

# THE ECONOMIC IMPACT OF THE PORT AUTHORITY OF ALLEGHENY COUNTY



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**Port  
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## REPORT OVERVIEW

The Port Authority of Allegheny County (PAAC) is the unified operator of transit services in Allegheny County, Pennsylvania. Its service network includes light rail, bus, incline and paratransit service, all of which are key elements of Allegheny County's comprehensive transportation infrastructure network. PAAC commissioned Econsult Solutions, Inc. (ESI) to undertake a comprehensive study of the economic impact of its activities. ESI is a leading provider of economic and strategic analyses to transportation providers, as well as businesses and public policy makers in a variety of fields.

The logo for the Port Authority, featuring the words "Port" and "Authority" stacked vertically in a blue, sans-serif font.The logo for ESI Econsult Solutions Inc., featuring the letters "ESI" in a bold, green, sans-serif font, followed by "ECONSULT SOLUTIONS INC." in a smaller, green, sans-serif font.

Traditional economic impact analyses of entities like the PAAC track the flow of dollars expended by the organization through the local economy. PAAC's purchasing footprint and employment generate direct and spillover economic impacts across the economy, supporting substantial levels of local employment and earnings. In addition to the economic stimulus they provide, PAAC's capital investments also represent a refreshing, expanding, and modernizing of the stations, bus lines, railways, and shelters located in residential neighborhoods throughout Allegheny County. These investments are crucial to PAAC's role as a steward of public-serving infrastructure, since these assets must be continuously maintained and modernized to assure their continued productivity and public value into the future.

More broadly, however, the dollars spent by a transit agency on operations and capital only begin to describe its economic impacts on a region. Transit is a public good with considerable positive externalities for residents, private businesses and property owners, and its benefits often extend to those that do not use the service directly. A volume of research has demonstrated that in the knowledge economy, density of activity is associated with greater productivity, making the quality and spatial efficiency of regional transportation networks a key point of distinction in a competitive environment. This productivity helps the Pittsburgh region attract investment and makes it an outsized contributor to Pennsylvania's economy and tax base relative to its land area and population size.

The density of activity needed to compete on a national and global scale is not possible without quality public transit, which can deliver large numbers of people to a central area without creating unmanageable congestion. Robust and affordable transit service is also an essential component of an inclusive economy and a region that shares the benefits of progress equitably.

The same features are also central to the competition for residents and workers that a vibrant city and economy rely on. After decades of suburbanization and an ever increasing reliance on private vehicles, people are increasingly looking to locate in denser areas with more access to workplaces, amenities, and travel options. These preferences and trends are reflected in the clustering of development activity in Allegheny County around transit-served areas, including explicit transit-oriented development projects. They are also evident in the county's residential housing market in the premium that buyers are willing to pay to locate near robust PAAC service.

Many of these impacts result from a synergy between the core characteristics of transit service and other macro trends, like the increasingly knowledge-based economy and changes in demographics and generational preferences. This makes it difficult to explicitly attribute precise impact amounts to PAAC's activities in some categories. Nevertheless, exploring broad social benefits and the role that PAAC plays in establishing the conditions for regional success is fundamental to understanding the nature of the impact of public transit on all residents of the region, including those who do not use the system directly.

This report is divided into three sections, each of which expresses PAAC's economic contributions through a different lens:

- **Section 1: PAAC Expenditure Impacts** details the aggregate activity (direct and indirect) from PAAC's operating and capital expenditures. PAAC has a significant economic footprint in the region in its capacity as a major employer and purchaser of goods and services. These investments serve the public on a daily basis both directly by providing quality transit service and indirectly by supporting local businesses and local employment.
- **Section 2: Economic Competitiveness and Equitable Growth Impacts** describes PAAC's contribution to the modern Pittsburgh region and its increasingly knowledge-driven economy, which relies on transit to deliver widespread and efficient access to dense employment centers that maximize the flow of ideas and innovation. The resultant productivity is essential to making the region an outsized contributor to the economy and tax base of Pennsylvania. Transit is also integral to efforts to share these gains equitably by connecting communities throughout the region to economic opportunities and amenities.
- **Section 3: Investment and Property Value Impacts** demonstrates how these competitiveness benefits translate into investment, tracking development patterns to well-served areas and to specific transit investments. Benefits are also analyzed for individual homeowners, who see a significant premium on residential property that is proximate to high-quality PAAC service, enhancing asset value for residents and growing the local tax base.

## 1.0 PAAC EXPENDITURE IMPACTS

The Port Authority of Allegheny County operates comprehensive public transit services and maintains key transportation infrastructure and assets across Allegheny County. PAAC's operating expenditures provide for the day-to-day operations of this service network, while its capital expenditures are used to maintain and enhance system infrastructure. PAAC's expenditures on its employees and on goods and services are an important economic generator for the region and state (prior to even accounting for value created by the transportation service it provides).

PAAC attracts significant funding from outside of the region and state, including federal support for its operating and capital budget, and circulates dollars locally in the form of employee compensation and contracting for a range of services and materials. This creates "spillover" effects across PAAC's supply chain and across the economy as wages are recirculated as household spending. In addition, while PAAC is a tax exempt institution, the economy activity generated by its expenditures creates significant tax revenues for state and local government.

### 1.1 SYSTEM OVERVIEW

PAAC has operated for more than 50 years as the first unified transit system in Allegheny County, consolidating the operations, facilities and fare structures of a mix of private carriers. Over the decades, PAAC has served a billion passengers and developed and maintained critical transportation infrastructure. PAAC's recent focus has been on making the system more efficient and easier to use, improving the quality and comfort of the passenger experience.

#### TRANSPORTATION ASSETS

PAAC creates and maintains a range of infrastructure components to provide transportation services, including:

- A fleet of more than 700 buses and more than 80 light rail cars
- More than 7,000 transit stops and stations, including more than 200 shelters
- More than 50 park and ride lots with 14,000 parking spaces
- Nearly 130 customer serving locations to purchase fare cards and tickets
- Operational centers like garages and maintenance facilities
- Fixed guideways including 26 miles of light rail tracks, 15 miles of dedicated busways, inclines and tunnels.

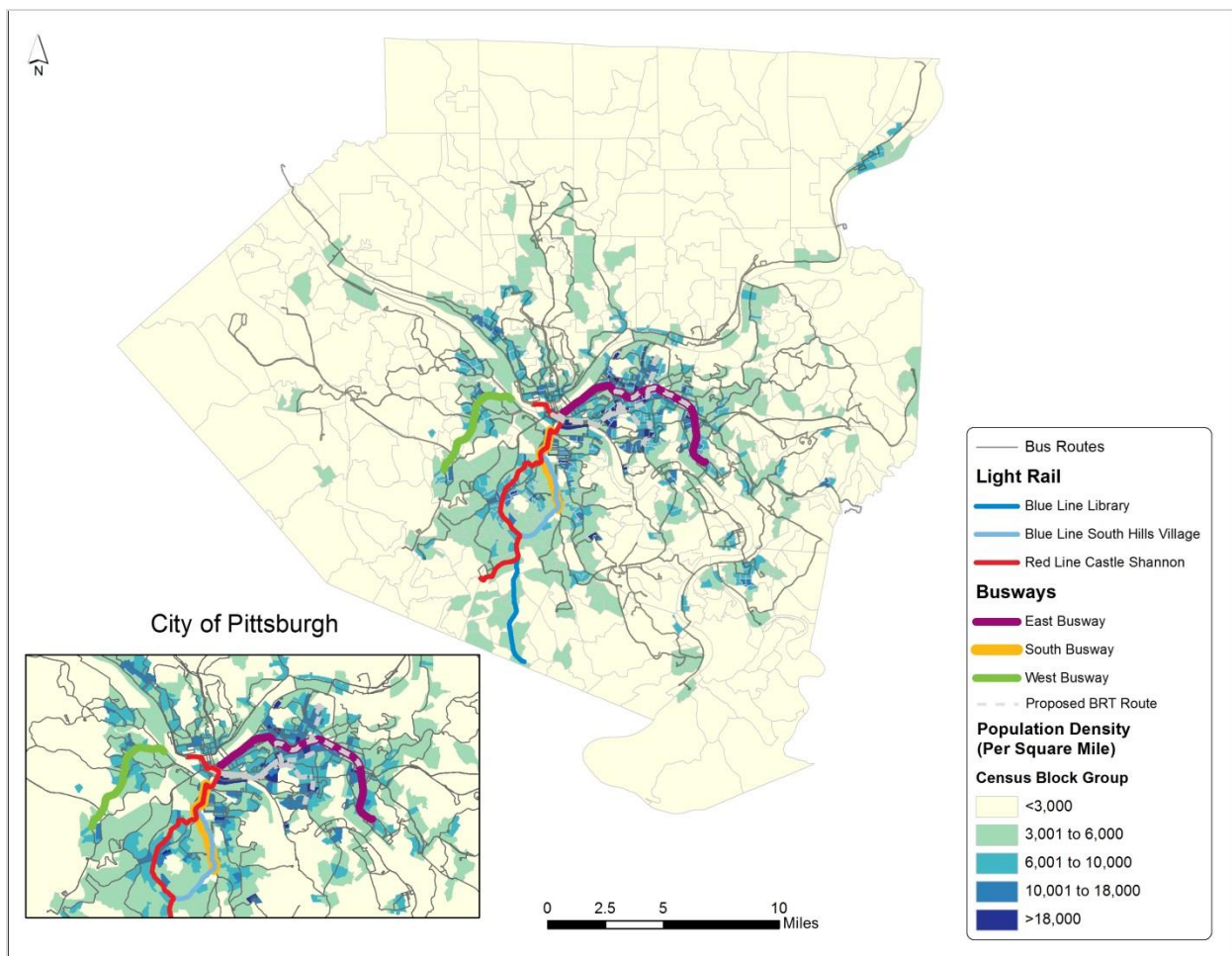
These assets represent valuable public infrastructure for both the present and future, and PAAC has successfully maintained and enhanced them over several decades. Light rail tracks run underground within Downtown Pittsburgh, and were recently connected to the North Shore via tunneling. PAAC's dedicated busways were among the first in the nation, and continue to serve as a core feature of the system, delivering efficiency and volume through these bus-only roads. The replacement value of these

assets to the region is significant, as it would be cost prohibitive to construct such a large and centrally-located system from scratch, or to invest in a new network of highways and roads that could match the volume of travel served by the transit system.

**SERVICE AND RIDERSHIP**

PAAC provides transportation services across nearly 100 bus routes, three light rail routes, two inclined planes (funiculars) as well as contracted paratransit service. To provide convenient service to the largest number of residents, PAAC has strategically planned its bus routes, light rail lines, and busways in order to connect residents to employment hubs. Throughout Allegheny County, the most population dense areas are supported by various transportation options (see Figure 1.1).

**FIGURE 1.1: PAAC CORE SERVICE AND ALLEGHENY COUNTY POPULATION DENSITY**



Source: American Community Survey (2012-2016), ArcGIS (2018)

Ridership across all of PAAC's service types totaled 63 million in 2017. Ridership on an average weekday is in excess of 200,000. In 2017, approximately 84 percent of rides were taken on PAAC buses while 13 percent were taken on light rail. Paratransit and incline plane rides made up the remaining 3 percent of annual rides (see Table 1.1).

**TABLE 1.1: 2017 RIDERSHIP BY MODE**

Mode	Ridership
Bus	53,136,626
LRT	7,751,500
Monongahela Incline	617,322
Paratransit	1,471,836
<b>Total</b>	<b>62,977,284</b>

Source: Federal Transit Administration (2017)

## KEY INITIATIVES

Many of PAAC's recent and current initiatives are focused on implementing technology and process changes to streamline and improving the experience of the user.

- TrueTime:** PAAC began implementation of real-time arrival information for buses in 2013, and added the light rail system in 2017. This program allows riders to access current vehicle locations and anticipated arrival times from their mobile devices or computers, allowing riders to reduce wait times and plan their trips more effectively. In 2010, a team of researchers from University of Washington found that for Seattle-area bus riders, providing real-time arrival information resulted in numerous positive outcomes. In addition to an overall increase in satisfaction with public transit, riders decreased their waiting time, increased their transit trips per week, and felt both safer and healthier. These results then led to reduced traffic congestion, reduced environmental impact, and a preference towards transit oriented development.<sup>1</sup>
- ConnectCard:** PAAC debuted a new smart fare system in 2014, which is replacing paper transit passes and tickets. The ConnectCard is reusable and rechargeable, fashioned in the style of a credit card, and provides greater convenience and security than traditional passes or cash. In PAAC's recent fare restructuring (described below), a 25 cent surcharge was added to cash fares to encourage card adoption. In addition to this lower fare, ConnectCard holders are eligible for hundreds of discounts at participating retailers throughout Allegheny County. Many restaurants, museums, flower shops, bookstores, libraries, and auto shops offer reduced prices for admission, services, or products when customers show their ConnectCard.



