PORT AUTHORITY OF ALLEGHENY COUNTY

2019 FIRST AND LAST MILE PROGRAM PLAN

ACKNOWLEDGEMENTS

Port Authority of Allegheny County (PAAC) provides public transportation throughout Pittsburgh and Allegheny County.

The Authority's 2,600 employees operate, maintain and support bus, light rail, incline and paratransit services for approximately 220,000 daily riders.

Port Authority is governed by an 11-member board – unpaid volunteers who are appointed by the Allegheny County Executive, leaders from both parties in the Pennsylvania House of Representatives and Senate, and the Governor of Pennsylvania. The board and its committees hold regularly scheduled public meetings.

Port Authority's budget is funded by fare and advertising revenue, along with money from county, state, and federal sources. The Authority's finances and operations are audited on a regular basis, both internally and by external agencies.

Participants

Port Authority of Allegheny County would like to thank agency partners for supporting the First and Last Mile Program Plan and all those who participated by dedicating their time and expertise.

This document was reviewed internally by Port Authority's Transit-Oriented Communities (TOC) advisory committee, an inter-departmental body established to support the TOC program. Development of the plan completed by Andrea Elcock, Community Planning Coordinator and Stephanie Kambic, Planning Intern with oversight provided by Breen Masciotra, TOD Project Manager. Representatives from Allegheny Conference on Economic Development, BikePGH, Pittsburgh Downtown Partnership, Pittsburghers for Public Transit, and the Southwestern Pennsylvania Commission also provided valuable external feedback.

Port Authority

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INTRODUCTION

INTRODUCTION

WHY THIS DOCUMENT?

Port Authority of Allegheny County (PAAC) provides access to the social, economic, and cultural resources that define the lives of Allegheny County residents and visitors. As part of PAAC's stated mission to connect people to life, the need for safe, convenient, and accessible transit for all users is essential. In addition to advocating for and building transit-supportive infrastructure, PAAC strives to consistently improve connections to transit where existing multimodal infrastructure is currently lacking. This Plan is intended to define the objectives and principles for optimizing transit access while establishing criteria that determine current needs and opportunities for future improvements.

Allegheny County and the City of Pittsburgh have a rich history of transportation. Many communities in the region formed around historic transportation assets including railroads and rivers. As a result of these growth patterns, legacy infrastructure such as public stairways, street networks, and long-established, dense, central job centers still exist in these communities and continue to support transit use and active transportation today. Yet auto-driven land use and policy changes, aging infrastructure, and geographic impediments, like steep topography, create challenges for those needing to access modern transit service.

While Port Authority has worked through and around these access challenges for decades, a growing interest in multimodal transportation options has provided an opportunity for PAAC to more thoughtfully address connections to transit. Initiatives such as Complete Streets Policies, Pittsburgh's 2030 District, the City of Pittsburgh's Climate Action Plan, and Allegheny County's Active Allegheny Grant Program have all called for creating more mobility options for the region as a tool to advance economic, environmental, and public health.

The data analysis for this Plan was completed in 2018. While many of the proposed improvements in the Plan will likely remain the same from year to year, PAAC aims to update the data evaluation process once every five years in order to monitor conditions and to keep up with station enhancement projects, as well as development and infrastructure changes in the station area. As new best practices and resources arise and are identified, they will be added to the Plan as well.

This document is subject at all times to and does not supersede any laws, regulations, or Board adopted policies applicable to PAAC. This document may be amended, suspended, and/or revoked, at any time and with or without notice, at PAAC's sole discretion.

FIRST AND LAST MILE DEFINED

Every transit trip begins and ends somewhere beyond the transit station or stop. Alternative methods of transportation, such as walking, biking, or driving, accompany transit on one's journey from origin to destination. For example, a commuter may bike to a station in the morning before work, ride the bus into the city, and then walk the last few blocks to her office building. The other methods that complement transit usage along one's journey are referred to as first and last mile connections. First and last mile connections encompass all the ways in which we get to and from stations or stops as we go to and from our homes, workplaces, businesses, schools, day cares, shopping centers, and other various destinations. While these connections and the physical environment that supports them are often referred to as the "first and last mile", the actual distance a user travels in the first or last leg of their journey may vary. For example, industry best practice finds transit users are most commonly willing to walk 5 minutes (approximately a quarter mile) to on-street service and 10 minutes (approximately a half mile) to fixed-guideway service (i.e. in a dedicated right of way). However, those driving or riding a bike may be willing to travel much further to transit, or the rider's end destination may be merely steps away from a bus stop. PAAC strives to facilitate connections that make all of the legs of a commute as safe, easy and comfortable as possible.

GOALS AND PRINCIPLES

By increasing and improving access to its services, PAAC intends to enhance a variety of agency goals. The three goals of the First and Last Mile (FLM) Program are to:

- increase transit ridership,
- promote non-single occupancy vehicle access to transit, and
- improve access to transit for those most likely to depend on it.

Increasing ridership is a determining factor in the success and financial sustainability of the agency. Promoting non-single occupancy vehicle access to PAAC service helps neighborhoods make the best use of limited space and promotes sustainable, transit-friendly communities. Lastly, improving access for those most likely to depend on it aligns with PAAC's equity goal, as outlined in the Port Authority's 2017 Transit Service Guidelines:

"In order to foster widespread mobility, the Authority shall strive to provide targeted and representative service to populations within Allegheny County with a greater need for transit so as not to allow a disproportionate burden to fall upon these populations".
(Port Authority's 2017 Transit Service Guidelines)

In addition to these goals, several principles serve as the foundation for why and how PAAC interacts with first and last mile connections.

Assessibility

PAAC is dedicated to accommodating people of all abilities and its approach to first and last mile connections is no different. PAAC ensures that all of its vehicles comply with the Americans with Disabilities Act (ADA) and accessible physical connections to transit should also be considered, as people with disabilities must be able to travel beyond the bus stop.

Attention should be given to people of all ages and abilities when planning and designing public spaces, access to public services, and connections to the transit station. PAAC will make proactive efforts to provide these services, and will offer guidance and support to others in facilitating accessible connections to transit where feasible.

Collaboration

PAAC service often runs under conditions and on facilities not controlled by the agency, which makes collaboration fundamental to its operations. Most roads and bus stops (property and shelters) in the PAAC system, for example, are not owned by PAAC. Similarly, most improvements identified through first and last mile planning will likely fall outside of PAAC's ownership or control. Inherently, connections to transit are formed by the land use, regulations, and resources of the local municipality. It is the intention of the FLM Program to establish a collaborative process to move these improvements forward with the support of and to the benefit of the agency's local, municipal, community, and regional partners. PAAC may bring ideas, staff time, or resources to these collaborations in hopes to support its riders in accessing services and supporting livable, transit-oriented communities.

Mode Hierarchy

In PAAC's Transit Oriented Development Guidelines (adopted in 2016), a mode hierarchy was identified to make best use of the limited space close to a station:

"Tough decisions have to be made with regard to how access is organized. People must be able to easily get where they need or want to go, and in whichever way they prefer. To facilitate connectivity, PAAC can use mode priority as a guide to make the best use of limited station space. Modes bringing the greatest number of people relative to the space they require and preserving the safety and quality of the pedestrian experience should receive greater priority over others."

The FLM Program Plan maintains the mode hierarchy established by the Transit Oriented Development Guidelines:

1. Pedestrian
2. Bicycle
3. Transit
4. Drop-off
5. Park and Ride

Since every transit, bicycle, and car trip begins and ends with walking, pedestrian access (including pedestrians with disabilities or who use mobility devices to aid them in walking) is the top priority. Safe, direct, fully accessible, and attractive pathways are a few key elements of a quality pedestrian environment.

Bicycle access is the second priority with regard to mode access to stations. People who cycle are welcome to bring their bikes – via bike racks on buses or in designated areas on light rail vehicles – on PAAC vehicles, and many do. With the option to store bikes at stations or transport them on the PAAC vehicles, bike connections and amenities require significantly less space and infrastructure than other mode options. On their own bikes, or using Pittsburgh's bike share system, Healthy Ride, many transit riders cycle for the first and last legs of their trips. Bike trips also greatly expand the FLM reach for Port Authority customers. While riders are generally willing to walk 10 minutes or a half mile to transit service in a dedicated right-of-way (referred to as fixed-guideway service), those who bike are willing to travel up to 3 miles in a 15 to 20 minute period.

Transit is the third priority mode in FLM planning. Riders alighting at one stop often make use of another service to shorten the last part of their journey. These trips may be brief and could likely also be completed by walking or biking, but the presence of transit makes the trip easier and more efficient. The difference between first and last mile service and transfer service (a connection that could not otherwise be easily replaced) is subtle, as the distance between connections may vary for each passenger. As a result, transit transfers may or may not serve riders as a FLM tool, but maximizing convenience of connections allows riders to more fully realize the benefits of service while maintaining ridership levels for the agency.

Drop-off locations, areas near and adjacent to stations where automotive vehicles can drop-off or pick-up transit riders, are convenient multimodal facilities that make an effective use of space at stations. As the fourth-highest priority in the mode hierarchy, drop-off areas should be given sufficient space to encourage a variety of vehicular access for rider pick-up and drop-off purposes without the need for vehicular storage. Space for drop-offs and

Wide sidewalks lined with benches and flower boxes encourage pedestrians to walk through and enjoy Mount Lebanon's business district.

