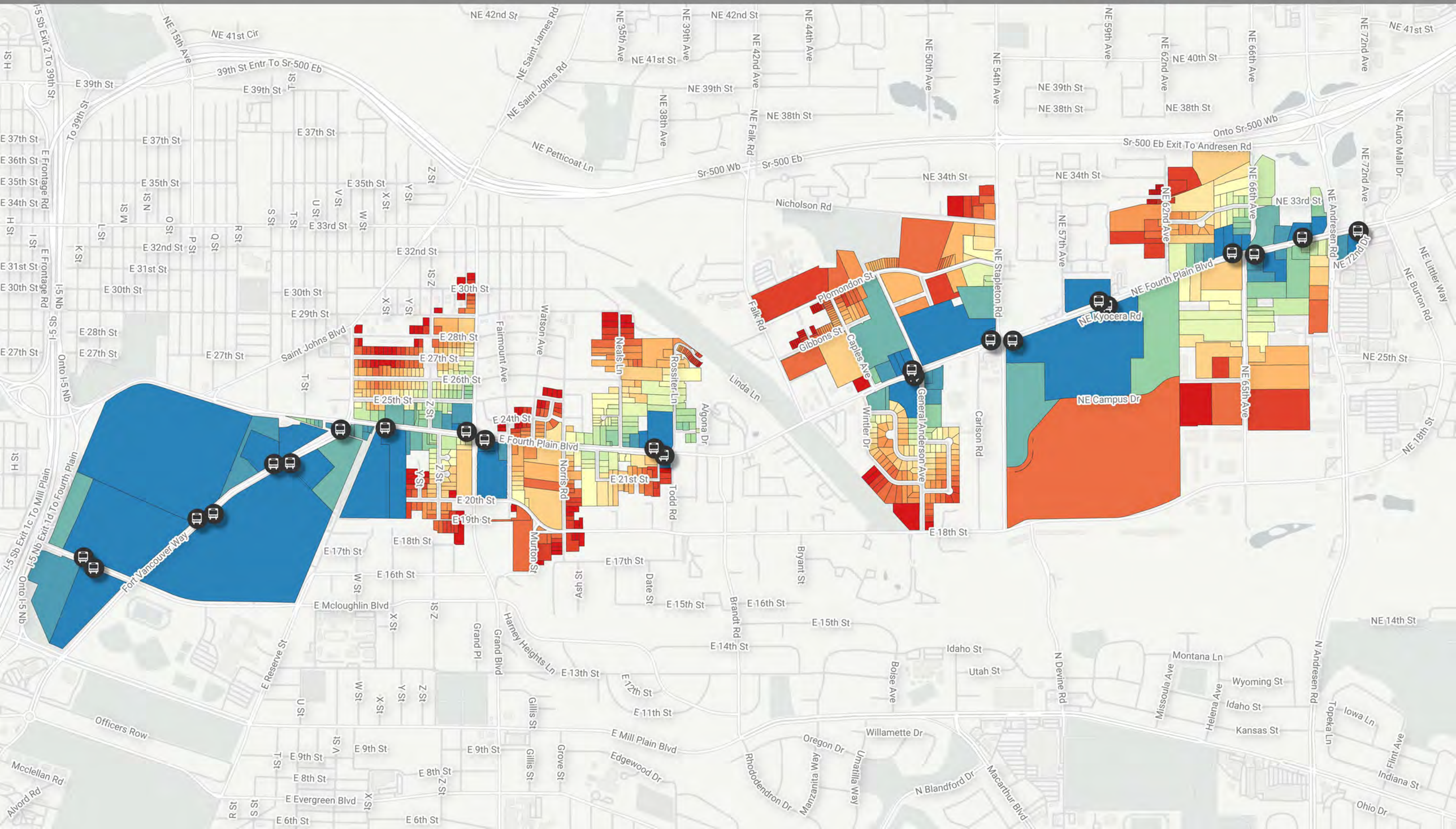
WALKING TIME TO BRT STOP

school-age children, single direction access | new crossings

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop, either direction of service