<sup>1</sup> Ferris, Brian, et al. University of Washington. *OneBusAway: Results from Providing Real-Time Arrival Information for Public Transit*. April 2010.

- **Flat Fare:** PAAC revamped its fare structure in 2017, replacing a mix of pricing zones, transfer fees and checkpoints with a single flat fare, pay-on-enter policy. This revised approach reduces confusion for riders, and dwell time and fare loss caused by the complicated nature of the prior structure. It also encourages connections between modes through the elimination of the transfer fee. In concert with this change, PAAC created new products such as a day pass, half-fare monthly and weekly ConnectCards and Child ConnectCards to provide value to riders with varied travel needs.

Not only have these initiatives helped to modernize PAAC's system, but they have also brought ease to transit riders. In an increasingly competitive market, simplicity and information while traveling is key. Riding the bus rather than taking an Uber or Lyft becomes the easy choice when arrival information is available via TrueTime and the rider can avoid the hassle of paper transit passes and tickets by using a ConnectCard. These changes in convenience have potential to shift a rider's mode preference away from driving and towards public transit.

### ORGANIZATIONAL STRUCTURE AND BUDGET

PAAC is governed by an 11-member board of Directors who serve as unpaid volunteers and hold monthly public meetings. Board members 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 Authority's CEO, Katharine Eagan Kelleman, came to PAAC in January 2018 after serving as CEO of the Hillsborough Area Regional Transit Authority in Tampa, Florida.

PAAC's financials are comprised of separate operating and capital budgets, which are audited on a regular basis both internally and externally. The operating budget is utilized for the day to day provision of transportation services, covering expenses like employees, fuel and utilities. State funding under Act 89 provides the largest portion of operating funds, with additional government funding from federal and county sources. PAAC-generated revenue also supports the operating budget, including fares, advertising and university contracts. In 2018, PAAC collected \$2.6 million in advertising revenue, a 20 percent increase since 2016. In addition, the City's bus shelter program generates advertising revenues to maintain the PAAC bus shelters. By partnering with firms to design, manufacture, install, maintain, and repair the bus shelters and the associated street furniture, the City of Pittsburgh is enhancing the overall street environment and promoting the use of transit without additional cost to the City or PAAC.

PAAC's capital budget is utilized to maintain and expand the extensive service network. Capital needs vary from year to year, but can include a mix of rehabilitation, maintenance, enhancement and new construction activities. Infrastructure includes PAAC's fleet as well as its fixed guideways (rail, busways, tunnels, etc.), stations and buildings. Capital funding comes from a mix of federal, state and county grants, which typically are dedicated to capital projects and cannot be used for daily operating costs. Federal funding for major projects like the North Shore Connector can attract a significant influx of new dollars into the region and state.

Since capital expenditures can vary in magnitude and type from year to year, the economic impact analysis in this section utilizes a four-year average of expenditures covering FY 2015-2018. All expenditures are inflated to current dollars (2018) in order to express results in common terms. Over



this period, operating expenditures averaged \$422 million annually and capital expenditures averaged \$171 million annually in current dollars.

As documented throughout this report, PAAC's service and transportation assets are crucial to the economic vitality of the Pittsburgh region. It is also crucial to residents and communities throughout Allegheny County. PAAC service provides access to economic opportunities, amenities and important services like health care to households that by choice or necessity do not rely on private cars. PAAC's fixed routes and frequent service cover areas with low-income residents, and connects these communities directly to the region's major employment centers. PAAC service not only contributes to the prosperity of the region, but is also crucial to sharing that prosperity in an equitable manner. PAAC therefore recognizes that its service is a public good with broad ramifications for the residents of Allegheny County, and that its service and assets play an important role in economic development efforts and community vitality.

PAAC also recognizes its fiscal responsibilities as an institution funded largely by the public (either in the form of government revenues or passenger fares). PAAC has worked in recent years to become a more responsible manager of public funds. PAAC uses advertising and contract for service programs to maximize the revenue it generates from its own system. Funding cuts during the most recent recession led to cutbacks in PAAC's service levels, and routes are consistently evaluated for their efficiency and return through the annual service planning process. Employee contracts have been restructured in recent years to reduce the proportion of the budget that will be dedicated to legacy costs for retirees moving forward. PAAC is currently seeking ways to deliver its bus service more cost-effectively on a per mile and per vehicle basis, knowing that new efficiencies will be needed to improve performance relative to peer agencies due to the challenging topography of the Pittsburgh region.

## 1.2 ECONOMIC IMPACT METHODOLOGY

PAAC's operating and capital expenditures are translated into economic impact estimates through standard economic modeling techniques implemented through the IMPLAN framework. Modeling is undertaken through a sequence of steps described below. Further methodology detail and results are documented in Appendix A.

- First, we categorize the direct expenditures of PAAC on operations and capital investments by type and sector
- Next, we estimate the spillover impacts of these expenditures at the county, state and regional level using the IMPLAN modeling framework
- Finally, we estimate the employment, earnings and tax revenue impacts of this activity, using a mix of IMPLAN results and custom analysis

**SPILLOVER IMPACTS**

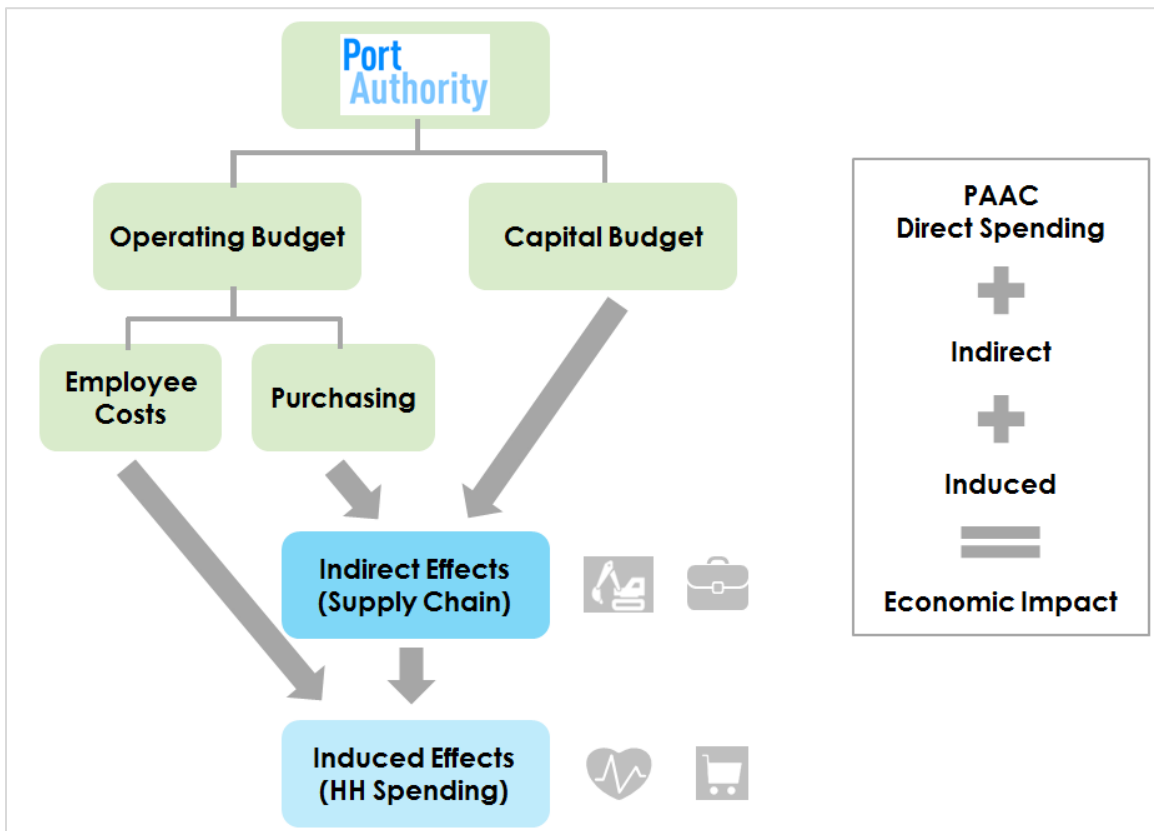
In an inter-connected economy, every dollar spent generates two spillover impacts:

- **Indirect effects** arise throughout the supply chain, as goods and services are purchased from local vendors, who in turn require additional purchasing from their own set of local vendors;
- **Induced effects** are generated throughout the local economy when employees of PAAC and its vendors recirculate their wages as household spending.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of the spillover impacts to all industries of a dollar spent in any single industry. ESI uses IMPLAN modeling software to create economic models tracking the flow of commodities through the economy at the county and state level to measure indirect and induced effects

Figure 1.2 below traces the flow of PAAC budgetary expenditures through the economy. Initial expenditures are divided into the operating and capital budgets, with the operating budget further subdivided into employee costs and purchasing. Capital expenditures and purchasing generate indirect effects for PAAC suppliers. Direct employee costs for PAAC as well as employee costs within PAAC’s supply chain create induced effects, when labor income is re-circulated locally as household spending. The total economic impact of PAAC is the sum of its own direct economic footprint plus the indirect and induced effects generated by that direct footprint.

**FIGURE 1.2: ECONOMIC IMPACT MODEL**



## EMPLOYMENT AND TAX REVENUE IMPACTS

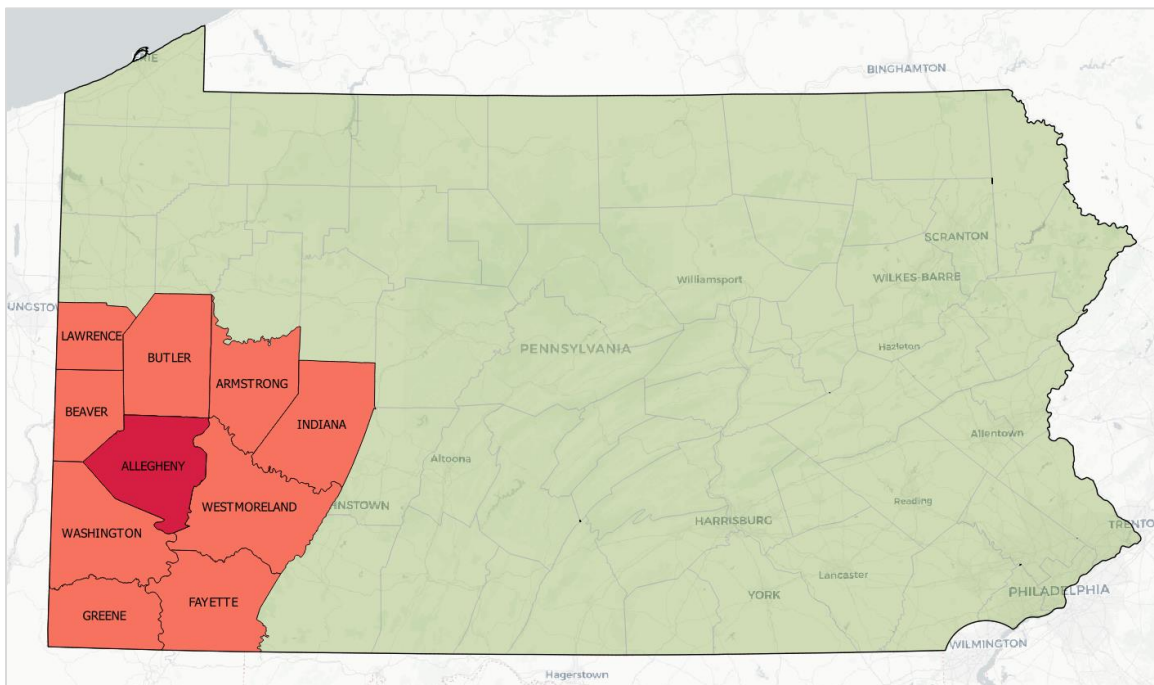
The aggregate economic output from direct, indirect and induced activity also supports employment and associated earnings. Employment is expressed in full-time equivalent (FTE) positions for a given year. Employee earnings associated with these positions represent the sum of wages and benefits.

The economic and employment activity increases various local and state tax bases, which in turn lead to increased tax revenue collections for local governments and for the Commonwealth. Tax revenue impacts are estimated through a custom fiscal model that relies on the known relationships between various types of economic activity and tax collections (i.e. effective tax rates) to translate the increases in activity estimates by IMPLAN into attendant tax revenue results. Categories that are tax-exempt due to PAAC's non-profit status are excluded from the analysis.<sup>2</sup> Additional tax revenue impacts stemming from the property value premium associated with PAAC service are addressed in Section 3.3.