Bike boxes, such as this one in the Cultural District of Downtown Pittsburgh, minimize conflict between cyclists and vehicles and make intersections easier to navigate.

pick-ups is beneficial for paratransit, ride-hailing services, taxis, and the family and friends who may drive a rider to transit service. Accommodating riders' flexible access to vehicles also helps reduce the dependency on personal vehicle ownership.

Finally, park and ride facilities provide a convenient transit access point for people living in communities without other viable connections to transit routes. Park and rides are particularly valuable in suburban locations where car ownership is high, local bus service is impractical and/or inefficient, and pedestrian or bicycle connections are limited or unsafe. This mode, however, does require significant space to accomodate automobile storage and space can be most efficiently used by discouraging single-occupancy trips through promotion of carpooling.

These modes are not exclusive; this hierarchy is a guide that should be considered in the context of each station area. Prioritization of modes can also align with the implementation of Complete Streets efforts on surrounding roads.

Public Health

All transit users start and end their trip actively, whether it be walking from a car to the bus stop or rolling between a station and office building. By encouraging connectivity, the FLM Plan and the resulting projects are intended to support walkable, bikeable, accessible, multimodal communities that allow for safe active mobility.

Ample first and last mile infrastructure promotes a pedestrian-friendly environment, therefore lessening the need for single-occupancy vehicle trips. As walking, biking, and taking transit become increasingly appealing options for commuters, the number of single-occupancy vehicle trips will decrease. Less time spent in personal vehicles means fewer vehicle emissions and less time idling in traffic, thereby improving regional air quality. Decreased reliance on personal vehicles also reduces the need for land-intensive parking, which captures heat and contributes to stormwater runoff, furthering the negative environmental impacts that most communities are working to mitigate.

While improving FLM connections promotes health and wellness, walking and cycling to and from transit stations can be risky, potentially resulting in injuries and even fatalities to pedestrians in environments not properly designed to accommodate such activities. Accordingly, protected pathways and other needed safety measures are a key consideration in identifying and implementing FLM improvements. Changes to the surrounding area may, and often will, be needed to protect the most vulnerable users of our streets.

Rider Safety, Comfort, and Satisfaction

PAAC seeks to create a positive rider experience for all who use its system. A rider's choice of what type of transportation to take is influenced by the safety, comfort, and satisfaction of each mode. In order to encourage ridership, both the transit experience and the access to transit must be satisfying.

Safety, comfort, and satisfaction result from numerous conditions and there is likely no perfect combination of the three factors. PAAC station user surveys have received a wide range of responses regarding ways to improve rider experience. Station design, amenities, service information, protection from traffic, sidewalk improvements and lighting were some of the most popular responses. Considerate, human-centered design takes into account the experiences of all users and creates people-friendly solutions for access to transit.

Sustainability

Public transportation plays an important role in addressing environmental challenges. PAAC sees the opportunity for public transit services to reduce energy consumption, decrease air pollution, and minimize road congestion in Allegheny County. By providing access to car-free or car-light mobility, sustainable lifestyles are facilitated and encouraged.

Each FLM solution will also have unique environmental aspects to consider with regard to sustainability. As an example, in many Pittsburgh neighborhoods, stormwater management is a priority in order to create safe streets and public spaces. There may be opportunities to integrate green infrastructure into first and last mile connections; many projects incorporate rain water capture in tree beds or swales. Additionally, street trees play a vital role in defining a comfortable pedestrian environment by slowing and creating buffers from vehicular traffic, while also providing environmental benefits in the form of water retention, shade, weather protection, and absorption of potential pollutants.

DEFINING SUCCESS

As first and last mile improvements are pursued, PAAC intends to monitor programmatic success through the lens of three categories of data points. First, ridership is an easily available indicator of achievement. PAAC can monitor station-level ridership numbers[1] before and after FLM improvements. Ideally, station ridership will increase over time as more people easily and enjoyably access service. However, it is important to consider that other factors may and likely will influence ridership, even at the station level. Preference trends, local development, service changes, weather, new technologies, and population change all contribute to fluctuations in station usage. For this reason, additional measures must be considered.

To measure how accessing transit stations has changed beyond ridership, Port Authority will need to create or access information regarding 1) the ways in which riders access the station and 2) the ease and experience they have when doing so. These two measures, mode split and user experience, can be measured through periodic station rider surveys.

1 While Port Authority collects ridership data through Automatic Passenger Counters on its bus network, as of 2019 Port Authority's light rail ridership is collected through in-person counts on an annual basis. The infrequent nature of data collection results in less reliable data for light rail stations. Data quality should be addressed in FLM analysis.

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2.
Bus
Stop

2018 FIXED-GUIDEWAY STATION FIRST AND LAST MILE EVALUATION

2018 FIXED-GUIDEWAY STATION FIRST

In order to identify PAAC stations with the greatest need for FLM accessibility, a multimodal data-driven evaluation was developed. The purpose of the evaluation, conducted in 2018, was to identify the current strengths and weaknesses of access to PAAC fixed-guideway stations and prioritize stations for FLM improvements. Focusing on the 69 unique, fixed-guideway stations with rapid service (as defined by PAAC's Transit Service Guidelines) allowed the planning team to develop the evaluation within a reasonable scope around a high capacity, reliable, frequent service area. With over 7,000 stops in PAAC's service area, applying this analysis to every stop would have taken significantly more time and effort. Additionally, as PAAC is considering stop consolidation, it would not be worthwhile to perform a FLM evaluation on all of the 7,000 stops, as some may change in the near future. The agency is currently undergoing several efforts geared specifically towards fixed-guideway stations (including the Station Improvement Program, Light Rail Station Design Guidelines and various State of Good Repair projects), creating opportunities to integrate FLM improvements. In the future, this analysis may be applied to additional PAAC stops outside of the fixed-guideway system as well.

Once completed, the FLM evaluation produced a ranked list of the 69 fixed-guideway stations, in order of suggested priority for improvements. While the list is not the sole factor that PAAC will use to determine a timeline for FLM planning, it helps to highlight the stations with the greatest opportunity for improvement. As the data used in this evaluation and its results capture a moment in time, continued analysis should be completed approximately every five years to monitor changes in station conditions and usage.

PROCESS

In the beginning stages of PAAC's FLM planning, the staff studied and learned from other transit agencies. After researching the best practices from organizations such as Utah Transit Authority (UTA) and Los Angeles County Metropolitan Authority (Metro), PAAC staff compiled a list of possible factors to include in the agency's FLM evaluation. Presence of bike lanes, sidewalk quality, and job density surrounding a station are examples of these factors.

Once a tentative list was drafted, staff held an internal cross-departmental meeting to discuss the data to be included in and removed from the evaluation. Gaining the perspective of employees who work first-hand in station maintenance, customer service, and other areas of service offered valuable insight into determining which factors had the most impact on FLM access and comfort. The list was then revised and reviewed at an external stakeholder meeting. County, municipal, non-profit, and other organizational representatives attended the meeting. Since FLM improvements often require complex collaboration, support from these local partners is critical for successful implementation and upkeep. PAAC staff obtained valuable feedback from these organizations, using it to construct a list of FLM evaluation features for further research.

The resulting list was then matched with existing available data. Some important factors, such as crosswalks, did not have data available consistently across all of Allegheny County and therefore could not be included. In the end, data for 27 factors were identified. The 27 factors are:

- ACCESS Paratransit Drop-offs and Pick-ups
- Bike Infrastructure
- Bike Racks
- Crashes per Rider
- Crime
- Destinations
- Destinations within .5 Miles of Station
- Drop-off and Pick-up Zones
- Equity
- Healthy Ride
- Inaccessible Roads
- Intersection Density
- Jobs
- Park & Ride
- Population
- Posted Speed Limit
- Ridership
- Sidewalks
- Slope
- Stair-Free Access
- Station Visibility
- Street Level Presence
- Trails
- Transit Connections
- Tree Cover
- Unique Approaches to Station
- Unique Area

For further explanation of these factors, see Appendix II.

Once the list was established, data collection for the 27 factors began. This process involved referencing various online databases, performing in-person assessments, and utilizing existing data from PAAC's internal records. For a full list of data sources used in the Plan, see Appendix III.

In order to define the study area around each fixed-guideway station, half-mile walksheds were used. Walksheds represent the possible walking range within a half-mile radius of each station. Each station walkshed is unique, determined by the street networks and pathways available to pedestrians. The evaluation used the same walksheds created for the 2016 Transit-Oriented Development Guidelines. For further explanation about walkshed methodology, see Appendix IV. All statistical calculations performed in the plan were calculated for the entire station walkshed, unless otherwise noted.

AND LAST MILE EVALUATION

CLASSIFYING DATA

In order to align with the three goals of the FLM Program, the 27 factors were sorted into three groups: Station Context, User Experience, and Equity. The first group, Station Context, aligns with the first goal: increase transit ridership. User Experience aligns with goal two: promote non-single occupancy vehicle access to transit. The last group, Equity, aligns with the Plan's final goal: improve access to transit for those most likely to depend on it.

The first group, Station Context, encapsulates the factors that influence how many trips riders take to and from a specific fixed-guideway station. Ridership is included in this group, as well as jobs within the walkshed and walkshed population. A station with a high Station Context score has the potential for more fixed-guideway users, as various amenities and destinations already surround the station and draw riders to use it.