WALKING TIME TO BRT STOP

elderly or mobility impaired pedestrian | existing conditions

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 2 ft/s

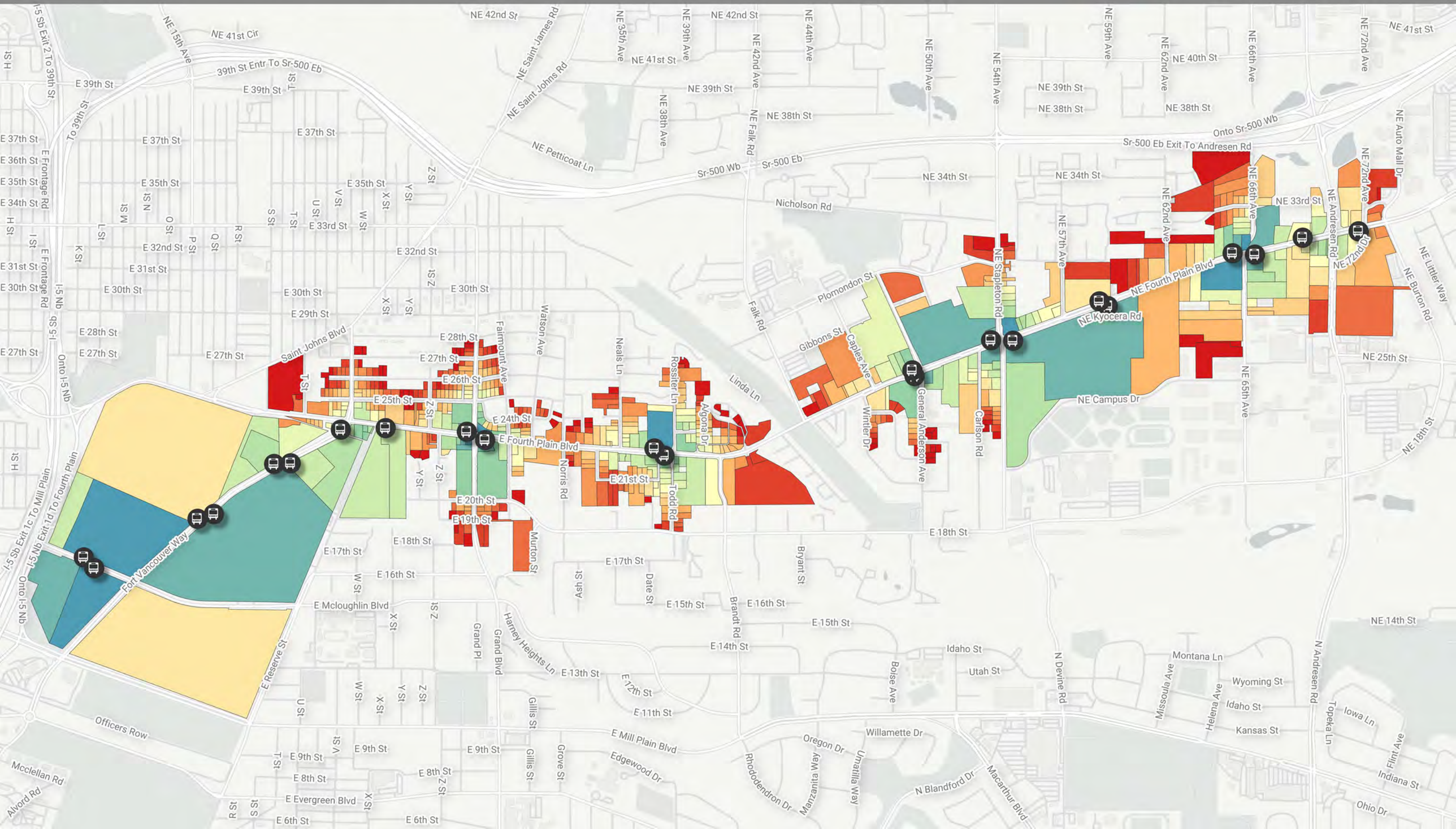
WALKING TIME TO BRT STOP

elderly or mobility impaired pedestrian | all new ped connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 2 ft/s