## GEOGRAPHIES OF INTEREST

Economic impacts are estimated for Allegheny County, the Southwest Region (covering 10 counties), and the Commonwealth of Pennsylvania. The definition of the Southwest Region matches the definition utilized by the Southwestern Pennsylvania Commission (see Figure 1.3).<sup>3</sup>

**FIGURE 1.3: ECONOMIC IMPACT GEOGRAPHIES**



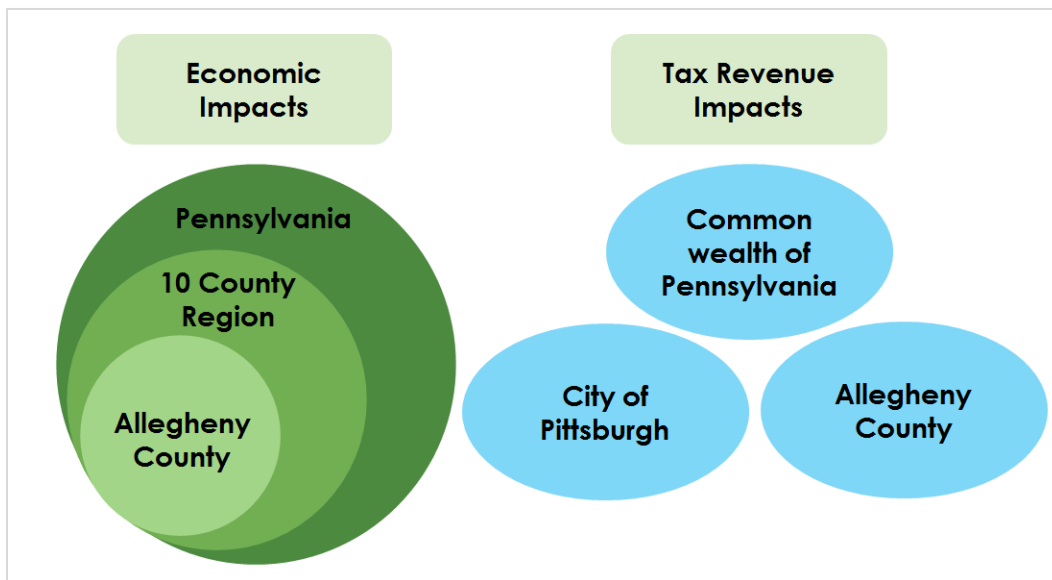
<sup>2</sup> Additional tax revenue impacts stemming from the property value premium associated with PAAC service are addressed in Section 3.3.

<sup>3</sup> The ten counties included are Allegheny (which encompasses the City of Pittsburgh), Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties, all in Pennsylvania. This regional definition is also utilized by the Allegheny Conference on Community Development. Notably, it is slightly larger than the Pittsburgh Metropolitan Statistical Area (MSA), as defined by the federal government, which does not include Greene, Indiana, or Lawrence counties. However, it is smaller than some regional definitions like a Combined Statistical Area (CSA) or Designated Market Area (DMA) which include portions of Ohio and West Virginia.

These geographies are concentric, with Allegheny County fully contained within the Southwest Region and the region fully contained within the Commonwealth. Direct expenditures by PAAC are larger at larger geographic levels, since some of its suppliers are located outside of Allegheny County but within the region, or outside of the region but within the Commonwealth. In addition, spillover impacts are by definition larger at larger geographic levels, since they include all of the indirect and induced effects taking place in the smaller geography plus any effects taking place in the remaining portions of these geographies.

While economic impacts within smaller geographies are fully contained within the larger geographies, local, county and state governments are each distinct entities with distinct tax bases. Tax revenues generated by PAAC activity are estimated for the City of Pittsburgh, Allegheny County and the Commonwealth of Pennsylvania. These impacts do not overlap - each represents distinct tax revenues generated to the respective governments (see Figure 1.4)

**FIGURE 1.4: GEOGRAPHY OF ECONOMIC AND TAX REVENUE IMPACTS**

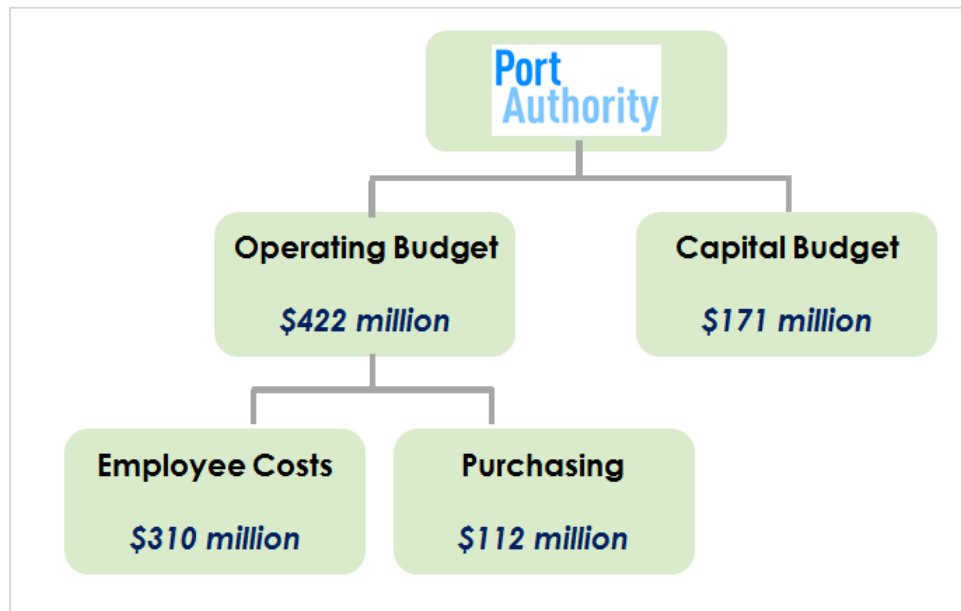


### 1.3 ECONOMIC IMPACT FROM OPERATIONS

PAAC's operating budget supports the day to day activity of the agency and its transportation services. Figure 1.5 below shows the average annual operating and capital spending by PAAC for fiscal years 2015 to 2018. All figures are expressed in inflation-adjusted dollars (\$2018) to allow for appropriate comparison. Annual operating expenditures during this period averaged \$422 million, while annual capital expenditures averaged \$171 million.

The majority of PAAC's operating budget goes to employee costs (including both salaries and benefits), which averaged \$310 million. The remaining \$112 million comprises purchasing activity on various types of goods and services.

**FIGURE 1.5: ANNUAL PAAC EXPENDITURES, FY 2015 - FY 2018 (IN \$2018)**



Sources: PAAC, BLS Consumer Price Index (Inflation Adjustment)

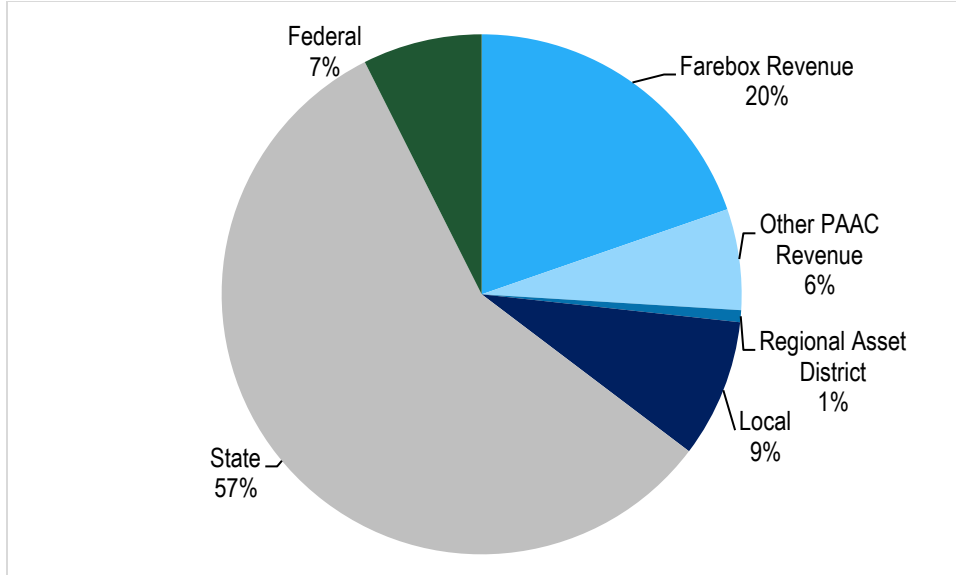
PAAC's operating budget is supported by a mix of local, state and federal funding sources (see Figure 1.6). The largest portion (57 percent) comes from Commonwealth of Pennsylvania funding. This funding is allocated based on Pennsylvania's Act 89, which was passed by the state legislature in November 2013 with the intent of establishing a dedicated long-term funding source for the state's transportation needs.

Local revenue sources accounted for 36 percent of operating funding over the FY 2015-2018 period. Chief among these is farebox revenue collected PAAC, which represents a direct contribution by transit users to its operations. The Authority also generates revenue through advertising and other means like contracts for service with universities.

Finally, 7 percent of operating revenue over this period comes from federal grants. These grants, which totaled more than \$120 million over the four year period, bring external dollars into the region and state.

As reviewed below, these external dollars not only support PAAC activity, but recirculate through the local economy.

**FIGURE 1.6: PAAC OPERATING FUNDING SOURCES, FY 2015 - FY 2018**



Source: PAAC Annual Operating Budgets

PAAC’s average operating expenditures from FY 2015-2018 were categorized by activity type and the indirect and induced impacts were modeled at the county, region and statewide level.<sup>4</sup> PAAC’s operating expenditures are a significant driver of economic activity in the region and Commonwealth through their direct, indirect and induced effects. PAAC operations generate \$726 million in economic impact in Pennsylvania each year, supporting over 5,000 jobs and more than \$400 million in earnings (see Table 1.2).

**TABLE 1.2: ANNUAL ECONOMIC IMPACT FROM PAAC’S OPERATIONS, FY 2015 - FY 2018 (IN \$2018)**

Impact Type	Allegheny County	Southwest Region	Commonwealth of Pennsylvania
Direct Output	\$373 million	\$381 million	\$384 million
Indirect & Induced Output	\$318 million	\$336 million	\$342 million
<b>Total Impact</b>	<b>\$691 million</b>	<b>\$718 million</b>	<b>\$726 million</b>
Employment Supported (FTE)	4,890 jobs	4,990 jobs	5,020 jobs
Earnings	\$412 million	\$417 million	\$418 million

Sources: See Appendix A

<sup>4</sup> See Appendix A for further information on ESI’s approach to modeling the economic and fiscal impacts from direct expenditures. Note that direct expenditures vary somewhat by geography, since a portion of purchasing activity takes place within the larger geography but outside of the smaller geography (such as purchasing that takes place within Pennsylvania but outside of the region and Allegheny County). Further, the larger geographies capture a somewhat larger proportion of spillover activity.

## 1.4 ECONOMIC IMPACT FROM CAPITAL INVESTMENTS

In late 2013, Pennsylvania's Transportation Bill, otherwise known as Act 89, was signed into law by the Pennsylvania General Assembly in order to fund road projects, bridge repairs, and public transit. Act 89 provides long-term funding for all aspects of transportation across the Commonwealth. Prior to Act 89, limited resources were available for capital projects and PAAC used state funds to focus primarily on maintenance projects. Act 89 capital funds now allow PAAC to bring its bridges, tunnels, fixed guideways, bus and rail facilities, and vehicles back to state of good repair. Beyond these projects, funding is also available for new transit oriented development, stop improvement projects, and sustainability initiatives.

PAAC capital investments averaged \$171 million per year in current dollars over the FY 2015-2018 period (as shown in Figure 1.4 above). These investments support infrastructure improvements of a number of types:

- *Fixed Guideway Improvements* represent investments in physical assets like bridges, tunnels, rails and busways. Recent activities have focused on rehabilitation of several bridges and the rehab and LED lighting of the CBD tunnel.
- *Facility Improvements* represent investments in rehabilitation and upgrades of PAAC stations and shops. Recent projects have included rehabilitation and expansions of bus and rail stations as well as rehabilitation of PAAC's Bus Main Shop and Heavy Equipment facilities.
- *Support Programs* represent investments in information technology and PAAC's network infrastructure, and non-revenue support vehicles to benefit ongoing operations. Recent investments have included the installation of Automated Passenger Counters on all light rail vehicles and upgrades in work order and financial management software.
- *Operating Capitalizations* provide investments, often through federal and state grant programs for activities like the overhaul and preventative maintenance of revenue vehicles.
- *New System Initiatives* provide additional investments for targeted programs like bus shelter replacements and bus and rail station improvements.<sup>5</sup>
- *Revenue Vehicle Replacement* represent investments in new vehicles to replace those that have exceeded their useful life. Recent activity has focused on the replacement of low floor clean diesel buses.
- *Debt Service* represents payments on bond debt incurred in 2011 for the construction of the LRT Stage II line and the construction costs for the expansion of the Martin Luther King East busway.