All 8 Station Context factors are displayed below:

Station Context Factors	What is Being Measured
ACCESS Paratransit Drop-offs and Pick-ups	How many paratransit users are frequently arriving at or being picked up from the area adjacent to the station?
Destinations	How many places of interest are in the walkshed?
Destinations within .5 Miles	How many places of interest are not in the walkable area, but could be reachable after first and last mile improvements?
Intersection Density	How many intersections are on the streets in the walkshed?
Jobs	How many people work in the walkshed?
Population	How many people live in the walkshed?
Ridership	How many riders use the station?
Unique Area	How much of the walkshed is not served by other fixed-guideway stops?

The User Experience group includes factors that define how riders choose to get to and from a fixed-guideway station and the quality of their experience when doing so. Sidewalks, bike lanes, and transit connections are examples of factors that impact access to a station. Improving User Experience discourages the use of single-occupancy vehicles to access a station, as alternative methods of travel will become more desirable for many commuters.

As part of the feedback and research process, PAAC staff concluded that not all 18 factors have equal impact on the user experience. For more information about the weighting that was applied, see Appendix VI.

All 18 User Experience factors are displayed below:

User Experience Factors	What is Being Measured
Bike Infrastructure	How many designated bike lanes or bike right-of-ways exist in the walkshed?
Bike Racks	Are there places to safely store a bike at the station?
Crashes	How many crashes occur in the walkshed?
Crime	How many crimes occur in the walkshed?
Drop-off and Pick-up Zones	Is there space for drop-offs or pick-ups at the station?
Healthy Ride	Is there a bike share dock at the station? Is there a bike share dock within 400 feet of the station?
Inaccessible Roads	Are there roads in the walkshed that do not allow pedestrian access?
Park and Ride	Is there a Park & Ride lot at the station?
Posted Speed Limit	How high or low is the average posted speed limit for streets within the walkshed?
Sidewalks	Are there sidewalks leading to the station?
Slope	How much of the walkshed topography is navigable (<10% grade) and comfortable (<5% grade)?
Stair-Free Access	Is there stair-free access to the station for riders with bikes? If there are steps, is there a runnel?
Station Visibility	Are there obstacles blocking the line of vision to the station?
Street Level Presence	How many ways can the station be entered at street level?
Trails	Are there trails in the walkshed?
Transit Connections	Are there transfers available at the station?
Tree Cover	Are the streets and sidewalks shaded in the walkshed?
Unique Approaches to Station	How many different ways can you approach the station?

Finally, Equity is represented using an index created by PAAC staff and used agency-wide to determine how great the need is for public transportation in a specific walkshed. There are 8 features that make up the Equity Index, therefore making up the Equity Score of this evaluation:

1. Female Householders
2. Households without Vehicles
3. Minority Race and Ethnicity Persons
4. Older Adults
5. People in Poverty
6. People under Age 18
7. People with Disabilities
8. People with Limited English Proficiency

The Equity Index is calculated for each individual block group (a geographic unit of the US Census) in Allegheny County, but for uses in this Plan, the data was applied to station walksheds as a whole. These walksheds may include numerous block groups; the final equity score for a walkshed is an average of each individual block group's equity. For more information, please reference Port Authority's Equity Index Report 2018.

All data for the 27 evaluation factors across the three groups outlined above was normalized for each station on a scale of .01 to 1. Zeroes were not used in the evaluation, in order to avoid multiplying by zero as weights were applied.

Many factors were simply yes-or-no questions, such as the presence of a Park and Ride. In these cases, an answer of "Yes" would receive a score of 1, and a "No" would receive a score of .01. However, other categories required an adjustment process in order to create an accurate ranking of the station factors. For further details, see Appendices V and VI.

RESULTS

After adding the totals for Station Context, User Experience, and Equity, the 69 fixed-guideway stations were ranked based upon their final scores. The top 10 stations are displayed below:

A high score in the Station Context column means that there are high numbers of people and destinations around the station area. User Experience data was inversed during the analysis; therefore, a high score in User Experience means there are more deficiencies in the station A A high score in the Station Context column means that there are high numbers of people and destinations around the station area. User Experience data was inversed during the analysis; therefore, a high score in User Experience means there are more deficiencies in the station area, emphasizing the need for improvement. Stations scoring low in User Experience likely have better infrastructure and accessibility already in place and are not intended to be priority targets for first and last mile enhancements. A high Equity score indicates that there is a great need for public transportation in the walkshed, and consequentially an opportunity for a high quantity of riders to benefit from FLM upgrades. In weighting and adding all three scores together, the high equity stations with lots of potential riders but a vast need for infrastructure improvements rise to the top.

The evaluation results are based on a weighted total of the three data groups. The best possible total score for the FLM evaluation is 100. The three groups in the FLM analysis were not all valued equally in the final score calculation. Station Context and User Experience both receive a 40% weight, and Equity receives the remaining 20%. Weighting was used to ensure that the scores best aligned with the three goals of the program. While all three goals were weighed equally at first, the highly correlated equity and station context scores overwhelmed the final score. Weighting was shifted as a result to put greater emphasis on the factors that define FLM experiences and generate ridership. As a commitment to providing service in high need and transit-dependent areas is a goal of both the plan and the agency as a whole, this weight was determined to be fitting.

The complete list of rankings for all 69 fixed-guideway station walksheds can be found in Appendix VII. The stations that ranked highest in the evaluation process will be the first ones targeted for FLM planning or investments, subject to PAAC funding and staff availability and budgetary allocation, in the future. However, additional factors such as low community support may hinder the potential for FLM planning and improvements and must be factored into consideration when selecting station areas for future projects. To deal with some of this uncertainty, PAAC has outlined a process for how the agency will proceed when pursuing implementation.

Station Name	Station Context	Equity Score	User Experience	Weighted Total	Rank
First Avenue	67.26	30.69	52.00	53.84	1
Wilkinsburg	46.02	100.00	38.55	53.83	2
Steel Plaza	78.27	38.89	35.36	53.23	3
Homewood	39.32	95.90	45.62	53.16	4
Wood Street	74.54	37.08	38.14	52.49	5
Negley	71.71	49.88	32.09	51.50	6
Bon Air	23.22	78.19	66.36	51.47	7
Penn Station	64.69	40.20	43.47	51.30	8
Hamnett	43.27	75.10	47.20	51.21	9
Gateway	77.09	39.48	31.04	51.15	10

Purple Line (East Busway) | Multi-Line (Red and Blue Light Rail) | Blue Line (Light Rail)

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3.

FIRST AND LAST MILE IMPLEMENTATION AT PORT AUTHORITY

FIRST AND LAST MILE IMPLEMENTATION

In order to encourage the development of projects that are beneficial to and supported by the station area community, PAAC has identified a collaborative process and structure for how it will pursue and advocate for first and last mile improvements.

AGENCY ROLES

There are many ways in which PAAC may act in support of FLM connections. When studies, plans, or improvement initiatives are led by others, PAAC can act as a collaborator, providing resources, guidance, and advocacy. When there is no ongoing initiative, PAAC staff may conduct key stakeholder outreach to identify interest in FLM projects. Where interest and goals align, PAAC may convene invested partners and begin the collaboration process. In conjunction with these efforts or as part of ongoing upgrades PAAC may also invest in its own property to provide connectivity, subject to PAAC funding availability and budget allocation. Through any of these roles, PAAC can support FLM improvements by providing internal resources such as data and staff time, dedicating direct funding, or partnering to seek external funding opportunities.

In all scenarios outlined hereinafter, PAAC seeks to be a leader in improving FLM connections to its services. While each station and stop and FLM planning process may call for different needs, PAAC may serve in the following roles:

- Advocate: supporting project design and land use decisions that contribute to a network of mobility, including current and future transit assets, typically when no property owned or controlled by the agency is involved;
- Collaborator: supporting and working with others, providing staff time, data, and/or joining or supporting an application for additional resources; and/or
- Sponsor: directly designing, constructing, and/or funding access improvements, typically on agency-owned or -controlled property or with the agreement of others when both agency and external property may be involved.

The paths that projects take for planning and implementation are varied and as a result, PAAC roles and the process steps identified here do not have a strict timeline or order requirement; they may overlap or occur simultaneously within one project. Using the 2018 Fixed Guideway Station FLM Evaluation described in earlier pages, staff will review the top scoring stations to determine interest in convening, implementing, and participating in FLM project development.

ADVANCING FLM PLANNING

When detailed access planning has not already begun or has been started but not implemented, PAAC can play a leadership role in convening interested parties around the goal of improving access to transit. Convening a group of stakeholders may mean starting a brand new process or picking up on work that has already been completed. For this reason, the actions laid out below are not necessarily linear. Projects may start and progress with different needs.

Gauge Interest

The first need in a planning process will be to identify key project stakeholders and establish the interest in working collaboratively towards improvements. As a starting point, PAAC should consider reaching out to municipalities, Allegheny County, community groups, PennDOT, and large institutions and property owners such as hospitals and universities. Adjacent station roadway owners are particularly important to include as these access points will likely be part of the study area. It is important to note that different goals, such as increasing access to a business district or school, may have different intentions but the same outcomes. For this reason, reaching out to a range of stakeholders is key.

Initial outreach is intended to gauge if there is serious interest in pursuing a project to address accessibility; key stakeholders should demonstrate commitment to advancing the project, through plans, staff time, funding, or other resources. There may be instances in which timing or interest is not aligned. For example, the municipality may have other priority areas or an existing plan to address access in the future. Cooperation is necessary in making improvements outside of PAAC-owned or -controlled property. If there is not stakeholder interest in participating, it may be most appropriate for PAAC to place FLM planning on hold and move along to the next priority station in the list.