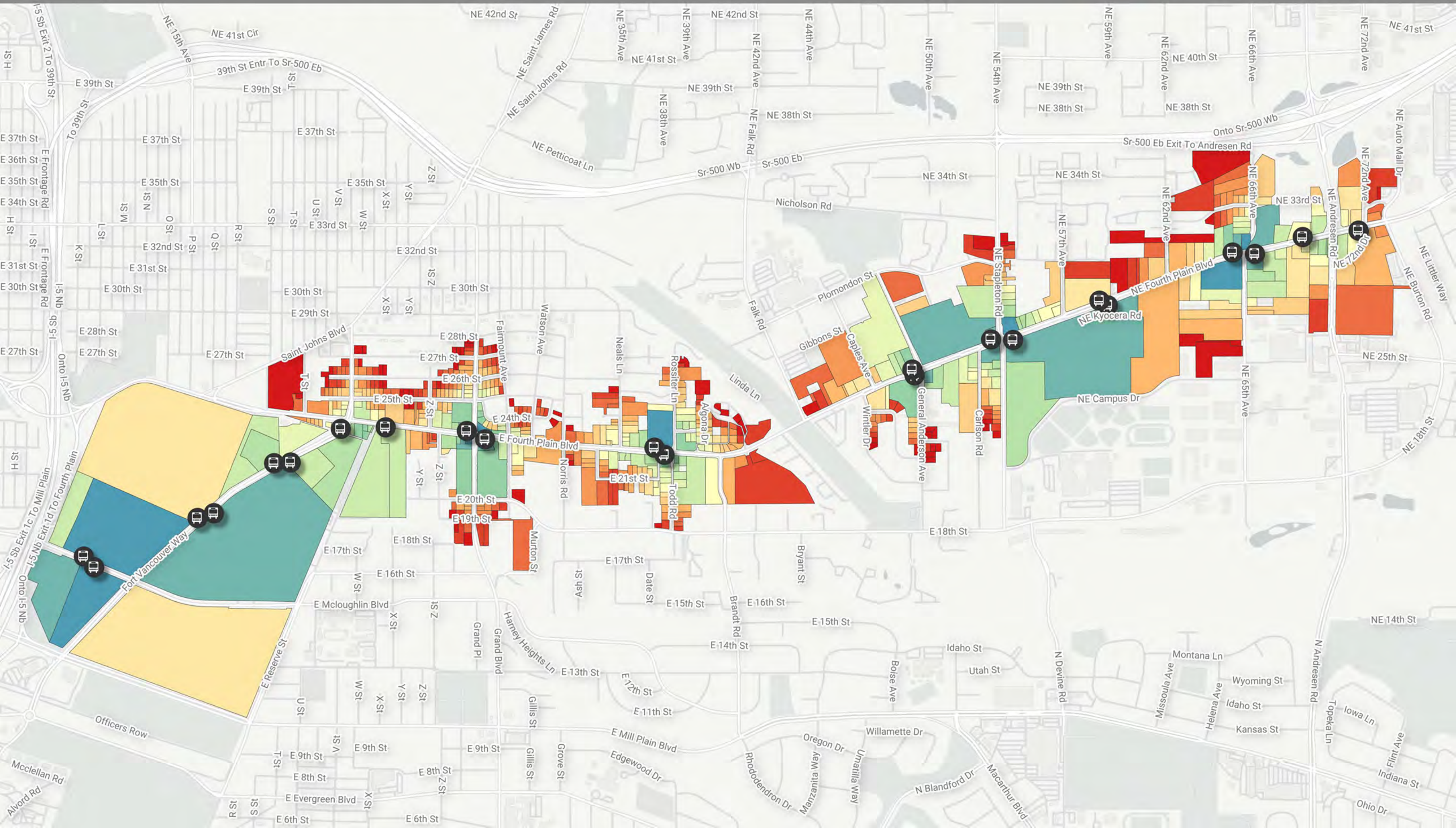
WALKING TIME TO BRT STOP

elderly or mobility impaired pedestrian | key new connections

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 2 ft/s



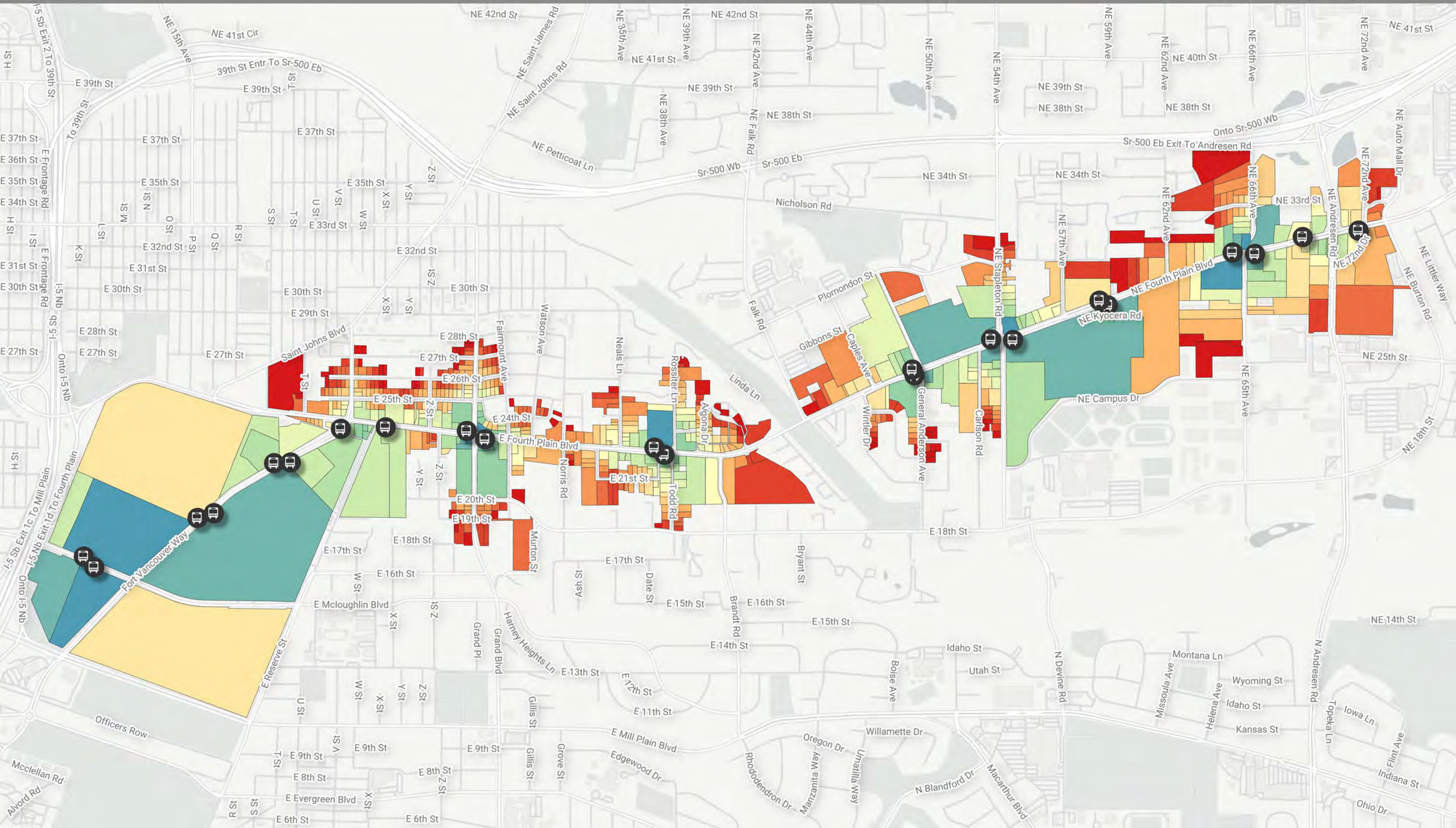
WALKING TIME TO BRT STOP

elderly or mobility impaired pedestrian | new crossings

0 0.25 0.5 0.75 1 mi

0 11 min

Number of minutes walk to the nearest BRT stop at 2 ft/s



DIFFERENCE FROM AVERAGE PEDESTRIAN

school-age children, single direction access

0 0.25 0.5 0.75 1 mi

0% 50% >90% Unreachable

Percent additional distance traveled compared to average pedestrian

DIFFERENCE FROM AVERAGE PEDESTRIAN

elderly or mobility impaired pedestrian

0 0.25 0.5 0.75 1 mi

0% 50% >90% Unreachable

Percent additional distance traveled compared to average pedestrian

IMPACT OF ALL CONNECTIONS

school-age children, single direction access

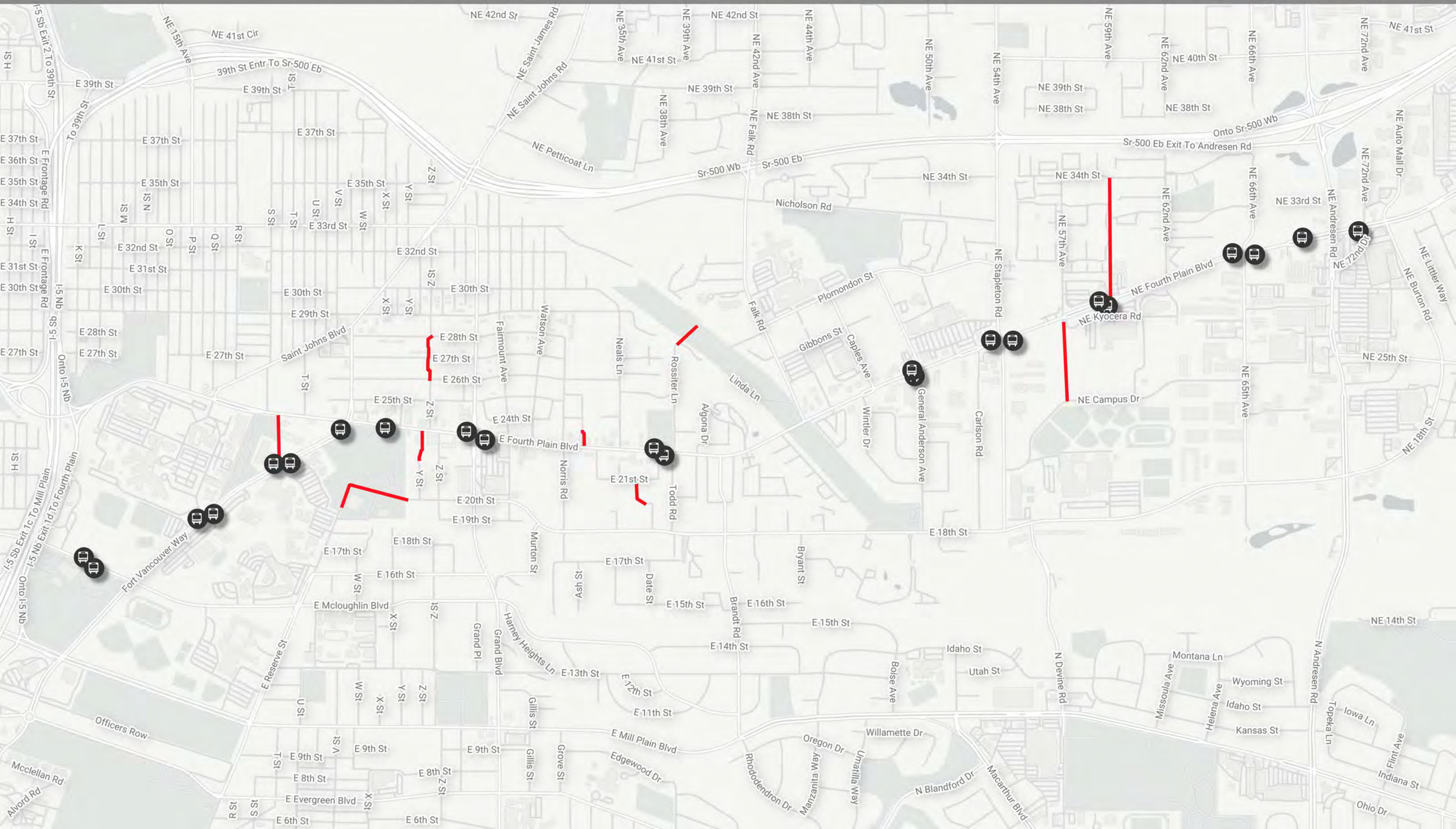
Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes

New Access

Reduction in travel time compared to the existing condition



IMPACT OF KEY CONNECTIONS

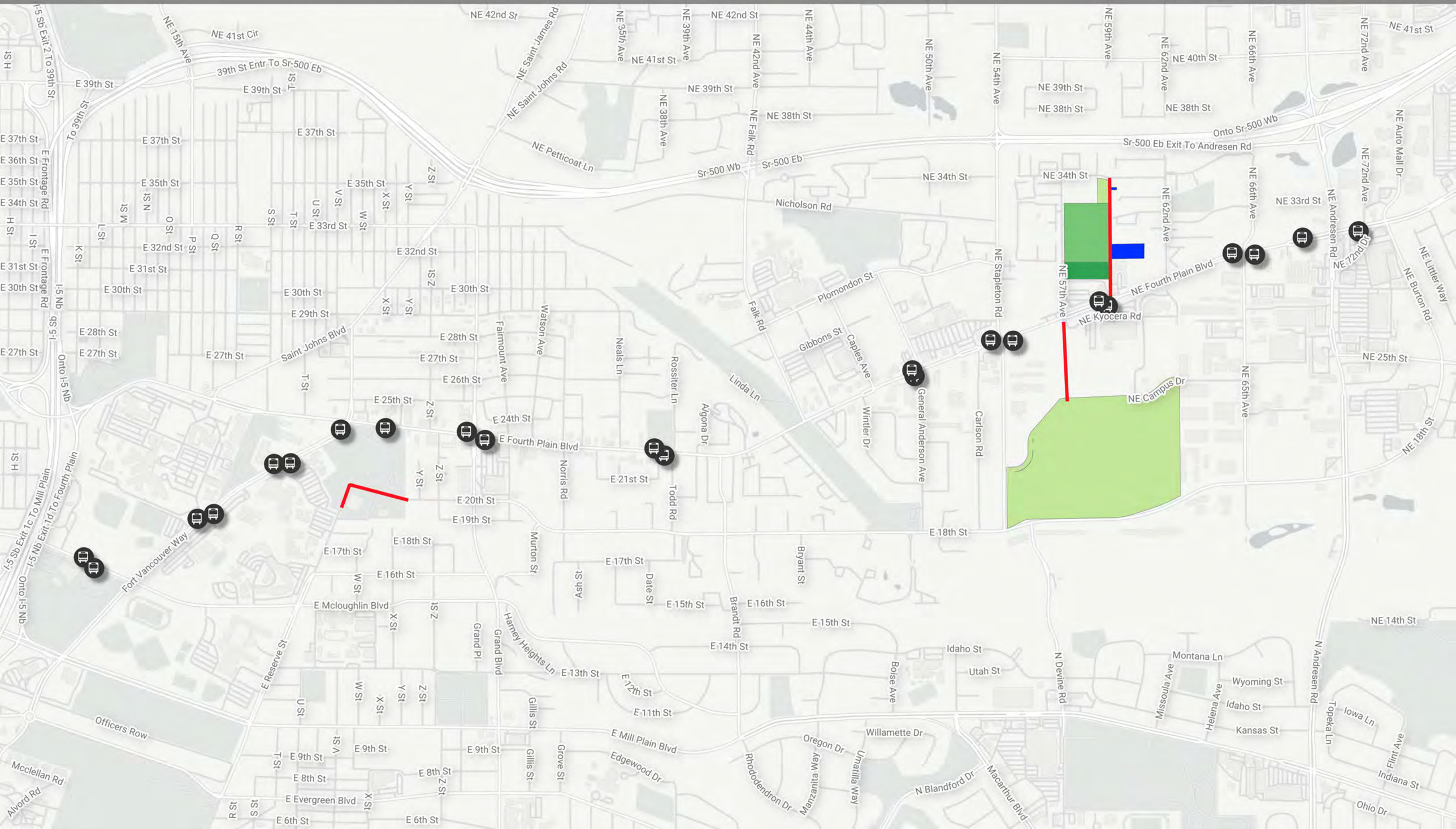
school-age children, single direction access

Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes New Access

Reduction in travel time compared to the existing condition



IMPACT OF IMPROVED CROSSINGS

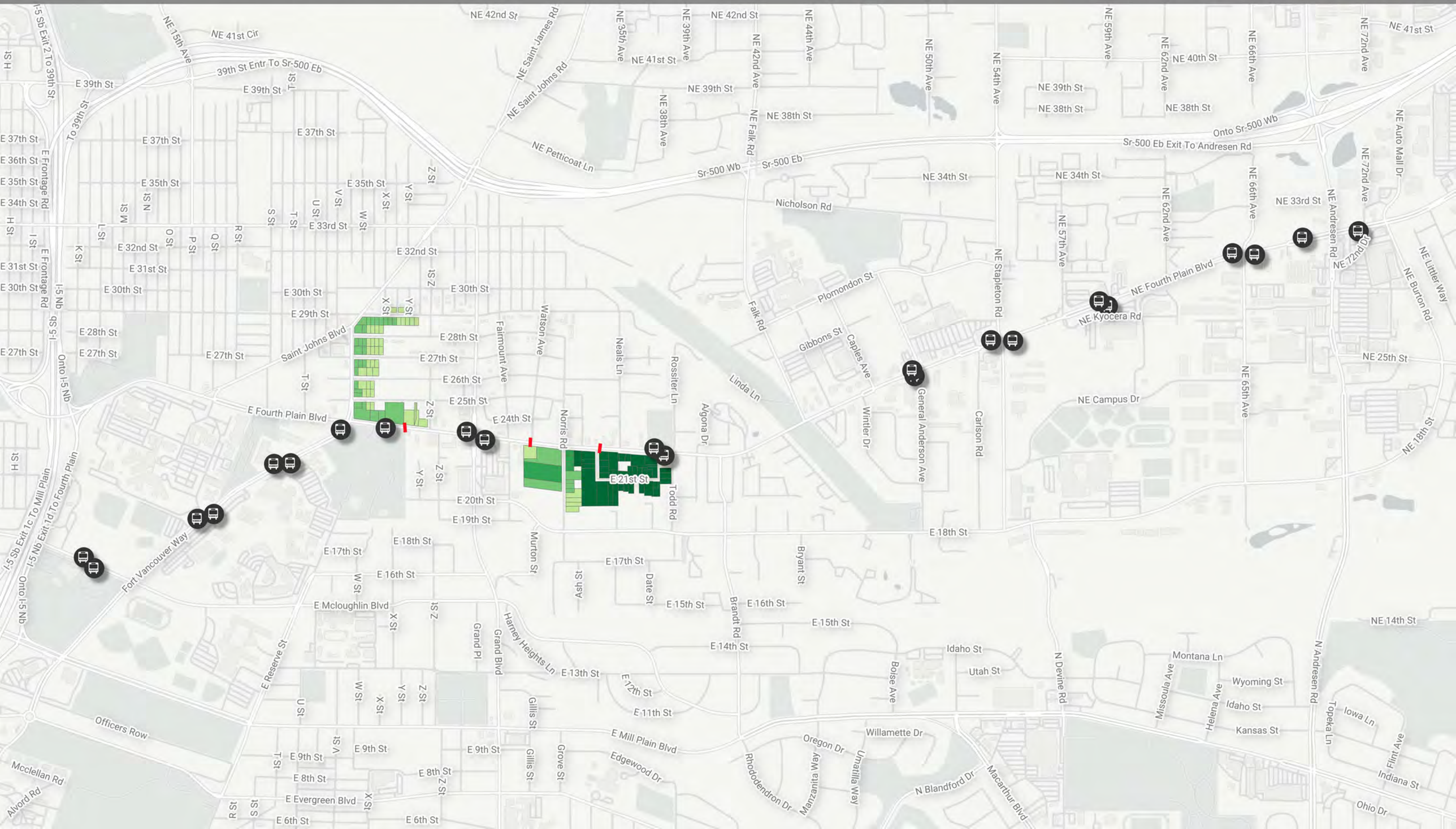
school-age children, single direction access

Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes New Access

Reduction in travel time compared to the existing condition



IMPACT OF ALL CONNECTIONS

average pedestrian

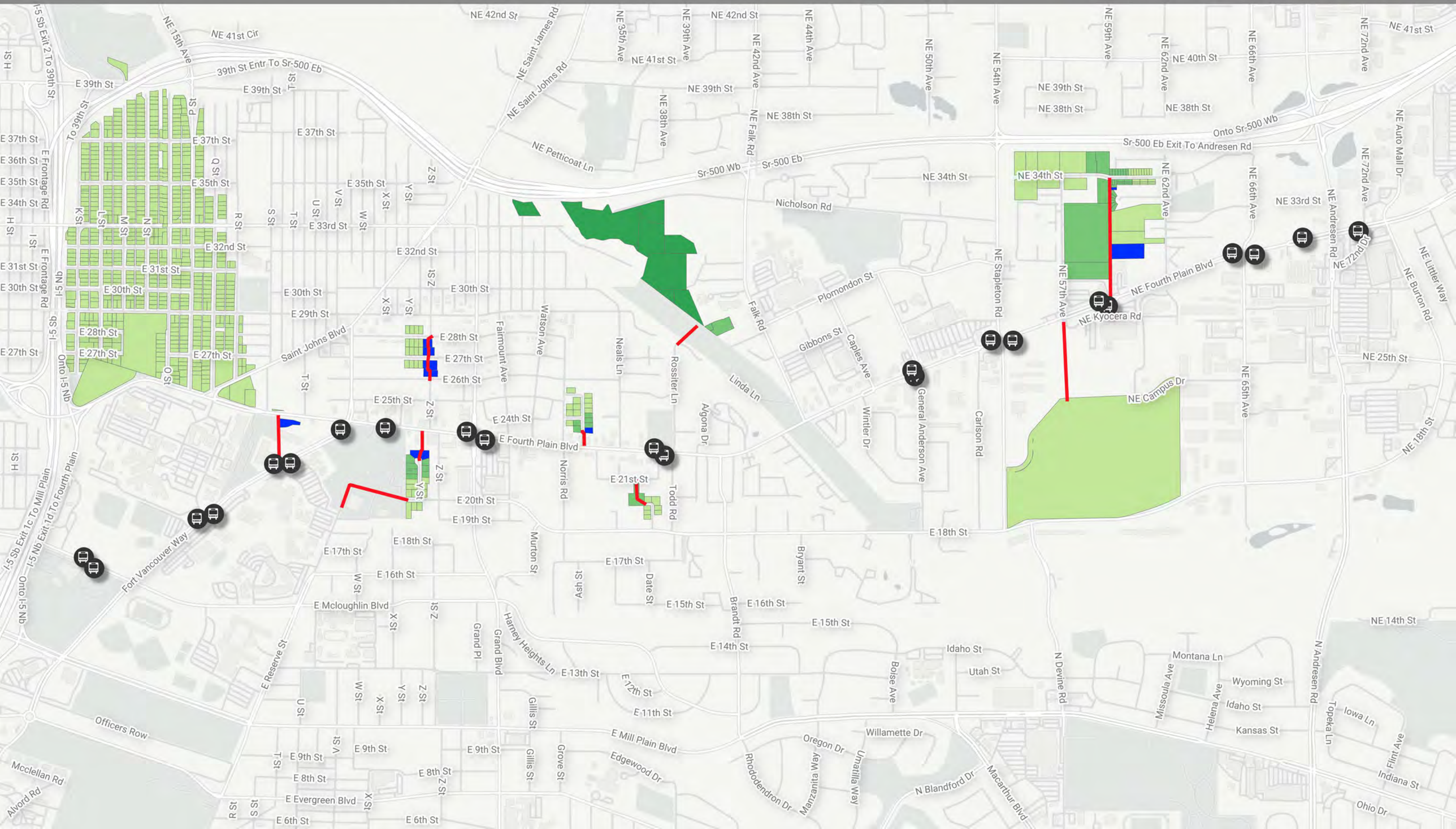
Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes

New Access

Reduction in travel time compared to the existing condition



IMPACT OF KEY CONNECTIONS

average pedestrian

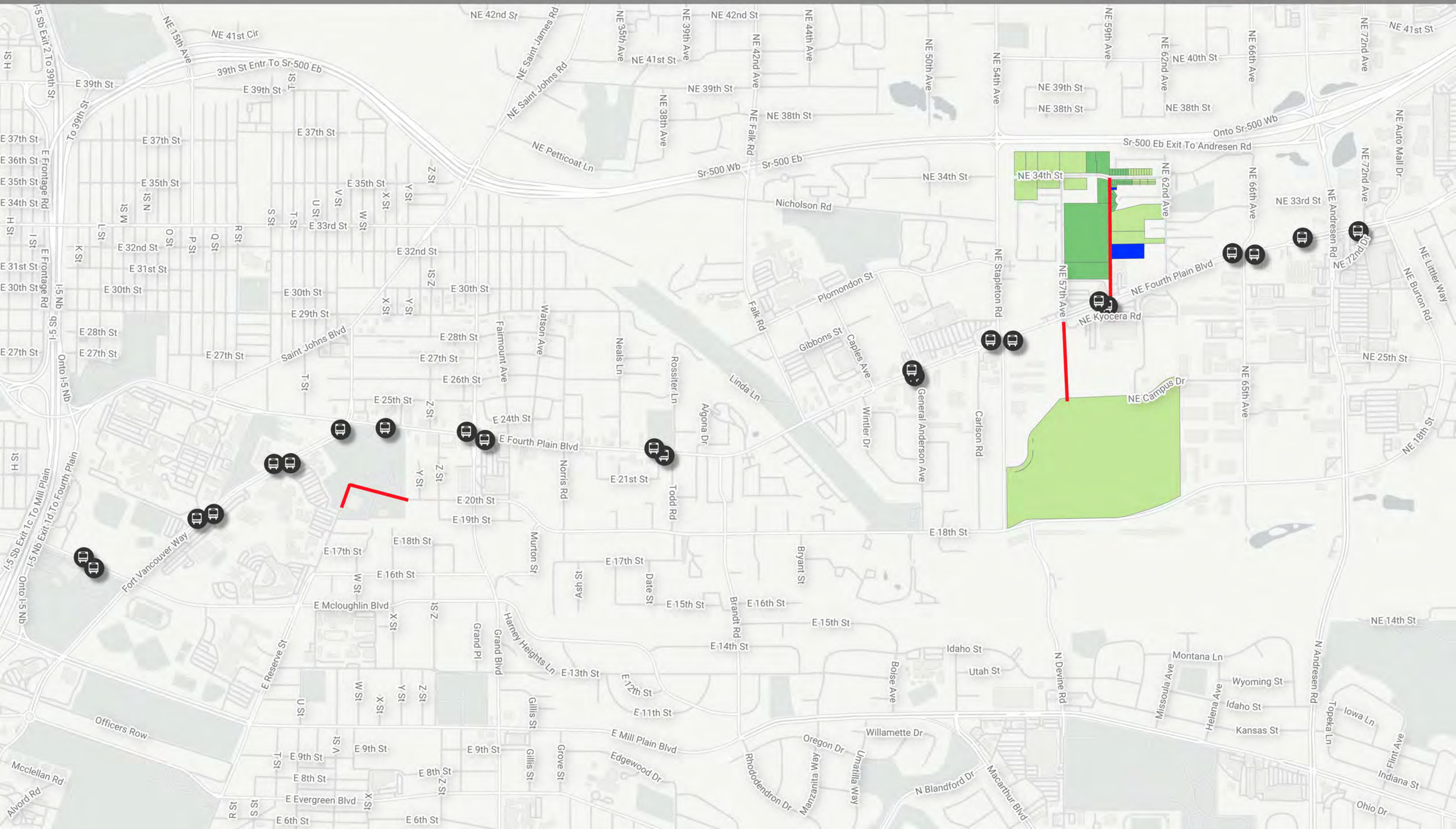
Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes

New Access

Reduction in travel time compared to the existing condition



IMPACT OF IMPROVED CROSSINGS

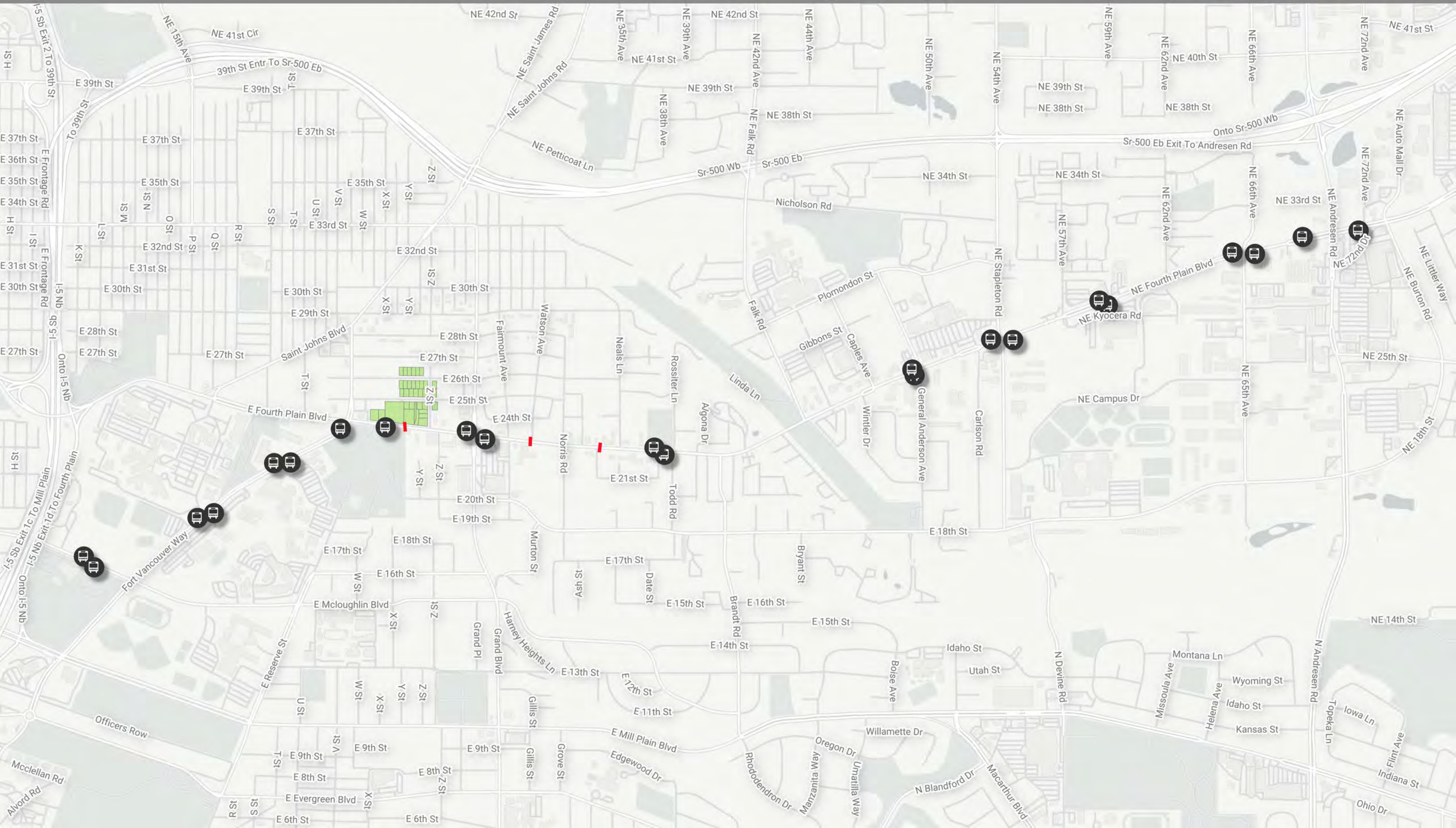
average pedestrian

Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes New Access

Reduction in travel time compared to the existing condition



IMPACT OF ALL CONNECTIONS

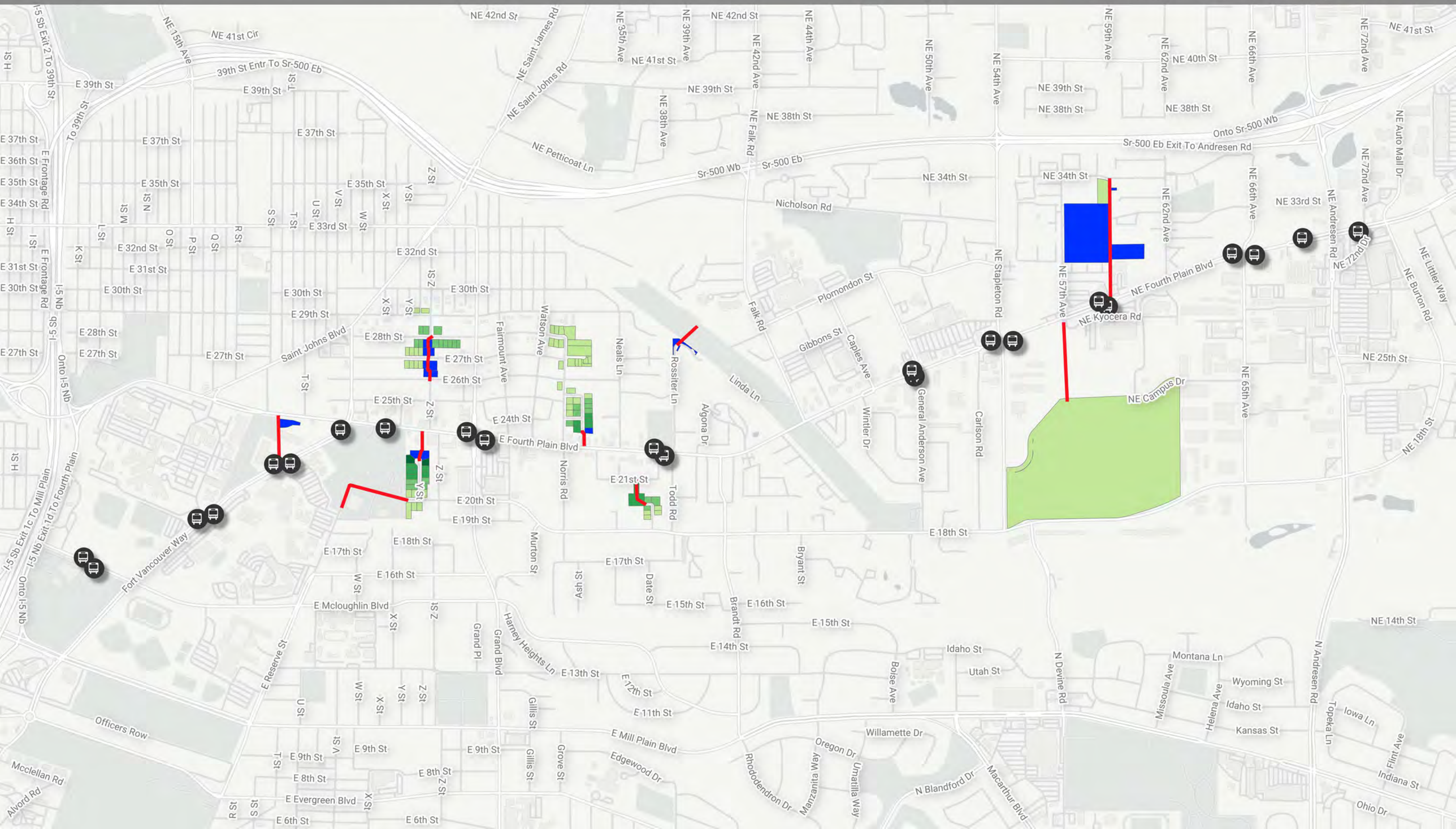
elderly or mobility impaired pedestrian

Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes New Access

Reduction in travel time compared to the existing condition