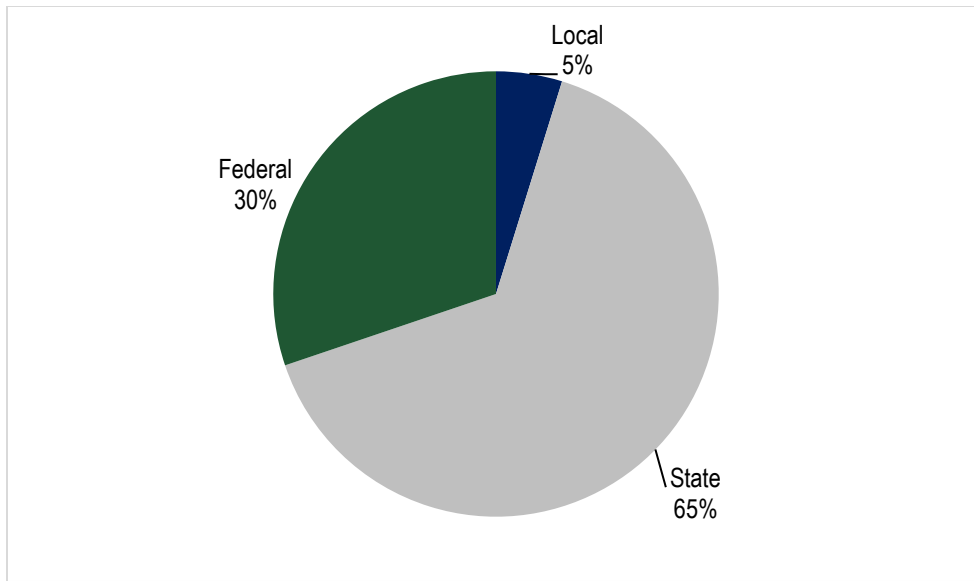
Debt service payments (which represent a transfer rather than new economic activity) and vehicle purchases (which typically come from outside of the region and Commonwealth) are excluded from economic impact modeling. Based on the remaining categories, direct activity modeled within the county, region and state economy totals \$105 million per year.

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<sup>5</sup> Note that the operating capitalizations and new systems initiatives categories vary programmatically, and were not included in the FY 2018 budget. However, they were included in prior fiscal years and therefore are reflected in the FY 2015-2018 average budget.

PAAC’s capital investments are funded primarily through state and federal sources (see Figure 1.7). State funding for capital projects, which increased under Pennsylvania Act 89, accounted for 65% of capital funding for the FY 2015-2018 period. Federal funds, which are typically attracted on a project basis or for various dedicated uses, represented 30 percent of capital funding over the period, bringing more than \$200 million into the region.

**FIGURE 1.7: PAAC CAPITAL FUNDING SOURCES, FY 2015 - FY 2018**



Source: PAAC Annual Capital Budgets

The total economic impact of PAAC’s capital investments within the regional and Commonwealth economy are the sum of these direct, indirect and induced effects.<sup>6</sup> PAAC’s capital investments generate \$203 million in economic impact within Pennsylvania each year, supporting 1,220 jobs and \$66 million in earnings (see Table 1.3)

**TABLE 1.3: ANNUAL ECONOMIC IMPACT FROM PAAC’S CAPITAL INVESTMENTS, FY 2015 - FY 2018 (IN \$2018)**

Impact Type	Allegheny County	Southwest Region	Commonwealth of Pennsylvania
Direct Output	\$105 million	\$105 million	\$105 million
Indirect & Induced Output	\$81 million	\$93 million	\$97 million
<b>Total Impact</b>	<b>\$186 million</b>	<b>\$198 million</b>	<b>\$203 million</b>
Employment Supported (FTE)	1,140 jobs	1,200 jobs	1,220 jobs
Earnings	\$62 million	\$65 million	\$66 million

Sources: See Appendix A

<sup>6</sup> See Appendix A for further information on ESI’s approach to modeling the economic and fiscal impacts from direct expenditures.



## 1.5 AGGREGATE IMPACT FROM PAAC EXPENDITURES

Economic impacts from operations and capital emerge from distinct budgets and are each expressed on an annual basis in \$2018, meaning that they can be summed to represent the annual economic impact from PAAC's aggregate expenditures. Table 1.4 below shows the combined impact within the county, region and state. PAAC's expenditures generate \$929 million in economic impact within Pennsylvania each year, supporting 6,240 jobs and \$484 million in earnings.

**TABLE 1.4: ANNUAL ECONOMIC IMPACT FROM PAAC'S OPERATIONS AND CAPITAL INVESTMENTS, FY 2015 - FY 2018 (IN \$2018)**

Impact Type	Combined Impact	Operating Impact	Capital Impact
<b>Allegheny County</b>			
<b>Economic Impact</b>	<b>\$877 million</b>	<b>\$691 million</b>	<b>\$186 million</b>
Employment Supported (FTE)	6,030 jobs	4,890 jobs	1,140 jobs
Earnings	\$474 million	\$412 million	\$62 million
<b>Southwest Region</b>			
<b>Economic Impact</b>	<b>\$916 million</b>	<b>\$718 million</b>	<b>\$198 million</b>
Employment Supported (FTE)	6,190 jobs	4,990 jobs	1,200 jobs
Earnings	\$482 million	\$417 million	\$65 million
<b>Commonwealth of Pennsylvania</b>			
<b>Economic Impact</b>	<b>\$929 million</b>	<b>\$726 million</b>	<b>\$203 million</b>
Employment Supported (FTE)	6,240 jobs	5,020 jobs	1,220 jobs
Earnings	\$484 million	\$418 million	\$66 million

Sources: See Appendix A

### TAX REVENUE IMPACTS

The economic activity generated by PAAC's expenditures also yields significant returns to state and local government in the form of tax revenues. These revenues contribute to essential public services for residents of the region and state.

While PAAC is itself tax-exempt, its expenditures nonetheless contribute to a significant amount of taxable activity. Most notably, income generated by its employment is subject to Pittsburgh and Pennsylvania income taxes. In addition, the spillover impacts of PAAC's expenditures generate revenue that circulates through the private sector, resulting in income, sales and business tax revenues.

On an annual basis, the total economic activity (including direct, indirect and induced impacts) from PAAC's expenditures on operations and capital investments generate \$19 million in tax revenues for the City of Pittsburgh, Allegheny County and Commonwealth of Pennsylvania governments (see Table 1.5).

**TABLE 1.5: ANNUAL TAX REVENUE IMPACT FROM PAAC OPERATING AND CAPITAL ACTIVITY (IN MILLIONS)**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Allegheny County</b>	<b>Commonwealth of Pennsylvania</b>	<b>Total</b>
Income / Wage Tax (\$M)	\$1.8	N/A	\$11.2	\$13.0
Sales Tax (\$M)	N/A	\$0.1	\$3.7	\$3.9
Business Tax (\$M)	\$0.3	N/A	\$1.3	\$1.5
<b>Total</b>	<b>\$2.1 million</b>	<b>\$0.1 million</b>	<b>\$16.2 million</b>	<b>\$18.5 million</b>

*Sources: See Appendix A*

Importantly, while these estimates include spillover activity from PAAC expenditures, they do not include effects from PAAC's broad contributions to the economic competitiveness of the region and to regional investment and property value, which are the subject of the sections to follow. These effects have far larger implications for the tax base. While some of these effects are difficult to quantify and attribute precisely to PAAC, Section 3.3 contains estimates of property tax and real estate transfer revenues attributable to the premium from transit service. These impacts are additive to the tax revenue impacts from PAAC expenditures shown above.

## 2.0 ECONOMIC COMPETITIVENESS AND EQUITABLE GROWTH IMPACTS

While the impact of the PAAC's expenditures represents an important and quantifiable economic contribution, the expenditures of a transit agency are a means to an end, rather than an end in and themselves. The transit service that PAAC provides is vital to the operation of the regional economy, connecting hundreds of thousands of commuters to their employers and customers to businesses and service providers each day. The transit service provided by PAAC is crucial to the ability of the Pittsburgh region to attract the activity and talent needed to growth the region's economy, and transit also serves a vital role in helping to share those gains equitably within the region. While this analysis does not seek to precisely disentangle transit's contribution to economic growth, there is little doubt that these impacts far exceed the impacts emerging from PAAC's expenditures.

Pittsburgh has undergone a remarkable transformation in recent decades from an industrial powerhouse to a knowledge and medical center. Where industrial activity relied on infrastructure that could move large volumes of goods (like waterways and railroads), modern knowledge activity is reliant on the agglomeration of large volumes of people and ideas to enhance productivity. Pittsburgh's economy remains focused on employment hubs in the Downtown area, and basic spatial math dictates that transit service is required to deliver the density of workers into a small area without creating unmanageable congestion.

Importantly, quality transit service not only enhances the attractiveness of a location to a business but also to the workers they are seeking to attract, and more broadly is essential to the quality of life for communities throughout the region. An extensive and effective transit system helps local universities, particularly Carnegie Mellon University and the University of Pittsburgh, attract students and staff. In doing so, it has helped to retain a younger and more diverse base of residents that are essential to the vitality of the region and its economy over the long-term. In addition, PAAC's service connects low-income areas to employment opportunities and other services and amenities, and provides vital paratransit service to populations in need.

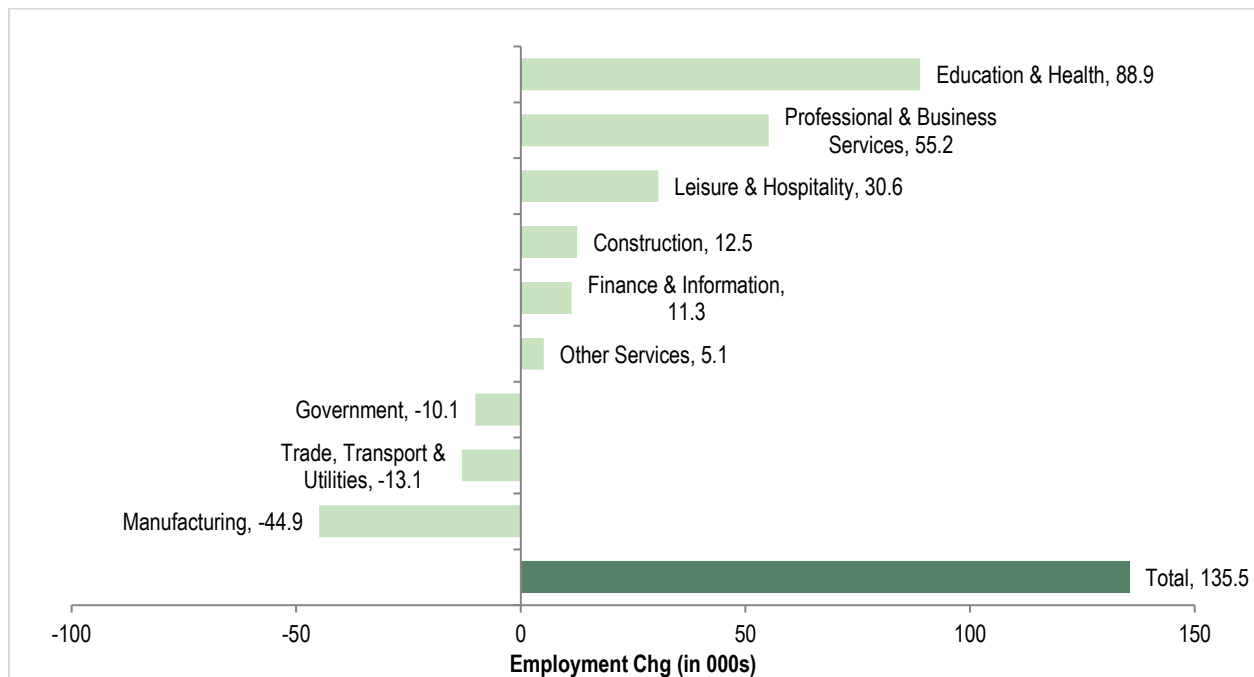
These contributions to the regional economy are also contributions to Pennsylvania. The density and productivity enabled by transit help the region to attract investment on a national and global scale and to make Allegheny County an outsized contributor to Pennsylvania's economy relative to its land area and population. This in turn means that the area is an outsized contributor to the Commonwealth's tax base.

## 2.1 DENSITY IN THE MODERN ECONOMY

Pittsburgh’s economy has experienced a dramatic transformation over the past fifty years, transitioning from a city and region built and dominated by manufacturing to one with a knowledge centered economy. The region is now anchored by sectors like finance, higher education and health care institutions, and excited about potential growth in information technology, robotics, energy and new transportation technologies.

Between 1990 and 2017, as manufacturing employment in the Pittsburgh MSA fell by 45,000 jobs, education and health care employment grew by 89,000, professional and business services added 55,000, leisure and hospitality added nearly 31,000 employees and finance and information grew by 11,000 jobs (see Figure 2.1). This transformation from an industrial to research powerhouse, while painful for many communities, is widely regarded as a success story, bringing reputational advantages and positioning the Pittsburgh region to be a leader in the emerging economy.