If there is alignment between stakeholder goals and interest, planning can advance in pursuit of additional information or resources to support solutions.

Conduct Analysis

When there is sufficient interest in and dedication to a FLM planning process, data and input must be gathered to fully define the problems and opportunities in the station area. Projects such as PAAC Station Area Plans and Transit Revitalization Investment District (TRID) studies likely provide detailed analysis that meet planning needs.

The following inputs are recommended for additional understanding of more detailed FLM needs, when prior planning does not suffice:

- Review in detail of the data used in the 2018 FLM Evaluation for the station in question
- Review of stakeholder plans
- Review of ACCESS paratransit data including recorded problem areas and obstacles
- Outreach via meetings or surveys to station users and stakeholders
- Audits of existing conditions (including sidewalk audits and more)
- Analysis of available data relevant to area mode split (i.e. bike or pedestrian counts)

The intention of this step is to pinpoint station-specific problem areas, challenges, and opportunities. This may occur at the street-level, intersection-level, or block-level.

PROCESS

Identify Solutions

With a thorough understanding of the current conditions and problems, the process to identify solutions can begin. The Toolbox section of this report outlines tools for access improvements including professional guides that can be referenced for additional details. Previous planning efforts may have also identified solutions. The development and design of FLM connections may take a variety of forms but the final solution should adhere to the principles, including mode hierarchy, identified in the FLM Program.

There should be an appropriate deployment of a cost-benefit analysis in solution design. From painting benches to repaving roads to fixing stairs to building bridges, FLM improvements can come with a wide range of costs, and benefits can include hard-to-quantify improvements to safety, access, and economic development. At the same time, not every station serves or has the potential to serve the same number of people. Fiscal responsibility, projected availability of funding or grant opportunities, and an efficient use of resources should be considered through all potential and implemented FLM projects.

Obtain Resources

Resources may be needed to identify problems and solutions as outlined previously (consultant support, for example) or to reach implementation. Funding will more often than not be both high priority and not readily available for the stakeholder group. Grant applications with high levels of local match are more competitive for state and federal funding; applications for funding will be more successful if the collaborative environment has been established early on. In cases where key participants are not yet on board, there may also be the need for advocacy, education, or, for any collaboration involving funding commitments or property license and use, formal agreements. To support creativity and flexibility in implementation, this Plan does not recommend a set funding source, but suggests that PAAC and partners continue to build their awareness and understanding of potential funding sources beyond PAAC's and partner's standard operating and capital budget.

Implement

Implementing FLM solutions can be completed either in-house or through contract. Property owners or municipalities may have upcoming projects where solutions can be easily integrated. Likewise, there may be forces on hand that can make minor improvements, like sidewalk repairs. With the possibility of limited resources, it is key to integrate solutions into other projects whenever possible. Street paving, utility repair, and new construction are just a few opportunities to implement FLM solutions as part of other work.

As the walkshed and FLM impact area is compromised of numerous property owners, some improvements may happen piecemeal over time. PAAC, for example, may implement new pathway improvements through normal state of good repair (see "Implementing on Agency Property") before adjacent property owners have the chance to improve their connections. When possible, however, projects should be coordinated to maintain a coherent network of connections and to minimize disruption from construction processes.

There may also be the need to contract additional capacity for implementation when outside expertise is required. In such cases, the coordination described above is still applicable and partner communication should be included as part of the project scope.

IMPLEMENTING ON AGENCY PROPERTY

PAAC often owns or exercises control over the property that defines the station, and sometimes land beyond it. At times, PAAC may have the opportunity to support FLM improvements on its property. To encourage FLM access, PAAC should address suggestions and concerns that are raised as part of a partner's planning process, a collaborative planning process, or to align stations with agency design guidelines.

These improvements may be made through several means.

- State of Good Repair: Improvements may be made along with ongoing maintenance and station upgrades intended to keep the system in a steady state of safe, good repair.
- Station Improvement Program: When station area planning is conducted as part of the Station Improvement Program, station access is always included. FLM designs may be identified through station area planning. Station renovation conducted as part of the Station Improvement Program provide opportunities to integrate FLM solutions.
- Singular Projects: When deemed appropriate, PAAC may look to integrate solutions separate from other construction or repair processes.

In all these cases, relevant PAAC guidelines should be followed. At the time of the issuance of the FLM Program, PAAC has finalized Light Rail Station Design Guidelines, has nearly finalized Bus Stop Design and Street Design Guidelines, and intends to pursue Busway Station Design Guidelines. Additionally the Port Authority's 2016 Transit Oriented Development Guidelines provide guidance on multimodal connectivity, walkability, and development infrastructure such as public space, public art, and design goals. All of these are relevant for future FLM projects. To further define the agency's planning for multimodal access, three sets of guidelines pertaining to pedestrian access, bicycle facilities, and emerging mobility are being drafted. Port Authority facilities that do not align with the conditions outlined in these three guidelines may receive improvements through the means outlined above (State of Good Repair, Station Improvement Program or singular projects), subject to funding availability and budgetary allocation.

PARTICIPATING IN OTHER ORGANIZATIONS' PLANS

In many instances, access planning may be started by other organizations who have an interest in connecting to transit. Whether it be municipalities, PennDOT, community groups, business owners, or regional leaders, PAAC will endeavor to participate (as resources allow) in FLM-related planning efforts to encourage best practice design and the principles outlined in this FLM Program document.

For these plans, the principles outlined under "initiating new projects and/or advancing prior planning" and "implementing on agency property" are still applicable.

4.

FIRST AND LAST MILE TOOLBOX

FIRST AND LAST MILE TOOLBOX

PAAC has developed a Toolbox as part of the FLM Program. Inspired by project ideas found through industry best practice documents such as National Association of City Transportation Officials (NACTO) guidelines and tools used by other transit agencies and municipalities, the Toolbox offers suggestions about what to look for when addressing barriers within the first and last mile of a rider's commute.

REFERENCE GUIDES

There are numerous documents already in place that detail improvements for some of the challenges to transit connectivity referenced in this FLM Plan. Use these guidelines to find detailed recommendations for solutions to improve first and last mile connections:

- National Association of City Transportation Officials (NACTO) Transit Street Design Guide
- NACTO Urban Bikeway Design Guide
- National Cooperative Highway Research Program (NCHRP) Systemic Pedestrian Safety Analysis
- University of North Carolina Highway Safety Research Center (HSRC) Pedestrian and Bicycle Information Center
- Pennsylvania Department of Transportation (PennDOT) Traffic Calming Handbook
- Pittsburgh Bicycle Parking Guidelines
- U.S. Department of Transportation Federal Highway Administration Pedestrian Safety Guide for Transit Agencies
- Southwestern Pennsylvania Commission Active Transportation Research Center

The following guidelines created by PAAC staff for external partners should also be reviewed and used when applicable. Additionally, external partners should coordinate with PAAC staff to ensure projects are consistent with standards used by PAAC's Engineering, Service Development and Road Operations Departments.

- Transit-Oriented Development Guidelines
- Station Area Plans
- Bus Stop Design and Street Design Guidelines

BEST PRACTICE TOOLBOX

The Toolbox is not an exhaustive list of every possible suggestion for transit-friendly communities and is not intended to provide detailed plans for specific stations in the PAAC system. When undertaking projects to fix connection barriers, each station will have unique needs and challenges. The FLM Toolbox is meant to offer guidance on best practices to remove such barriers and improve access. A successful FLM project will incorporate many of the suggestions offered in the Toolbox, using these methods to help build a safer, more transit-friendly walkshed.

PAAC'S FLM Program and the Toolbox do not supersede laws, regulations, or Board adopted policies applicable to PAAC or its municipal and implementation partners. Rather, the FLM Program and the Toolbox should be used to supplement existing standards (e.g. design guidelines, zoning, building code, etc.) and to guide access improvement where other standards do not.

In the Toolbox, improvement suggestions are split into 5 categories based upon mode prioritization:

1. Pedestrian
2. Bicycle
3. Transit
4. Drop-off
5. Park & Ride

Every transit rider is ultimately a pedestrian, walking at the very beginning or end of their commute. Therefore, pedestrian infrastructure improvements will positively impact users of all modes at some point in their trip. Pedestrian improvements are outlined in the "Pedestrian" section of the Toolbox but should be considered in tandem with other modes. Above all, a successful mobility environment must be safe, visible, comfortable, accessible, and connected. These principles apply to every mode of transit.

The following checklist contains qualities to look for when aiming to enhance mobility and tools that could be deployed to provide those qualities.

1. Pedestrian

☐ Minimize Crossing Distances

- Curb extensions promote traffic calming and increase visibility.
- Pedestrian islands protect pedestrians from traffic at large intersections.

☐ Clarify Crossing Locations

- Crosswalk maintenance ensures that the paint remains bright and unbroken.
- Piano key stripes increase visibility of crosswalk.
- Tactile warning strips help the visually impaired to locate the crossing.

☐ Clarify Crossing Expectations

- Countdown timers help pedestrians know when it is safe to cross.
- Leading signals give pedestrians time to establishing themselves in the intersection while cars are stopped.