IMPACT OF KEY CONNECTIONS

elderly or mobility impaired pedestrian

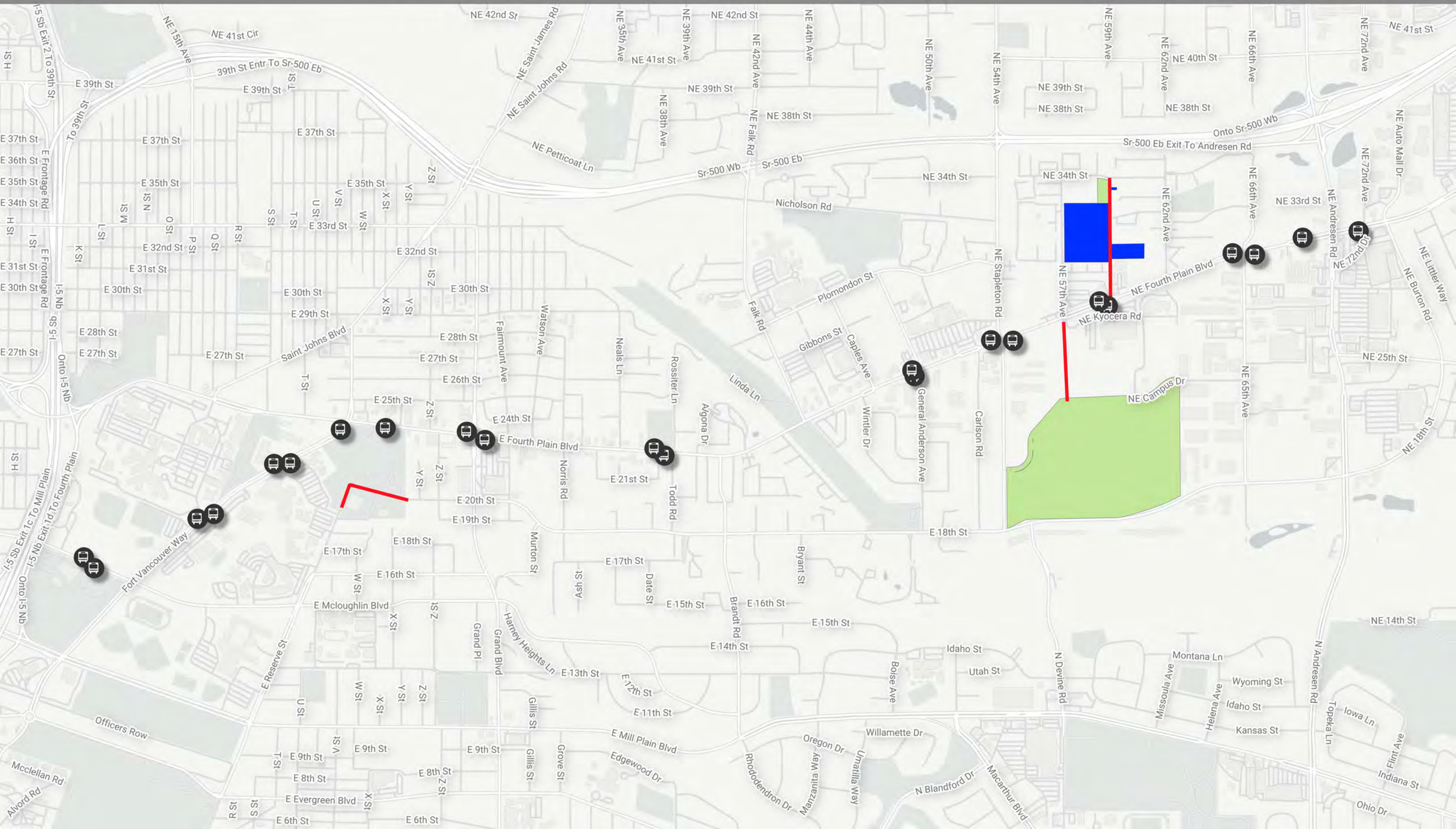
Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes

New Access

Reduction in travel time compared to the existing condition



IMPACT OF IMPROVED CROSSINGS

elderly or mobility impaired pedestrian

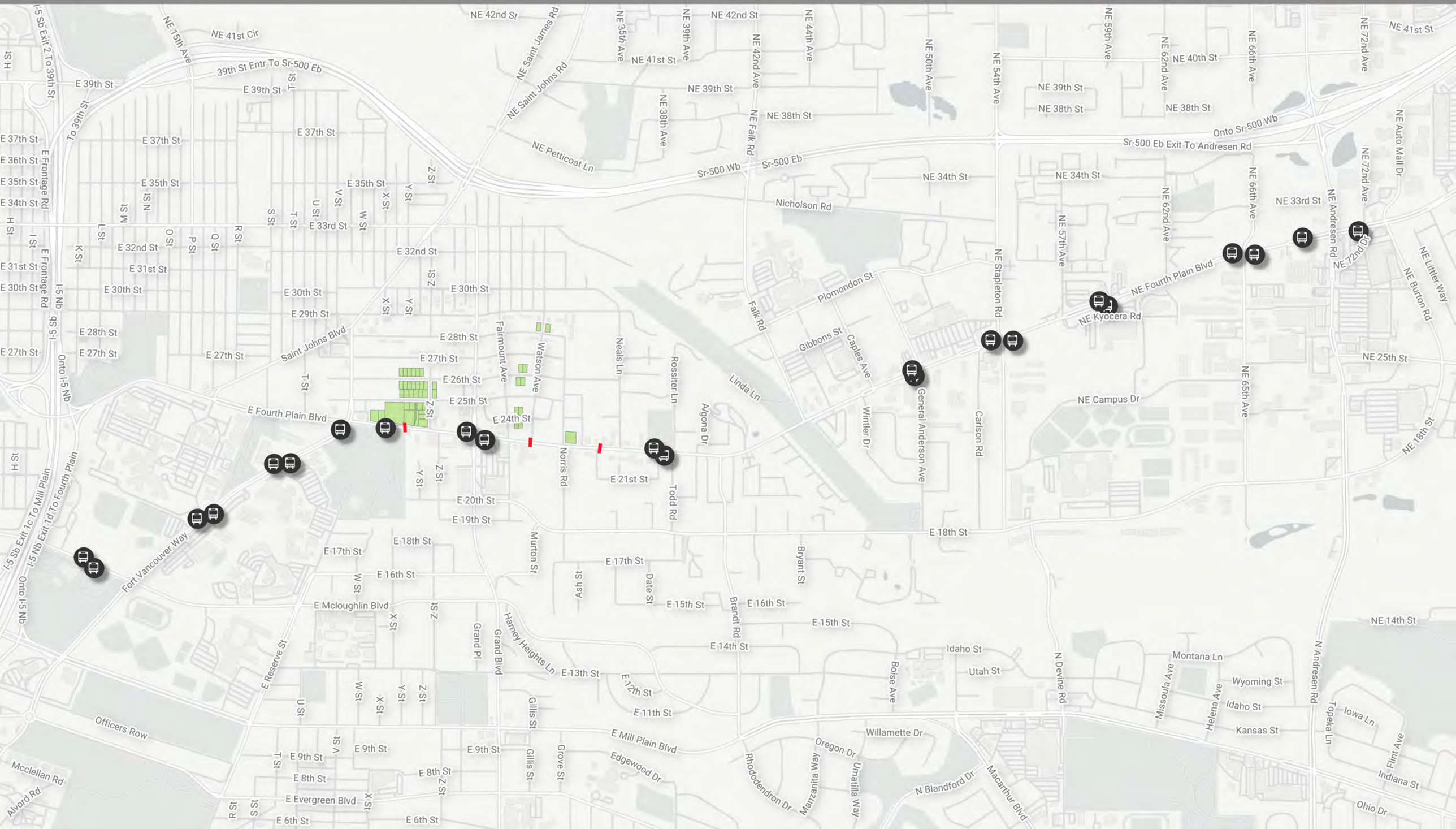
Proposed improvement

0 0.25 0.5 0.75 1 mi

2.5 minutes 5 minutes > 7.5 minutes

New Access

Reduction in travel time compared to the existing condition



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