**FIGURE 2.1: PITTSBURGH MSA EMPLOYMENT CHANGE, 1990-2017**



Source: Bureau of Labor Statistics State and Area Employment, Hours, and Earnings (1990-2017)

This transformation has only reinforced the strength and importance of the region’s two primary centers of activity – Downtown Pittsburgh and Oakland / East End. The Greater Downtown central business district (the Golden Triangle and the adjacent Strip District, North Shore and Southside neighborhoods) is dominated by corporate headquarters and operation/technology centers, business and professional service firms, and government operations. The closely linked Oakland and East End communities of Shadyside and East Liberty are anchored by higher education and health care institutions and a

burgeoning community of related companies, including offices of global tech firms like Google, in addition to startups and spinoffs inspired by university-driven research.

Through an era marked by suburbanization and a significant decline in the city's population, Pittsburgh has retained a vibrant central city economy. According to the Pittsburgh Downtown Partnership, the Greater Downtown's 113,000 jobs account for 40% of all jobs in City of Pittsburgh – with 70% in the regional growth sectors of finance, business and professional services, accommodations and food services, and health care and social assistances. While the regional economy has shifted, Pittsburgh's manufacturing and corporate finance legacy remains, with 5 Fortune 500 companies with their headquarters in Greater Downtown – Kraft Heinz, PNC Financial, PPG Industries, U.S. Steel, and Wesco International. Add to that the health care corporate headquarters of Highmark and UPMC, and the Greater Downtown district remains the focal point of the regional economy.

Concurrently, the higher education and health care institutions in Oakland and East End of Pittsburgh have become the engines of the region's emerging economy. As the University of Pittsburgh and Carnegie Mellon University have increased their combined research funding to over \$1 billion per year, their presence and influence has grown and expanded. Basic and applied research in health, information technology, robotics, transportation and the talent base at both universities are attractive to companies, help support new start-ups, and add value to existing companies. The robust health care community in Oakland and other parts of the East End provide abundant employment opportunities across a variety of skill areas and support local businesses through both direct purchasing and visitor spending. With over 50,000 employees in the area, Oakland is the third largest employment center in Pennsylvania, with almost all those employees commuting into Oakland from outside of the district.

## AGGLOMERATION AND PRODUCTIVITY

An increase in volume and density of business activity in Downtown centers signal high levels of economic strength. When clusters of firms and people locate in close proximity to one another, the benefits from agglomeration boost economic productivity by enabling collaboration and an exchange of knowledge.

Not only do agglomeration effects spur advanced innovation, but these benefits also work to increase the attractiveness of the area. As such, these gains are self-reinforcing, as new businesses drive further investment, yielding still greater density and growth. It is important to note that agglomeration effects apply to consumption as well, with concentrations of amenities (such as food and beverage, retail or arts and culture) in a particular area attract a disproportionate share of consumer spending.

With growth in business activity comes increased employment density within a region. Just as important as creating this innovative, collaborative business environment is connecting workers to these employment hubs.<sup>7</sup> Across a growing city, the ability of a transportation network to efficiently connect

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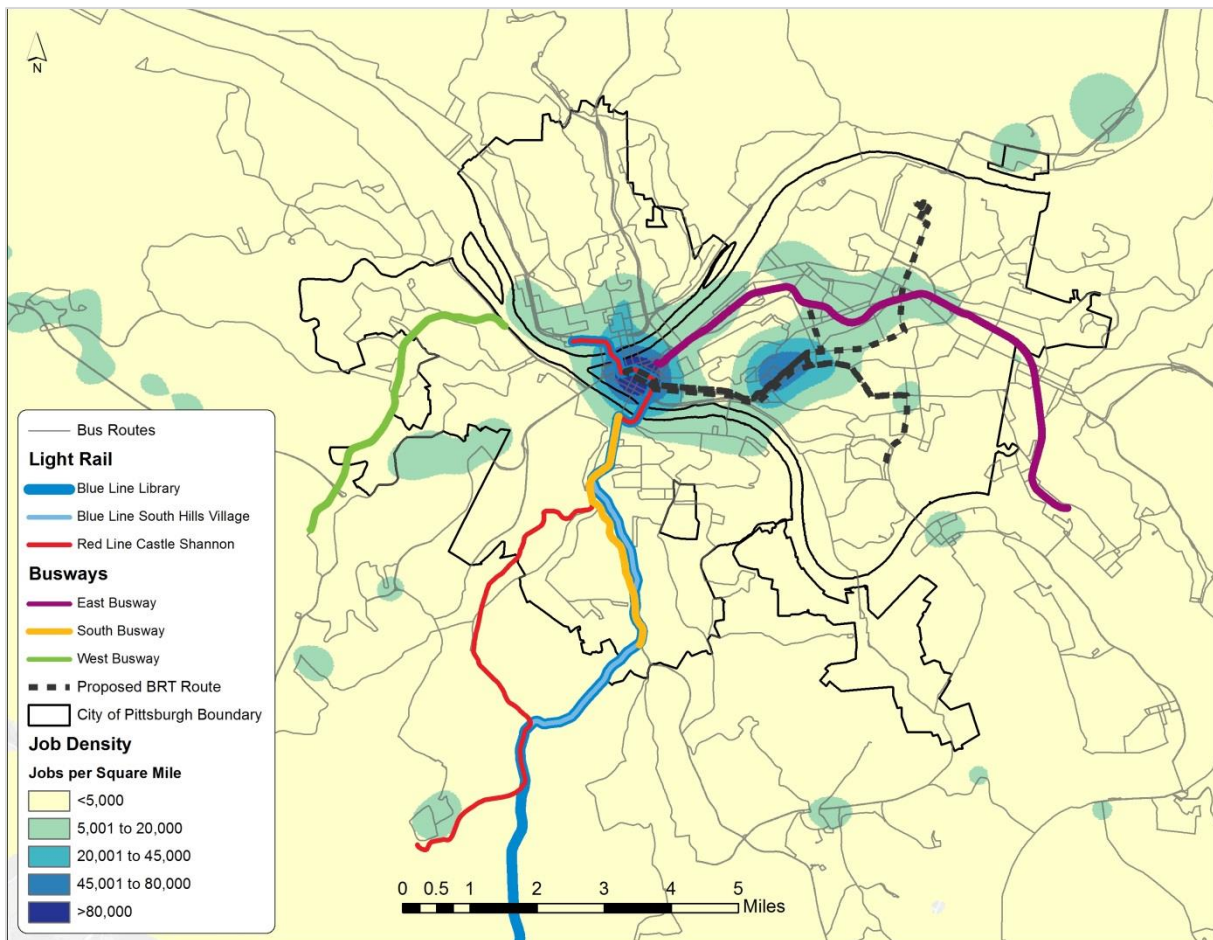
<sup>7</sup> Agglomeration effects have been the subject of a large volume of research in recent years, as economists seek to better understand productivity dynamics in the modern knowledge economy. Their connection to transit has also been the subject of intense research interest. For a summaries of this literature, see (among others):

Agglomeration Economics." *National Bureau of Economic Research*. Edward Glaeser, Editor (2010).

workers with businesses is one of the key determinants of economic growth. The important connection between agglomeration and productivity is therefore heavily dependent on access to public transit, which serves as an integral mechanism for bringing people and ideas together. In Pittsburgh’s Downtown, PAAC is central to increasing the efficiency of the business environment and enabling future growth.

Proximity to public transit is therefore recognized as a valuable amenity for businesses and, as a result, concentrations of employment in an urban core cluster around infrastructure that can bring commuters to their place of work. As seen in Figure 2.2, the most employee dense areas are the areas with the most frequent transit service. While PAAC transit service can be seen as both a cause and effect of the ever-expanding, knowledge-driven, innovation hub that Downtown Pittsburgh has become, the relationship between agglomeration and transit access is the key to economic growth

**FIGURE 2.2: ALLEGHENY COUNTY EMPLOYMENT DENSITY**



Source: LEHD OnTheMap (2015), ArcGIS (2018)

Graham, Daniel J. “Quantifying Wider Economic Impacts of Agglomeration for Transport Appraisal: Existing Evidence and Future Directions.” *London School of Economics* (2018).

## POPULATION AND EMPLOYMENT PATTERNS

While Pittsburgh's business centers have seen significant transitions, they have been major employment and activity centers for over 100 years. Each of the districts has also been a focal point for transit and transportation corridors on a continuous basis, with a level of service to a large portion of the region that helps to support continued growth, development and redevelopment. As the system has evolved from rail and streetcars to today's light rail, busways and bus routes, the region's two largest business districts have developed as transit-oriented business and activity centers. PAAC's planned Downtown-Uptown-Oakland-East End Bus Rapid Transit service will grow the linkages between these areas and to the rest of the system, particularly to the east, by increasing the speed and reliability of service.<sup>8</sup>

The abundant transit service available in both districts is crucial to their ability to support more employment and economic activity than would be expected for these relatively compact areas. For example, 82% of all PAAC bus routes serve Downtown, reaching over 40% of Allegheny County's population, and the busways and light rail lines all serve Downtown. Many lines either directly serve Oakland and the East End or have simple connections via the Fifth and Forbes corridor service, or via the East Busway.

PAAC calculates "Frequent Service Walkshed" of walkable areas<sup>9</sup> within quarter mile around a transit stop or half mile around a transit station with frequent service<sup>10</sup> to help define those areas best served by transit (see Figure 2.3).<sup>11</sup>

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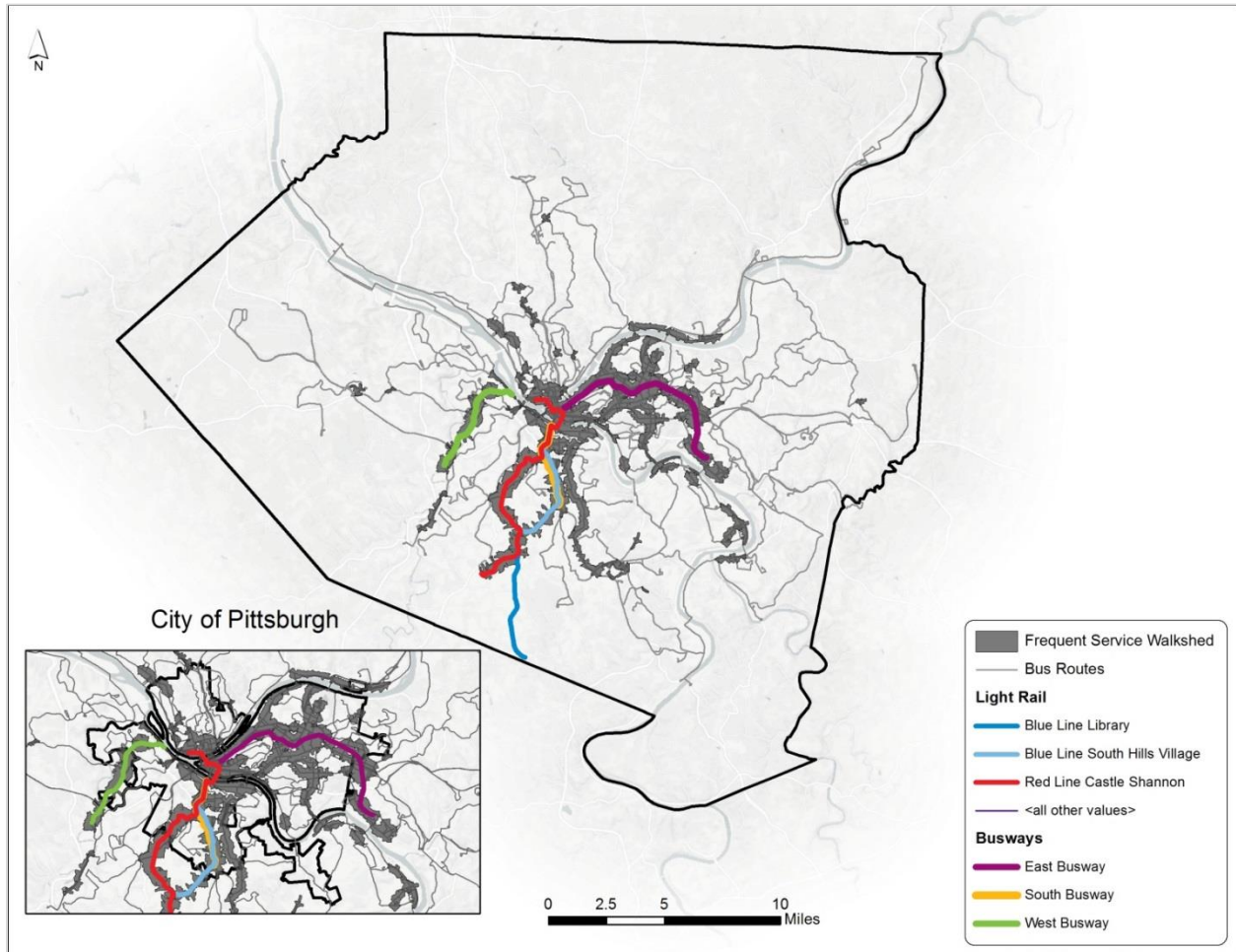
<sup>8</sup> This project is discussed in greater detail in Sections 2.2 and 3.1 of this report.