☐ Connect Sidewalk Network

- ADA compliance ensures that sidewalks are wide enough for wheelchairs and are ADA compliant.
- New sidewalks minimize missing links in sidewalks.
- Sidewalk maintenance repairs broken, cracked sidewalks.

☐ Adequately Light Walkways

- Even spacing ensures that lights are appropriately dispersed along pedestrian walkways to minimize dark spots.
- Smart location of lights ensure that wayfinding tools and transfer locations are highly visible.
    - Light narrow stairways and other isolated locations.
    - Add extra lighting to areas with a history of crime.
    - Add uplighting to minimize glare.

Brightly painted crosswalks with tactile warning strips, like this one in East Liberty, clarify to pedestrians and vehicles that this is a safe area to cross the street.

Wide sidewalks like this one near Potomac Station offer a safe pathway for pedestrians. Street trees, trash cans, and frequent lighting increase pedestrian comfort.

This Healthy Ride bike share dock on Seventh Avenue sits infront of a mural covering the wall of a building.

☐ Maximize Pedestrian Comfort

- Street furniture provides pedestrians with places to rest along sidewalks.
- Street trees increase shade along pedestrian walkways.
- Trash cans help the streets remain free from litter.

☐ Provide Wayfinding

- Estimated travel times or distance inform riders of the approximate duration it will take to get to nearby amenities.
- Directional signage clarifies where pedestrian should travel.

Guidance is being developed for Port Authority property.

2. Bicycle

☐ Dedicate Road Space for Cyclists

- Appropriate bike lane selection assures that lanes are fitting for particular street.
- Bike lane buffers protect bicyclists from vehicular traffic.
- Frequent signage notifies bicyclists of their surroundings.
- Passing lanes make bike lanes comfortable for both casual and experienced riders.
- Trail connections allow bike lanes to meet up with bike-friendly trails.

☐ Provide Protection at Intersections

- Bike boxes create safe waiting areas for cyclists at intersections.
- Bike signal heads minimize conflict between bicyclists and vehicles.
- Continuous bike lanes extend throughout intersections to minimize conflicts with vehicles.
- Signage indicates to cyclists whether they should follow car or pedestrian signals if bike signals aren't possible.

☐ Expand Bike Share

- Bike share docks near transit stops maximize bike share as a FLM connection.
- Coordination with transit ensures that bike share facilities do not interfere with bus and light rail operations.

☐ Securely Store Bikes

- Covered bike racks protect bikes from the elements.
- Short and long-term options give riders flexible choices for storing their bikes.
- Well-lit facilities ensure that bikes are secure at all hours of the day.
- Lockers offer safe bike storage and are an opportunity for revenue.

☐ Provide Vertical Connections for Bikes

- Runnels on staircases help cyclists move their bikes up and down stairs without having to carry the bike.

FIRST AND LAST MILE TOOLBOX

- Signage informs cyclists of where the runnel is and how to use it to transport a bike.

☐ **Promote Bikes on Transit**

- Signage clarifies bike boarding process for bus and light rail vehicles.
- Transit wayfinding on bike facilities raises awareness of and supports bikes connections to transit.

☐ **Collect Bike Data**

- Counting methods should be chosen based upon which type is best for each specific route.
- Popular routes should be targeted to identify and analyze the areas with the highest bike traffic.

☐ **Provide Repair Space**

- Adequate lighting maximizes safety at repair station and prevents theft and vandalism.
- Installation location of repair stations should be near bike storage and busy bike corridors.

Future guidance is being developed for Port Authority property.

3. Transit

As noted previously, the line between transit transfers and first and last mile trips is undefined. Some riders may make transfers simply to complete the last leg of their journey more quickly, while others require the transfer to get where they are going. The tools in this section, therefore, are generalized to promote better transit for all users. To improve transit as either a primary mode of travel or as a FLM service, support from agency partners in the following ways can greatly improve the rider's journey.

☐ **Dedicate Right-of-way for Buses**

- Painted bus lanes make lanes stand out from traffic.
- Peak-only bus lanes target areas with bad congestion at certain times of the day, such as rush hour.

☐ **Minimize Conflict between Buses and Other Vehicles**

- Appropriate turning radii ensures that buses have enough space to navigate tight intersections without imposing on curb space.
- Boarding islands minimize bus-bike conflicts and give pedestrians a protected place to wait for bus.
- Transit signal priority detects bus presence and coordinates signals to give buses right-of-way.
- Refer to Port Authority's Bus Stop Design and Street Design Guidelines

☐ **Make On-street Bus Stops Comfortable**

- Lighting makes the stop feel safe at all hours of the day.
- Shelters, benches, trash cans, and recycling bins provide amenities for riders at stops.
- Signage informs riders of routes at the stop, when buses will arrive, and how to contact customer service.
- Refer to Port Authority's Bus Stop Design and Street Design Guidelines.

Bike racks like these on municipal property adjacent to Mt. Lebanon Station offer a safe place for riders to store their bikes.

Unique bike racks in the Cultural District of Downtown Pittsburgh add art to the public space while serving a functional purpose.

Dedicated bus lanes, such as this one on Liberty Avenue, separate buses from traffic and are especially beneficial at rush hour. Bright red paint helps the bus lanes stand out even more.

☐ **Facilitate Transfer Process**

- Real-time data informs riders of when their transfer will arrive.
- Wayfinding makes it easy for riders to transfer to a different transit route.

4. Drop-off

☐ **Dedicate Waiting Zone**

- Coordination with bus and light rail ensures that the waiting zone does not interfere with operations.
- Multiple directions of access allow people to access the location from different streets.
- Signage defines an exact location for pick-ups and drop-offs.

☐ **Coordinate with Paratransit**

- Locations with high paratransit usage should be prioritized and maintained to assure ADA compliance.

☐ **Coordinate Deliveries**

- Coordination with loading zones minimizes conflicts with other vehicle modes that may need to access the curb space.

☐ **Plan for New Transportation Trends Utilizing Curb Space**

- Active dialogue ensures that there is communication with external organizations that may need to access the curb space and the policy makers that will define curb access regulations.

5. Park and Ride

While many Park and Rides are owned and operated by Port Authority, other entities do operate Park and Rides for PAAC service.

☐ **Prioritize Carpool**

- Reserved parking spaces offer spots close to the station that are exclusively for carpools (example: “Carpools only before 9:30 a.m.”).

☐ **Prioritize Car Share**

- Dedicated parking spaces incentivize car-share use as another alternative mobility option.

☐ **Increase Safety**

- Emergency call boxes make riders feel more comfortable using the facility at night.
- Frequent lighting reduces crime and increases the feeling of safety.

Drop-off zones, like this one next to Roslyn station, provide space for vehicles to pull over when picking up and dropping off riders at the busway. Benches, a bike rack, and clear signage add to the amenities at this drop-off.

Park and rides, such as this one in Bethel Park, offer a viable alternative for suburban commuters, as they allow riders to park their cars at a station and use transit for the remainder of their commute.

FIRST AND LAST MILE TOOLBOX

6. Other Modes

Transportation is always evolving; in order to maintain current ridership and grow the customer base in the future, PAAC, municipalities, and mobility stakeholders must be attuned to new modes of transportation. Exploring opportunities to utilize emerging technologies that provide alternative mobility access helps bridge FLM gaps in the places where bus or rail service cannot easily exist. It is important to examine other modes of transportation ,promote those that are complementary to public transit, and amend tactics if new modes compromise the six principles (accessibility, collaboration, mode hierarchy, public health, rider comfort and satisfaction, sustainability) outlined in this plan.

- ☐ **Electric Scooters:** assess whether electric scooters are an upcoming first and last mile connection tool and research policies to manage implemenation.
- ☐ **Microtransit:** perform analysis to understand the impact of alternative methods of transit.
- ☐ **Future Modes:** constantly monitor trends in new modes and be ready to collaborate with other groups if beneficial.

Future guidance is being developed for Port Authority property.

7. Policies and Programs

While not an infrastructure tool, policies can be an effective and necessary way to establish culture, vision, and/or processes helpful in implementing the tools outlined above. Often, a policy or vision statement is the first step for organizations in a planning process and acts as a beacon of direction. A policy alone, however, is useless; changes to procedures and process, training, evaluation, and modifications to design standards must follow.

Across the county, three types of policies have gained traction in commitment to safe, accessible, healthy streets that align with the intentions of this Plan.

Scoobi is an on-demand electric scooter company that is quickly growing in popularity. The scooters pictured were found on the University of Pittsburgh campus.

☐ Complete Streets

Complete Streets policies mark a commitment that future transportation projects take into account the needs of all road users. All road users is defined to include people of all ages and abilities who walk, bike, drive, and ride transit. There are numerous local examples of Complete Streets policies. The City of Pittsburgh adopted their policy in 2016 while Sharpsburg, Millvale, and Etna passed policies in 2018. A local coalition of organizations including Allegheny County Economic Development, Allegheny County Health Department, American Heart Association, Bike Pittsburgh, Congress of Neighboring Communities (CONNECT), Pittsburgh Community Reinvestment Group and others have provided education, advice, support, and technical resources to assist in adoption of Complete Streets policies. Additionally, Smart Growth America's National Complete Street Coalition has numerous case studies, research and educational resources.

☐ Transportation Demand Management

Transportation Demand Management (TDM) is a program used to understand and influence how people optimize transportation resources. TDM establishes a set of strategies geared to inform travelers of transit options in order to incentivize travelers to use alternatives to the single-occupancy private automobile. TDM is often applied at a site level as a requirement of certain development triggers. As a result, large employers or developers submit a plan to measure travel patterns and establish strategies that incentivize use of transit, biking, walking, or other efficient travel options. TDM is a common and effective strategy for municipalities to require of others but can also be used by the municipality itself.