<sup>9</sup> Walkable areas are areas within a five minute walk of a bus stop or a ten minute walk of a light rail, incline or busway station.

<sup>10</sup> Transit stations with frequent service as those with transit vehicles come, on average, every fifteen minutes for fifteen hours of the day, and every thirty minutes for an additional five hours of the day, every day of the week.

<sup>11</sup> The frequent transit walkshed is defined by PAAC with the assumption that the average adult will walk up to ten minutes to use transit service and will cover approximately one-half mile in that time. One half mile is the typical standard and was further refined in some areas by PAAC using spatial mapping tools to account for specific topography. The frequent services walkshed used throughout this analysis therefore best represents the places that could be reached within a ten-minute walk.

FIGURE 2.3: PAAC FREQUENT SERVICE WALKSHED

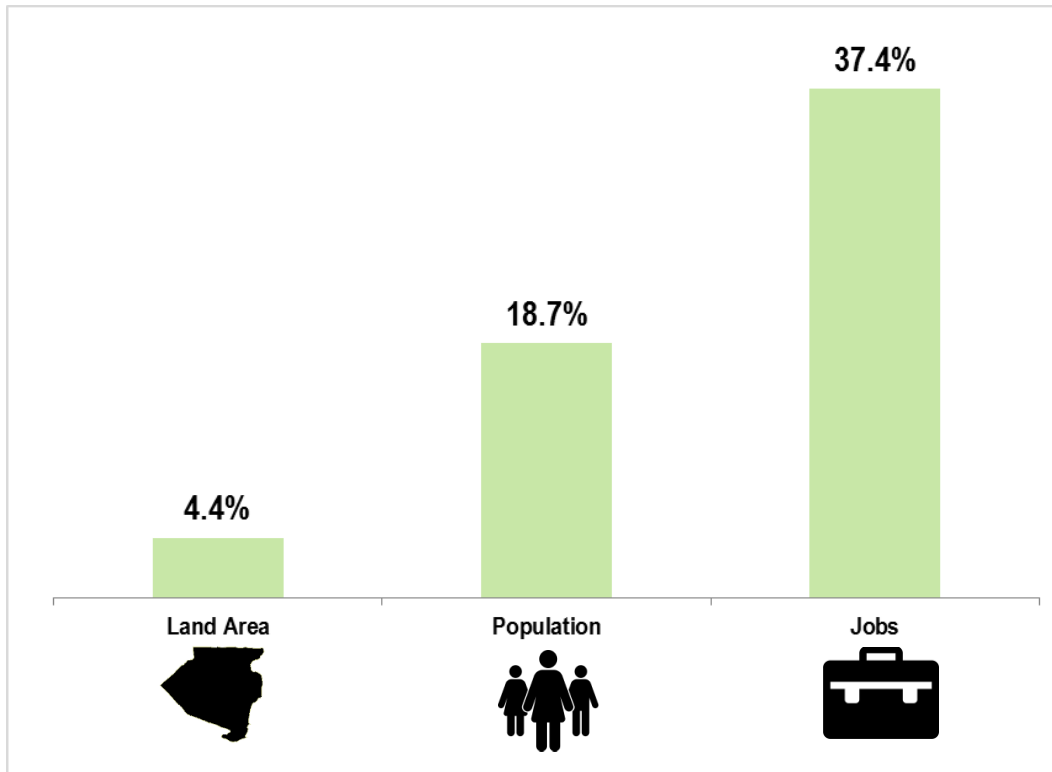


Source: Port Authority (2018), ArcGIS (2018)



Analysis of population and employment concentrations within these areas illustrate the benefit of the connection that transit service provides between communities and employment hubs. In addition to Downtown and Oakland, frequent transit is crucial to secondary employment nodes like East Liberty and South Side Flats. Across Allegheny County, the frequent service walkshed covers only 4% of the total land area, but contains 19% of the population and 37% of all jobs (see Figure 2.4).

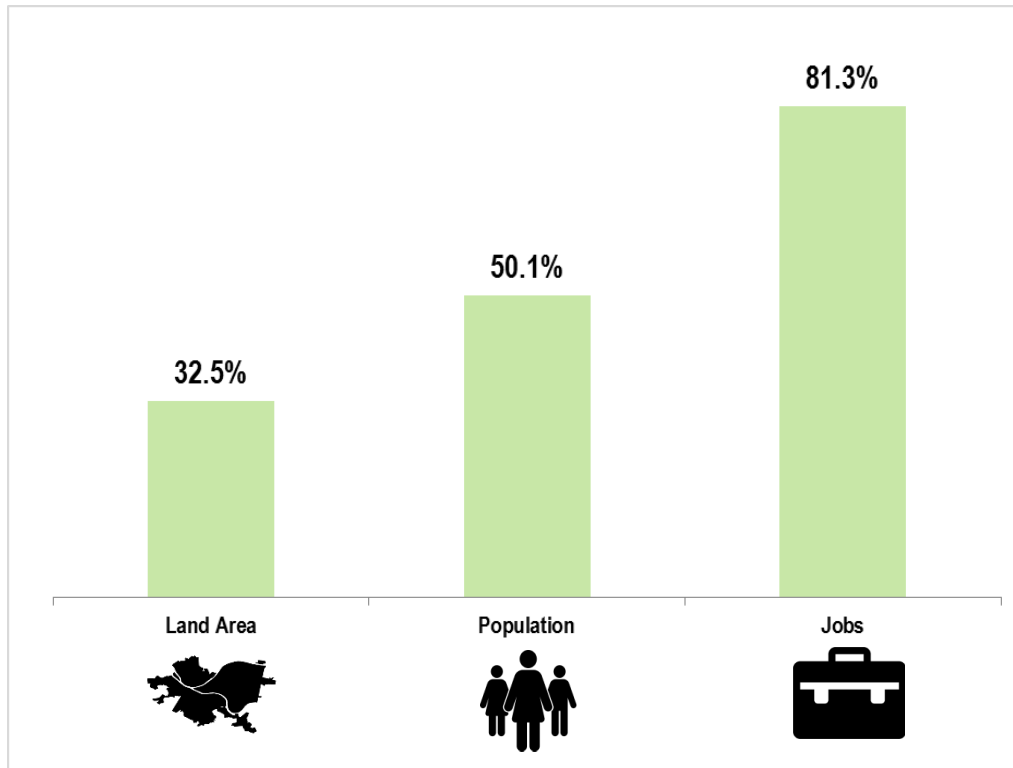
**FIGURE 2.4: SHARE OF ALLEGHENY COUNTY ACTIVITY IN PAAC FREQUENT SERVICE WALKSHED**



Source: Esri Business Analyst (2018)

Within the limits of Pittsburgh, the results are even more dramatic. The PAAC frequent service walkshed covers one-third of the land area of the city, but accounts for half the population and more than four-fifths of all jobs in Pittsburgh (see Figure 2.5).<sup>12</sup>

**FIGURE 2.5: SHARE OF PITTSBURGH ACTIVITY IN PAAC FREQUENT SERVICE WALKSHED**



Source: Esri Business Analyst (2018)

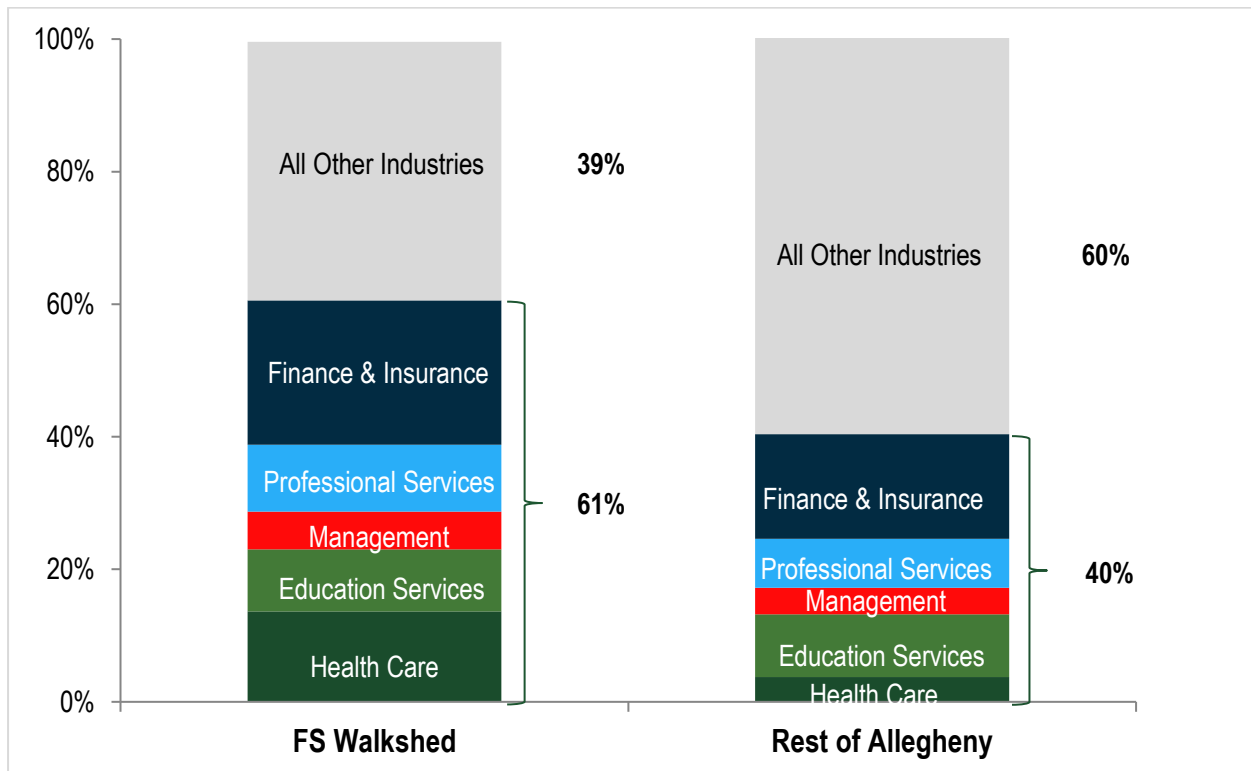
These land use patterns ultimately serve to benefit communities of all types across the County. When activity is concentrated in transit-served areas, it helps in maintaining open space and a variety of community types (from urban to rural, from dense to sparse) within the region while allowing for economic and population growth.<sup>13</sup>

<sup>12</sup> Note that the Pittsburgh analysis excludes the portions of the walkshed within the county but outside the city in order to appropriately calculate activity within the portion of the walkshed in the city to the city as a whole.

<sup>13</sup> Section 3 of this report contains a related discussion of the impact of PAAC's network on development patterns and residential housing markets within Allegheny County.

It is also notable that these transit-served areas not only see a greater density of economic activity, but also activity of a different type. Employment within the PAAC frequent-service walkshed is heavily concentrated in the faster growing knowledge sectors of Finance, Professional Services, Management, Education Services and Health Services. More than 60% of jobs within the walkshed fall into these categories, compared to 40% of jobs in the remainder of Allegheny County outside of these areas (see Figure 2.6). Not coincidentally, these are the sectors that rely most directly on innovation activity and derive the greatest productivity benefits from agglomeration effects.