☐ Vision Zero

Vision Zero is a stated goal to eliminate all traffic fatalities and severe injuries. Used around the world, Vision Zero puts safety at the center of roadway design and consequently makes special consideration for the most vulnerable populations on the road (the elderly, minors, pedestrians, etc.). While not attached to specific design standards or types of infrastructure, Vision Zero can serve as a goal for right-of-way planning, engineering, design and enforcement. The Vision Zero Network establishes the standards below for Vision Zero.

- "A clear goal of eliminating traffic fatalities and severe injuries has been set."
- "The Mayor has publicly, officially committed to Vision Zero."
- "A Vision Zero plan or strategy is in place, or the Mayor has committed to doing so in clear time frame."
- "Key city departments (including police, transportation and public health) are engaged."

- Vision Zero Network
https://visionzeronetwork.org/resources/vision-zero-cities/

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P1 TO SWISSVA
3415
PORT AUTHORITY
PORT AUTHORITY
P1 SKISSVALE
6999
3415

APPENDICES

APPENDIX I: LIST OF STATIONS

1. Allegheny
2. Arlington
3. Beagle
4. Belasco
5. Bell
6. Bethel Village
7. Boggs
8. Bon Air
9. Carnegie
10. Casswell
11. Castle Shannon
12. Crafton
13. Dawn
14. Denise
15. Dorchester
16. Dormont
17. East Liberty
18. Fallowfield
19. First Avenue
20. Gateway
21. Hamnett
22. Hampshire
23. Herron
24. Highland
25. Hillcrest
26. Homewood
27. Idlewood
28. Ingram
29. Killarney
30. Kings School
31. Library
32. Logan
33. Lytle
34. McNeilly
35. Memorial Hall
36. Mesta
37. Monongahela Incline Lower
38. Monongahela Incline Upper
39. Mount Lebanon
40. Munroe
41. Negley
42. North Side
43. Overbrook Junction
44. Palm Garden
45. Penn
46. Pennant
47. Poplar
48. Potomac
49. Roslyn
50. Sandy Creek
51. Sarah
52. Sheraden
53. Shiras
54. Smith Road
55. South Bank
56. South Hills Junction
57. South Hills Village
58. South Park Road
59. St. Anne's
60. Station Square
61. Steel Plaza
62. Stevenson
63. Swissvale
64. Washington Junction
65. West Library
66. Westfield
67. Wilkinsburg
68. Willow
69. Wood Street

Note: The South Busway and Duquesne Incline stations were excluded from this evaluation as they are not defined as rapid-transit.

APPENDIX II: FACTOR DESCRIPTIONS

USER EXPERIENCE FACTORS

For the following factors, points were awarded to the stations with the greatest deficiencies. As previously mentioned, the User Experience factors are meant to highlight shortcomings at stations that provide opportunities for improvement.

Bike Infrastructure

Bike Infrastructure measures the "bike friendliness" in a walkshed by assessing the quality of its bike facilities. A scale was created in order to rank the safety of differing bike lanes:

(Protected Bike Routes x 10) + (Bike Lanes x 5) + (On-street Bike Routes x 2) + Cautionary Bike Routes.

Because protected bike routes are the safest for commuters, they were multiplied by 10 in the Bike Infrastructure Score. Inversely, cautionary bike routes offer the least amount of safety to riders, so they were not multiplied by any factor in the calculations. Stations with a lack of bike infrastructure received the most points.

Bike Racks

Bike Racks is a yes-or-no measurement. Stations with no bike racks received points.

Crashes per Rider

This score measures the amount of vehicle crashes that occur in a walkshed per every rider that uses the station. Crashes can be between multiple vehicles, a vehicle and a bike, or a vehicle and a pedestrian. For this score, the total number of annual crashes in a walkshed was divided by the average annual ridership for each of the fixed-guideway stations. Stations with the highest crashes per rider received the highest scores.

Crime

PAAC staff developed a "crime score" to measure both the frequency of crime at a station, and the number of crime incidents per rider. For these purposes, a crime incident is defined as either a crime against person, crime against property, quality of life incident, or harassment incident. First, the total number of annual crime incidents at a station was divided by the average annual station ridership, to find the amount of crime per rider. Next, the amount of annual crime incidents for each walkshed were totaled. Both of these values were normalized on a scale from zero to 1. Finally, the values for crime per rider and crime incidents per year were averaged to ultimately find a "crime score" to measure the safety of PAAC's stations. Stations with the highest crime scores were awarded the most points.

Drop-off and Pick-Up Zones

This factor is a yes-or-no measurement of whether or not the station has drop-off and pick-up zones. Stations without drop-off and pick-up zones received points.

Healthy Ride

Healthy Ride is Pittsburgh's bicycle share program, and the organization is rapidly expanding to increase connections and install more bike docks in the city. Because short bike trips can take riders where public transit does not go, Healthy Ride bikes are a viable first and last mile connection. Additionally, PAAC has recently partnered with Healthy Ride to offer unlimited free 15-minute bike rides to users with a PAAC ConnectCard.

The Healthy Ride score was determined by two different measures: the presence of a bike share dock at a station, and the presence of a dock within the half-mile walkshed. For the first measure, the walkshed received points if there was not a bike dock within 400 feet of the station. After consulting with Healthy Ride, this distance was determined to be an appropriate measurement, as 400 feet is the approximate length of one small city block. For the second measure, stations were awarded points based upon the amount of Healthy Ride docks that existed within the walkshed. Higher scores indicate a low number of bike docks in the walkshed. These two numbers were normalized and then averaged to get the final Healthy Ride score.

Inaccessible Roads

This measurement was developed by totaling the percent of inaccessible roads in each walkshed. Inaccessible roads are defined as a bypass, extension, highway, interstate, ramp, or tunnel, meaning that they are inaccessible to pedestrians. Points were awarded to stations with the greatest amount of inaccessible roads.

Park & Ride

This factor is a yes-or-no measure of whether or not there is a park and ride at the station. Stations without a park and ride received points. Both free and paid park and rides were included in this measure.

Posted Speed Limit

For the posted speed limit factor, the speed limits for all of the roads in each walkshed were averaged. The highest scores were awarded to stations that had the greatest average speed in their walkshed.

Sidewalks

The presence of sidewalks in each walkshed was measured on a scale by PAAC staff during site visits. These measurement match what could be seen during a site visit and does not reflect every street in the walkshed. Walksheds that appear to have safe, well-maintained, and extensive sidewalks recieved no points. Partial sidewalks, including sidewalks on half the street or incomplete networks, received a score of .5. Walksheds with no sufficient sidewalks received a score of 1.

Slope

After researching the standard pedestrian "comfort" level for slope as well as ADA guidelines, a scale was created to measure areas in a walkshed with a steep grade:

(% of slope from 5-9.99% x .5) + (% of slope in walkshed above 10%).

In other words, all slopes in a walkshed that were steeper than a 10% grade were added together. Slopes from 5-9.99%, which are less desirable for pedestrian access but still not uncomfortable, were multiplied by .5 and added to the score as well. Any slope below a 5% grade was omitted from calculations, as relatively flat

APPENDIX II: FACTOR DESCRIPTIONS

ground around a station is desirable. Similarly, ADA standards suggest a grade below 5% to maintain accessibility.

Points were awarded to stations that had the greatest amounts of "uncomfortable" slope. Walksheds with very steep slopes are targets for FLM projects, as improving ramp conditions and adding steps can make a hilly commute to a station easier and safer to navigate.

Stair-Free Access

This factor is a yes-or-no measurement that indicates whether the station has steps rendering it inaccessible to bikes. Stations that are inaccessible to bikes received points.

Station Visibility

Station visibility was calculated by PAAC staff visiting each station and measuring how well it could be seen from surrounding areas. By drawing diagrams of the lines of sight, polygons of approximate station visibility areas were used to calculate square miles. The resulting measurements were ranked, and the stations with the smallest visible area received the most points.

Street Level Presence

This factor indicates the number of entrances to a station that can be directly accessed from street level. If a station has stairways or ramps serving as the sole access point from the street, these access points were not counted. Stations with the least street level entrances received the highest scores.

Trails

This factor indicates the number of trails present in each walkshed. Stations with the least amount of trails in the walkshed received the most points. Trails are a valuable first and last mile connection, as they create a safe path for pedestrians and bicyclists. Only 13 of the fixed-guideway stations included in the evaluation had one or more trails in the walkshed.

Transit Connections

Transit connections for each station were calculated by totaling the number of PAAC routes that can be accessed at a stop within a 1/8 of a mile buffer of the fixed-guideway station. Research indicates that 1/8 of a mile is the standard distance that transit users are willing to travel for a transfer, so PAAC staff chose this distance as a baseline. The transit connections did not necessarily have to be routes that use fixed-guideways; many are not. Stations with the least transit connections received the most points.

Tree Cover

The percentage of tree cover in each walkshed is measured by the space within 20 feet of the center of streets. 20 feet from the center of the street includes both streets and sidewalks, which is where the vast majority of commuters will travel on their way to a station. This also allows for the exclusion of large wooded areas such as parks or back yards that may influence tree cover measures. Larger amounts of tree cover surrounding a station contribute to better shade and a more aesthetically pleasing user experience; therefore, the stations with the least percentage of tree cover scored highest.