**FIGURE 2.6: FREQUENT TRANSIT WALKSHED KNOWLEDGE SECTOR RELATIVE TO ALLEGHENY COUNTY**



Source: LEHD OnTheMap (2015)

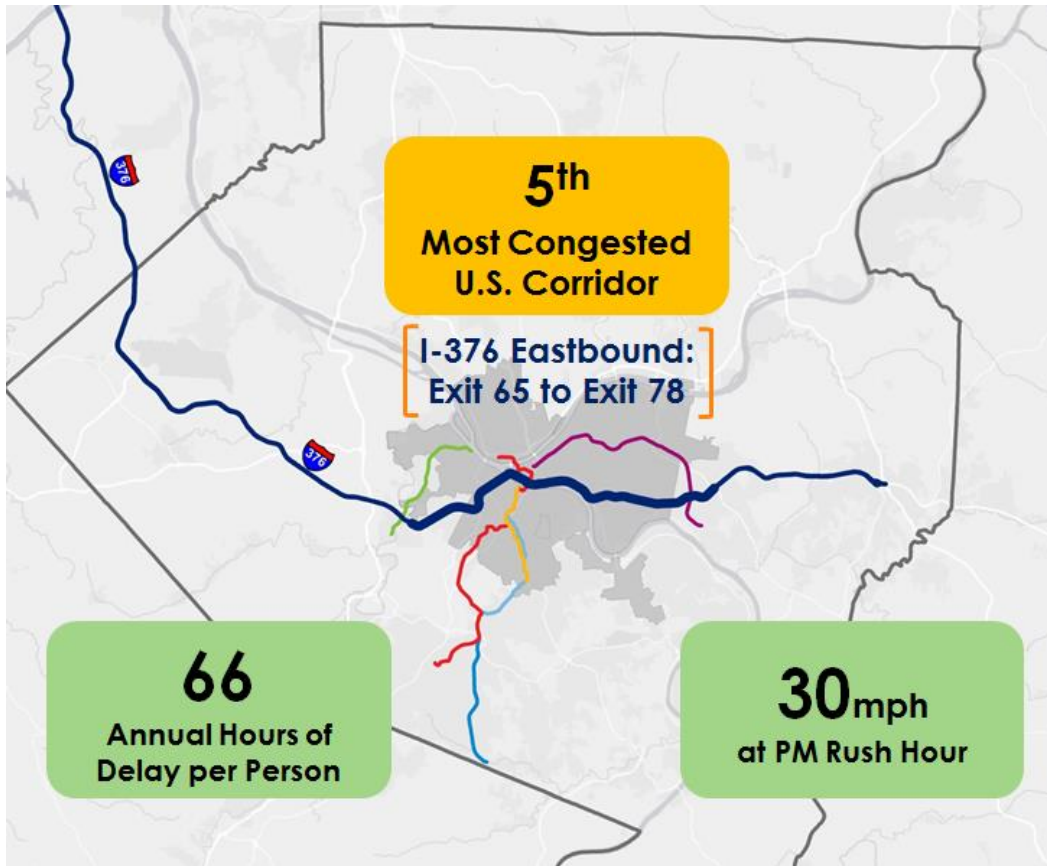
It is important to note that these knowledge sectors include jobs at a wide range of skill levels, from entry-level to advanced positions. The inclusivity of the job market within the frequent-service walkshed benefits not just the area’s highly educated and experienced employees but also residents seeking entry-level positions. Because transit makes these jobs accessible to residents from a range of socioeconomic backgrounds, PAAC is connecting employers in Downtown Pittsburgh to employees in various communities across the county (see additional discussion in Section 2.2).

**CONGESTION RELIEF**

In addition to providing a means of transportation for many workers, PAAC service also serves to relieve congestion on the roads and highways serving both districts, helping to alleviate the transportation challenges for districts facing geographic boundaries such as tunnels, deep valleys,

ivers, and the City's primary urban parkland. Despite the County's decentralized population, a lack of major highways into the city means that most car traffic from the more concentrated eastern and southern suburbs is channeled into the city along I-376. A recent study by INRIX identified the stretch of I-376 (the Parkway East) encompassing the Fort Pitt and Squirrel Hill Tunnels as the nation's fifth most congested corridor (see Figure 2.7), alongside key arteries in larger cities known for their congestion like New York, Chicago, Los Angeles and Boston.<sup>14</sup>

FIGURE 2.7: I-376 CONGESTION CORRIDOR



Source: INRIX 2017 Global Traffic Scorecard

This stretch of I-376 carries the inflow and outflow of many of the region's workers, and in part, this congestion signals the productivity of the area's business activity, with congestion standing as unfortunate symptom success. However, lengthy delays for commuters ultimately limit the attractiveness of an area to businesses and the workers they seek to attract, in turn limiting growth. This is a particular challenge for Pittsburgh due to the concentration of Downtown activity and to the topographical challenges created for traffic flow by rivers and hillsides.

<sup>14</sup> INRIX Research, *INRIX Global Traffic Scorecard*, February 2018. Table 8: Top 10 Worst US Corridors

As shown in Figure 2.7 above, PAAC service provides commuters with alternative paths to access the region's key employment nodes. Most notably, dedicated busways bypass these key choke points, providing (along with light rail) reliable and consistent commute times into Downtown. Additionally, PAAC's extensive park and ride network intercepts commuters destined to Downtown and Oakland. The existence of these alternatives also benefits drivers who do not use them, because they take single occupancy vehicles off the road, mitigating congestion problems that would be even worse.

More broadly, basic spatial math dictates that mass transit service is crucial to supporting flows of people into dense and productive areas and enabling these key job corridors to grow. Analysis by the City of Pittsburgh's Department of Mobility and Infrastructure indicates that light rail service represents the most space efficient means of travel on a per person basis, with the capacity to carry 11 times as many people per square foot utilized as a private vehicle. Similarly, the ratio for bus rapid transit is 8:1. Even with autonomous technology that can cluster cars more closely together, the amount of space needed per passenger will be larger than what is needed on public transit, creating conditions within the fixed space of an urban environment and at key chokepoints like tunnels and bridges.

**FIGURE 2.8: STREET SPACE OCCUPIED BY CARS VS. BUSES**



*Source: Cycling Promotion Fund (2017)*

Combining these dynamics, it is clear that PAAC's dedicated services like light rail, busways and the forthcoming BRT are crucial to enabling the growth in activity and productivity that fuels the region's key employment areas.

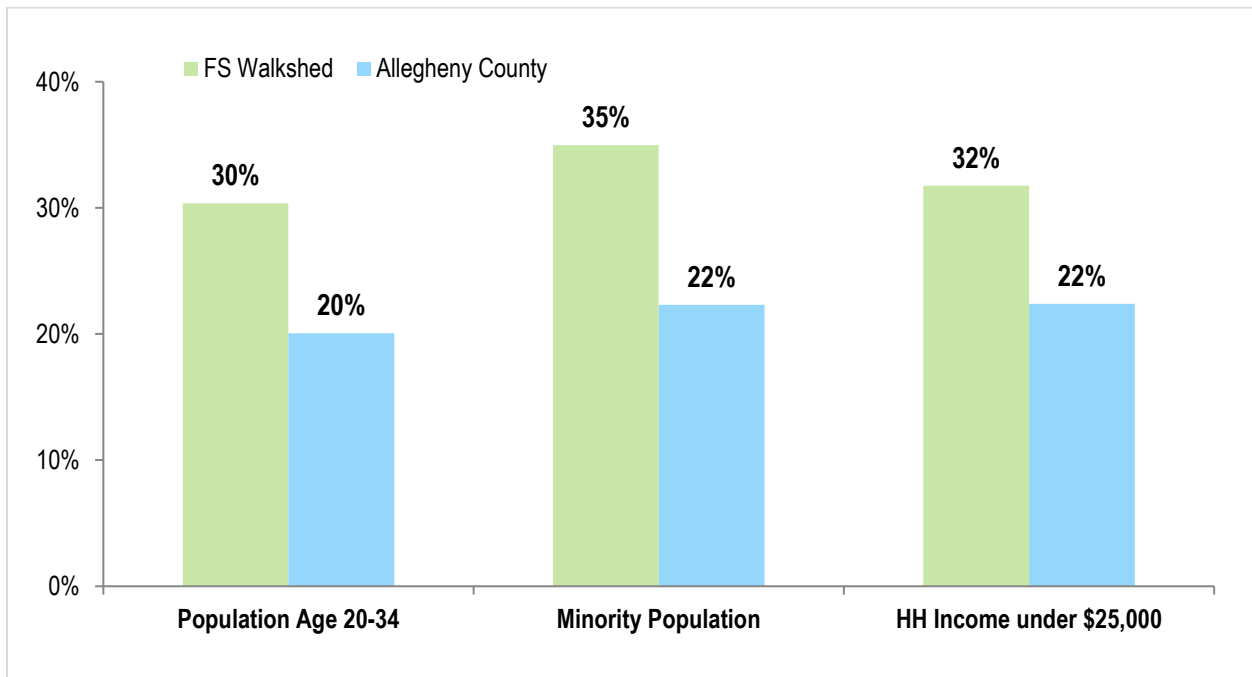
## 2.2 CONTRIBUTION TO EQUITABLE GROWTH

While the employment and knowledge centers that PAAC supports are crucial to economic growth, transit service is also fundamental to connecting residents and communities throughout the region to economic opportunities and services. Reliable and affordable transit service is an essential component of an inclusive economy and a region that shares the benefits of progress equitably. PAAC’s focus on equity helps ensure that it delivers robust services to low-income areas where other transportation options can be cost prohibitive. The areas served by PAAC’s frequent service are also younger and more diverse than the county as a whole, illustrating the role of transit in helping to attract and retain key demographic groups for the long-term trajectory of the region and its economy.

### DEMOGRAPHICS

Figure 2.9 below compares the demographics of the population within the half-mile walkshed of PAAC’s frequent service to the overall demographics of Allegheny County. The walkshed features far higher proportions of young residents (ages 20-34), minority residents and low-income residents (incomes under \$25,000) than the county as a whole.<sup>15</sup>

**FIGURE 2.9: RESIDENT DEMOGRAPHICS WITHIN PAAC FREQUENT SERVICE WALKSHED**



Source: ESRI (2018)

<sup>15</sup> Since the walkshed areas encompasses half the population of the city of Pittsburgh, and a much smaller portion of the population of the remainder of the county, demographic differences interact with differences between the city and suburban portions of Allegheny County. However, these differences themselves are reflective of development and population patterns and preferences that have been dependent over the long term in part on transit service.

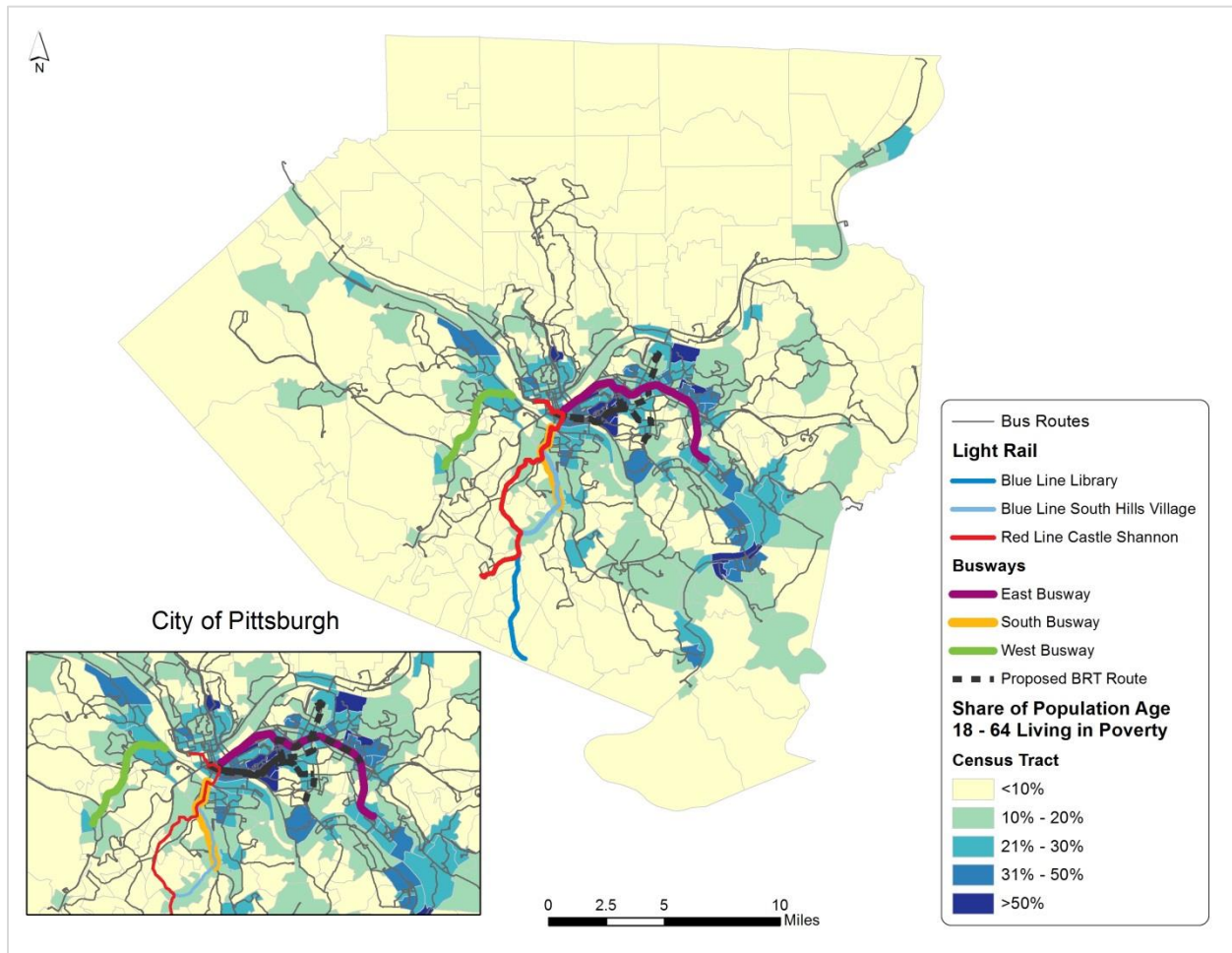
The Pittsburgh region as a whole has among the oldest and least diverse populations among large metro areas across the country. The ability to attract and retain a younger workforce is crucial to the economic future of the region. Further, the knowledge activity that the region is pursuing requires diverse viewpoints and attracting talent from around the globe through immigration.