Unique Approaches to Station

This factor is a count of how many unique directions a rider can use to enter a station. A unique direction is defined as a reflection of pathway geometry that a standard compass measures. Stations with the least number of unique entrances received the most points, in order to highlight the deficiency.

STATION CONTEXT FACTORS

The following factors indicate the number of opportunities in a station walkshed. Unlike User Experience factors, there is a positive relationship between number of points awarded and number of amenities in the walkshed. Therefore, a higher score is meant to highlight the opportunities that already exist at the station.

ACCESS Paratransit Drop-off and Pick-up

The ACCESS score is a count of how many ACCESS Paratransit drop-off and pick-up stops within 400 ft. of a station. 400 ft. was used as an estimate to account for a small city block. While all riders using the door-to-door services of ACCESS may not be able to transverse 400 ft., improvements in the infrastructure will likely improve their travel experience as well. Stations with the most drop-offs and pick-ups scored highest.

Destinations

This factor is a count of all of the destinations within a walkshed. For the purposes of this Plan, a destination is defined as a grocery store, library, hospital, university, park, school, public building, fare location, or general attraction, such as a museum or an arena.

Destinations within .5 Miles

This factor is a count of all of the destinations listed above that are outside a station's networked half-mile walkshed, but that fall in a perfect half-mile buffer surrounding the station. This measure was intended to capture destinations that were just barely outside of a station's current walkshed, but that could be included if the walkshed expands due to first and last mile improvements.

Intersection Density

Intersection density for each walkshed is a measure of the number of intersections divided by the area of a walkshed. This factor is an indicator of walkability in a walkshed. Stations with the greatest intersection density scored highest.

Jobs

This factor is a count of the number of jobs in each station's walkshed. Stations with the greatest number of jobs received the most points.

Population

This factor is a count of the residents living in each walkshed. Stations with the greatest population received the most points.

CONTINUED

Ridership

Ridership measures the total trips made to or from a stop each day. Stations with the greatest ridership received the most points.

Unique Area

Unique area indicates the amount of area in a walkshed that does not overlap with any other walkshed. Walksheds with the greatest percentage of unique area received the most points.

APPENDIX III: DATA SOURCES

USER EXPERIENCE

Factor	Data Source
Bike Infrastructure	Developed with data from BikePGH
Bike Racks	Port Authority
Crashes per Rider	Pennsylvania Department of Transportation
Crime	Port Authority
Direction of Entrances	Port Authority
Drop-off/Pick-up Zones	Port Authority
Healthy Ride	Healthy Ride
Inaccessible Roads	Pennsylvania Spatial Data Access
Park & Ride	Port Authority
Posted Speed Limit	Pennsylvania Spatial Data Access
Sidewalks	Port Authority
Slope	Pennsylvania Spatial Data Access
Stair-Free Access	Port Authority
Station Visibility	Port Authority
Street Level Presence	Port Authority
Trails	Southwestern Pennsylvania Commission
Transit Connections	Port Authority
Tree Cover	Pennsylvania Spatial Data Access

STATION CONTEXT

Factor	Data Source
ACCESS Paratransit Drop-off/ Pick-up	Port Authority, provided by ACCESS
Destinations	Allegheny County: Parks, Schools, Public Buildings, Grocery Stores Allegheny County Library Association: Libraries Allegheny County Health Department: Hospitals Port Authority: Fare Locations Southwestern Pennsylvania Commission: General Attractions ARCGIS Online User EDP_ LLC: Universities
Destinations within .5 miles	[Same as Destinations]
Intersection Density	Allegheny County Street Network
Jobs	Longitudinal Employer-Household Dynamics
Population	American Community Survey
Ridership	Port Authority
Unique Area	Port Authority

EQUITY SCORE

Factor	Data Source
Children	American Community Survey (ACS) 2016
Disabilities	American Community Survey (ACS) 2016
Female Head of Household	American Community Survey (ACS) 2016
Low Income	American Community Survey (ACS) 2016
Low Wage Jobs	2015 Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES)
Limited English Proficiency	American Community Survey (ACS) 2016
No Vehicle Ownership	American Community Survey (ACS) 2016
Older Adults	American Community Survey (ACS) 2016
Racial and Ethnic Minorities	American Community Survey (ACS) 2016

Many of these data sources were accessed using the Western Pennsylvania Regional Data Center (WPRDC). WPRDC provides a convenient central point for the sharing of data across Allegheny County, allowing various agencies in the region to provide public data in one accessible place.

APPENDIX IV: WALKSHED METHOD

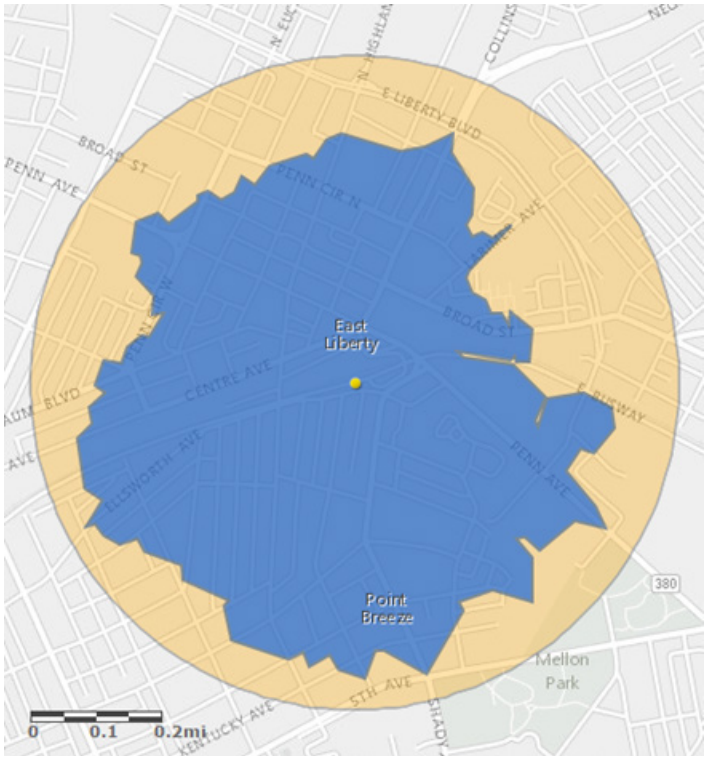
In order to property analyze each of PAAC's fixed-guideway stations and surrounding areas, half-mile walksheds around each station were created. The walksheds in this plan were created in 2015; however, we anticipate that there have been no major or significant changes in walkshed shape or size since then, and the values are still accurate.

To create the half-mile walksheds, PAAC staff visited each fixed-guideway stop in 2015 and mapped all of the formal and informal walking paths that could be used by pedestrians to directly access the station. These paths were then merged with the existing Allegheny County street network dataset using Geographic Information Systems (GIS) software. After the merger, limited access highways, access ramps, service drives, tunnels, and PAAC busways were removed to create a street and path network that was more representative of the network utilized by pedestrians to access the station.

The modified street and path network was then loaded into the network analyst tool in the ESRI ArcGIS suite along with each of the stations. The analyst tool was used to compute a separate half-mile service area for each station with options set to allow for "U-turns" and to disregard the directionality of streets, to better account for how pedestrians realistically utilize the street network. Each walkshed was allowed to overlap with others to capture the maximum service area for each station, as well as to avoid making assumptions about the station choices of residents living in areas covered by more than one station.

Most of the qualities for the stations analyzed in this plan were measured for the entire walkshed surrounding the station. Exceptions to this rule would be the values for Park & Ride, Drop-off and Pick-up Zones, Direction of Entrances, Bike Racks, Bike Access, and Street Level Presence, as these are factors that solely relate to the characteristics of a station. All of these factors are found under "User Experience."

The image below displays the walkshed for East Liberty Station, shown in blue. The yellow circle surrounding the blue walkshed shows the "ideal" half-mile accessible area around East Liberty station, if all of the streets were to be connected and if users could walk to the station from any direction. The goal of the First and Last Mile Program is to expand station walksheds from shapes that look like the blue polygon to stretch to the perfect half-mile circle shown in yellow through improved connections. Prioritizing first and last mile advancements will make stations more accessible for more people, therefore broadening PAAC's reach of service and encouraging more users to choose transit.



A note about sidewalks: At the time of this document's release, there is no comprehensive database of sidewalks in Allegheny County. As a result, PAAC and other stakeholders do not have a complete understanding of the completeness or quality of the sidewalk network. While walksheds offer an effective way to measure walkability around a station, an in-depth analysis of sidewalks would be even more helpful in measuring the walkability in a region.

APPENDIX V: DATA NORMALIZATION

The scores for the factors that make up User Experience, Station Context, and Equity were normalized on a scale from .01-1. As stated in the evaluation section, .01 was determined to be the lowest possible score for a factor, in order to avoid using zeroes in the analysis. The normalization technique used for each factor was to divide each station's value by the highest value in the group. Therefore, the highest scoring station for that factor would receive a 1, because the number would be divided by itself. For an example of this process, see the normalization of Tree Cover below:

Station Name	% Tree Cover	Divided by the Highest
Bon Air	38%	1
Poplar	36%	0.9453
Hamnett	33%	0.8602
Sheraden	32%	0.8353
Arlington	27%	0.6991
Mt. Lebanon	27%	0.6986
Boggs	26%	0.6887
Duquesne Incline at Upper	26%	0.6735

In the Tree Cover example, the far right column shows that the normalizing process is an effective way of ranking the stations from 1 to .01, based upon how much tree cover is present in the walkshed.

However, during the normalization process, there were sometimes large outliers in data that heavily skewed the results. An example of this trend can be seen in the Transit Connections characteristic under the Station Context group. The raw data for Transit Connections shows that, understandably, Wood Street station downtown has the largest number of Transit Connections:

Station Name	Transit Connections	Divided by the Highest	Percent Rank
Wood Street	71	1	1
Gateway	38	.5322	.987
Steel Plaza	29	.4048	.7631
Penn	26	.3662	.6842
East Liberty	23	.3239	.6043

Wood Street has nearly twice as many transit connections (71) as the next highest ranked station, which is Gateway station (38). In continuing with the previous normalization process, every other station would be divided by 71, and the resulting numbers would be the final rankings for Transit Connections. Yet, because Wood Street is an outlier, it causes the following stations to have very small numbers. While Gateway still offers almost 40 connections in its half-mile walkshed, the station is only scoring a .5 out of 1. Similarly, East Liberty offers over 20 connections and is only scoring a .32. Large outliers such as Wood Street also cause even lower scoring stations to receive values such as .009 or .00001, which are not useful for data analysis on PAAC's chosen scale.

PAAC staff identified a process to fix extreme outliers and create more accurate normalizations. Whenever there was a jump of more than 15% between concurrent stations when dividing by the highest, percent rank would be used instead. Percent rank compares the scores in a group of data to one another on a scale of zero to one. Percent rank was used for the factor's high outliers, but after the numbers were no longer 15% apart, the numbers would once again be divided by the new highest number. For example, in the chart above, Wood Street and Gateway are using percent rank, and the dividing by the highest process begins once again at Steel Plaza. Steel Plaza is divided by Gateway's score, of 38, and now scores .7631 instead of .4048, which is a much more representative ranking.

The percent rank rule for a 15%+ jump in data was only used once for each dataset. In other words, even if there was another jump in data later on, the pattern of dividing by the highest would still continue.

There were also a few cases in which large jumps in data most accurately explained a station factor, and therefore the 15% rule was not used. To do so would have diluted the most important differences between stations for specific factors. These exceptions often occurred when the highest numbers were all small to begin with, so a 15% drop between two numbers would be expected. For example, for Street Level Presence - the count of streets that connect directly to a station without a ramp or stairs - the highest number is three, and the lowest is zero. In this case, a large jump between scores is expected.

FLM factors that were exceptions to the 15% rule include:

- Direction of Entrances
- Healthy Ride
- Inaccessible Roads
- Street Level Presence
- Trails

APPENDIX VI: USER EXPERIENCE WEIGHTS

Factors in the User Experience were weighted by PAAC staff based on importance of the feature during a user's transit journey, as discussed with internal and external stakeholders. The resulting totals are also in accordance with the mode hierarchy, reinforceing the principles of this Plan.

Factor	What is Being Measured	Weight
Sidewalks	Are there sidewalks leading to the station?	13.25
Transit Connections	Are there transfers available at the station?	8.00
Posted Speed Limit	How high or low is the average posted speed limit for streets within the walkshed??	7.75
Bike Infrastructure	Are there designated bike lanes or bike right-of-ways in the walkshed?	7.25
Inaccessible Road	Are there roads in the walkshed that do not allow pedestrian access?	6.25
Slope	How much of the walkshed topography is navigable (<10% grade) and comfortable (<5% grade)?	6.25
Tree Cover	How flat is the walkshed?	6.00
Station Visibility	Are there obstacles blocking the line of vision to the station?	5.50
Street Level Presence	How many ways can the station be entered at street level?	5.25
Unique Approaches to Station	How many different ways can you approach the station?	5.25
Drop-off and Pick-up Zones	Is there space for drop-offs or pick-ups at the station?	4.00
Bike Racks	Are there places to safely store a bike at the station?	4.00
Healthy Ride	Is there a bike share dock at the station? Is there a bike share dock within 400 feet of the station?	4.00
Crime	How many crimes occur in the walkshed?	4.00
Crashes	How many crashes occur in the walkshed?	3.75
Trails	Are there trails in the walkshed?	3.50
Stair-Free Access	Is there stair-free access to the station for riders with bikes? If there are steps, is there a runnel?	3.00
Park & Ride	Does the station have a Park & Ride lot?	3.00
Total		**100.00**

Note: The User Experience score was inversed, so the stations that scored the highest are the stations with most deficiencies and need for improvement. When Station Context and User Experience scores are added together, the result displays stations with the best potential for ridership but worst accessibility, safety, and comfort: in other words, stations that need FLM improvements the most.

APPENDIX VII: FINAL EVALUATION RESULTS

Name	Station Context	Equity Score	User Experience	Weighted Total	Rank
First Avenue	67.26	30.69	52	53.84	1
Wilkinsburg	46.02	100	38.55	53.83	2
Steel Plaza	78.27	38.89	35.36	53.23	3
Homewood	39.32	95.9	45.62	53.16	4
Wood Street	74.54	37.08	38.14	52.49	5
Negley	71.71	49.88	32.09	51.5	6
Bon Air	23.22	78.19	66.36	51.47	7
Penn Station	64.69	40.2	43.47	51.3	8
Hamnett	43.27	75.1	47.2	51.21	9
Gateway	77.09	39.48	31.04	51.15	10
Boggs	20.39	86.17	64.09	51.03	11
Palm Garden	18.95	66.35	71.19	49.33	12
Sheraden	33.08	89.9	44.45	48.99	13
Swissvale	31.04	90.45	46.12	48.96	14
Dawn	9.57	63.56	79.89	48.5	15
Mon Incline Upper	35.3	37.31	66.75	48.28	16
East Liberty	60.16	68.53	25.63	48.02	17
Roslyn	37.9	74.93	43.39	47.5	18
South Hills Junction	32.54	67.1	52.32	47.37	19
Hillcrest	16.67	52.66	73.07	46.43	20
Denise	13.22	60.27	72.3	46.26	21
Stevenson	26.72	51.13	62.1	45.75	22
North Side	52.32	33.41	44.93	45.58	23
Pennant	11.55	59.32	72.56	45.51	24
Allegheny	48.71	40.28	44.54	45.36	25
Herron	35.37	54.77	48.44	44.48	26
Hampshire	21.86	60.71	58.49	44.28	27
Carnegie	32.79	56.72	48.72	43.95	28
Belasco	19.15	63.11	58.81	43.8	29
South Bank	15.08	52.36	67.79	43.62	30
Ingram	32.91	57.53	47.2	43.55	31
Smith Road	13.85	49.53	70.04	43.46	32
Dorchester	12.85	48.38	71.11	43.26	33
Bell	22.94	47.91	60.48	42.95	34
Beagle	13.53	42.29	72.37	42.82	35

LEGEND

Purple Line (East Busway)	Multi-Line (Red and Blue Light Rail)	Red Line (Light Rail)	Blue Line (Light Rail)	Green Line (West Busway)	Incline

Name	Station Context	Equity Score	User Experience	Weighted Total	Rank
Station Square	35.2	31.34	56.17	42.82	36
Shiras	17.86	60.5	58.84	42.78	37
Mon Incline Lower	33.81	26.94	59.37	42.66	38
Memorial Hall	21.98	42.14	63.55	42.64	39
Poplar	26.31	52.97	53.59	42.55	40
Lytle	16.95	53.76	62.1	42.37	41
Kings School	10.99	44.11	72.29	42.13	42
Crafton	34.25	46.79	47.66	42.12	43
Potomac	34.72	46.69	46.99	42.02	44
Fallowfield	21.91	61.23	52.04	41.83	45
Sarah	6.64	48.83	73.35	41.76	46
Killarney	18.32	46.98	62.44	41.7	47
Bethel Village	18.88	48.76	60.89	41.66	48
McNeilly	11.46	51.23	67	41.63	49
St. Anne's	18.94	48.34	60.86	41.59	50
Casswell	9.94	48.2	69.54	41.43	51
Library	20.2	45.22	60.55	41.34	52
Logan	7.43	45.77	72.98	41.32	53
Sandy Creek	6.67	42.73	75.23	41.31	54
Westfield	17.97	59.89	55.12	41.21	55
Highland	14.02	50.77	63.12	41.01	56
Arlington	15.51	47.51	63.1	40.95	57
Overbrook Junction	16.5	45.76	62.6	40.79	58
Munroe	10.26	50.97	65.27	40.4	59
Dormont	37.31	44.93	41.11	40.35	60
South Park	15.04	52.81	59.08	40.21	61
Willow	19.31	45.47	58.32	40.15	62
Mesta	11.21	54.58	61.56	40.03	63
Mt. Lebanon	34.69	51.67	37.11	39.05	64
Idlewood	20.54	46.56	52.51	38.53	65
West Library	11.34	42.8	62.85	38.23	66
Castle Shannon	16.44	46.34	54.52	37.65	67
South Hills Village	19.67	48.81	49.52	37.44	68
Washington Junction	13.62	50.03	52.7	36.53	69

LEGEND

Purple Line (East Busway)	Multi-Line (Red and Blue Light Rail)	Red Line (Light Rail)	Blue Line (Light Rail)	Green Line (West Busway)	Incline