As demonstrated by the demographics of the frequent service walkshed, the growth in these groups has occurred within the proximity of transit service. Younger residents are a natural transit constituency, as they may not have the fixed investments or ingrained habits towards personal vehicles that are typical among older residents. The median age within the frequent service walkshed is 35 years old (compared to 43 for the county as a whole) and though it only covers 4% of the county's land area and 18% of its population, more than one in every four 20-34 year olds (28%) who live in Allegheny County live within the walkshed.

PAAC has cultivated this connection with younger residents through its contracts with several universities in the city to sell transit passes to their student body. Helping students learn how to navigate the system and see more of the region while in school can improve graduate retention in the area, and can also increase the likelihood that those residents will become transit riders after graduating.

PAAC carefully tracks the equity implications of its network through its planning process. The Authority's annual service plan includes an equity analysis that considers several categories of residents with higher mobility needs (low-income, minority, elderly, young, persons with disabilities and households with no vehicles) and demonstrates that service frequencies are more robust in higher need areas. Figure 2.10 below shows the distribution of low-income households in Allegheny County relative to PAAC's service map.

**FIGURE 2.10: LOW INCOME HOUSEHOLDS IN ALLEGHENY COUNTY AND PAAC SERVICE**



Source: American Community Survey (2012-2016), ArcGIS (2018)

**ACCESS TO EMPLOYMENT**

Importantly, PAAC’s frequent service network encompasses both low-income areas and major employment centers. As noted above, the frequent service walkshed covers 37% of jobs in Allegheny County and 81% of jobs in Pittsburgh. This network thereby connects lower income communities to economic opportunities with affordable and reliable service, allowing broad access to the engines of job creation in the county.

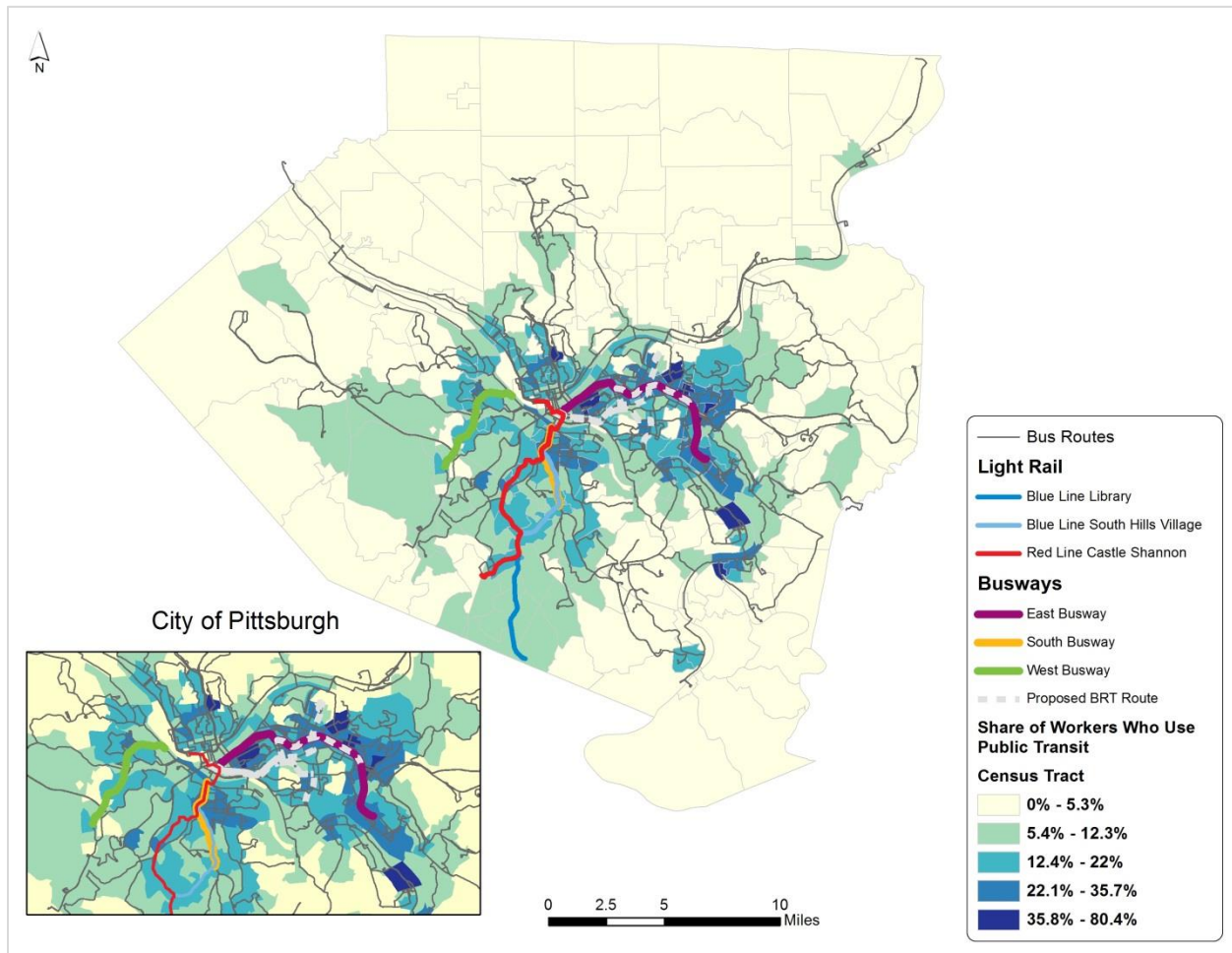
Transportation costs are an important factor in the budget and locational decisions for all households, and are particularly important for those with lower incomes. While housing affordability is an issue that receives significant attention from policymakers, housing and transportation are often a “bundled” cost, since living in a particular location may require a commute of a certain length or access to a private vehicle. Conversely, living in a location with access to quality public transit may allow for significant savings on transportation costs, making that location more economical even if direct housing costs may be higher than some alternatives. Therefore, combined housing and transportation costs like those



tracked by the Center for Neighborhood Technology (CNT) provide a more comprehensive picture of affordability.<sup>16</sup>

Figure 2.11 below shows the share of Allegheny County residents who use public transit to commute to work by location.<sup>17</sup> The spatial patterns in transit commutes track closely with PAAC’s service network, both within the city and along further outlying lines. These patterns also align with prior visualizations of population density and low-income populations.

**FIGURE 2.11: SHARE OF ALLEGHENY COUNTY COMMUTERS USING PUBLIC TRANSIT**



Source: American Community Survey (2012-2016), ArcGIS (2018)

<sup>16</sup> See: *Housing & Transportation Affordability Index: True Affordability and Location Efficiency*. Center for Neighborhood Technology <<https://htaindex.cnt.org/map/>>

<sup>17</sup> Note that overall, close to 10% of Allegheny County residents commute by public transit, while about 80% commute by car (with the remainder walking, working at home, or commuting by other means).

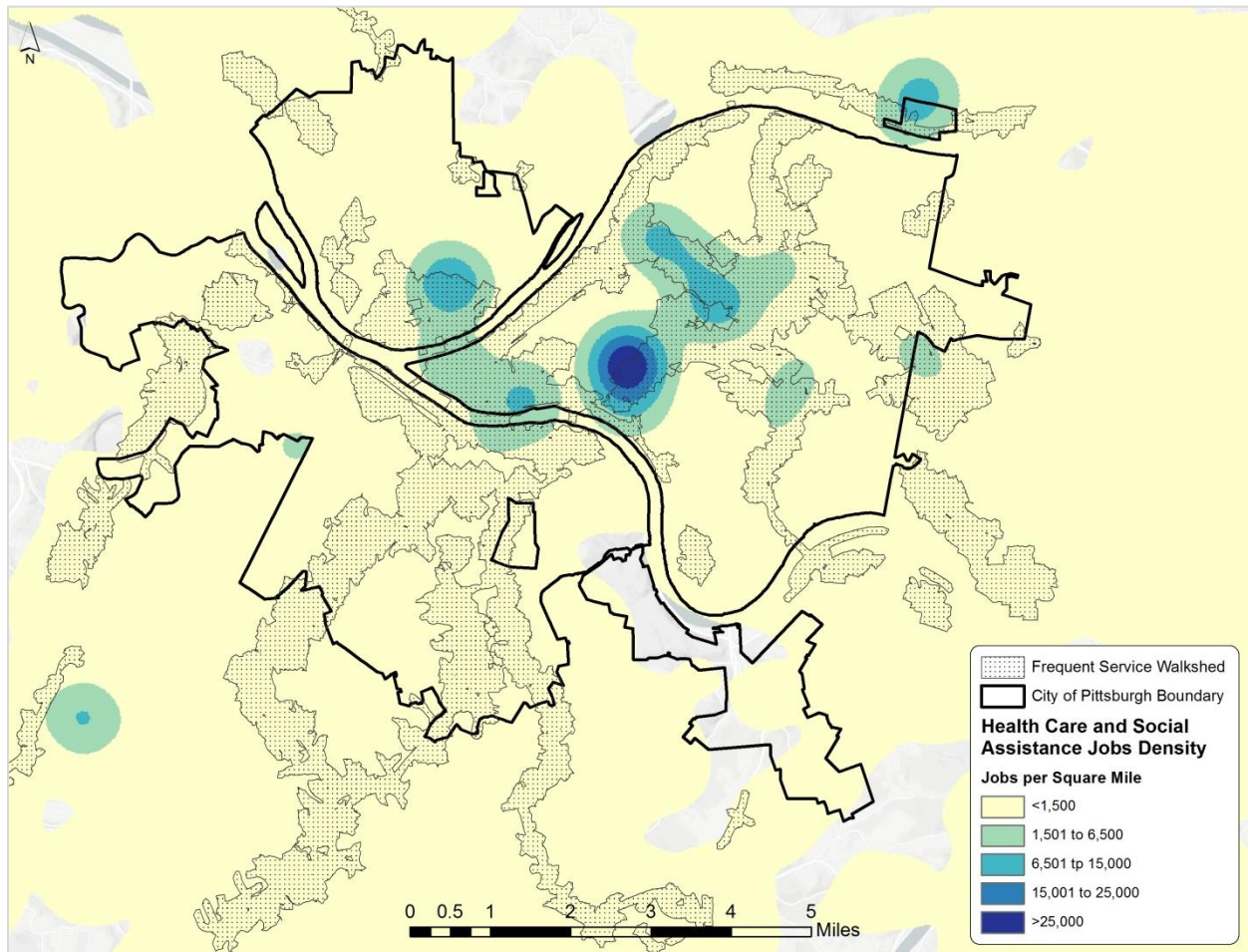
It should also be noted that license plate analysis done at PAAC's park and ride stations around the County indicate that around one-quarter of vehicles belonged to residents of neighboring counties. Therefore, commuter patterns showing only Allegheny County residents understate the reach of the system, which extends to and beyond the county line in some cases. These commute connections to neighboring counties help expand the labor force available to Allegheny County employers, and also build the tax base.

### **ACCESS TO AMENITIES AND SERVICES**

While transportation networks are often discussed and evaluated in terms of access to employment, the impact of transportation options on communities and residents extends far beyond employment commutes. Effective public transit improves the quality of life of its riders by expanding their mobility options throughout different facets of their lives, allowing them to visit friends and family, take advantage of amenities and activities throughout the region, access educational and training facilities, and utilize vital services like health care.

Figure 2.12 below maps the density of health care employment, which serves as a proxy for where large concentrations of health care services are delivered. Clusters align closely with areas served by frequent transit. This is most apparent in the densest health care concentrations in Oakland and on the North Shore, but is also evident further from Downtown. Hospitals like UMPC St. Margaret, LifeCare Hospitals of Pittsburgh, and the Children's Institute are at the center of well-served transit corridors to the north and east of the city. This service helps to make these medical centers accessible to both patients and employees.

FIGURE 2.12: DENSITY OF HEALTH CARE EMPLOYMENT



Source: LEHD OnTheMap (2015), ArcGIS (2018)

PAAC service also connects neighborhoods throughout Allegheny County to amenities that improve quality of life for residents. Grocery stores and other neighborhood serving retailers are often located along commercial corridors served by transit, helping residents access these services and in turn helping attract the customers that retailers need to sustain their activity.

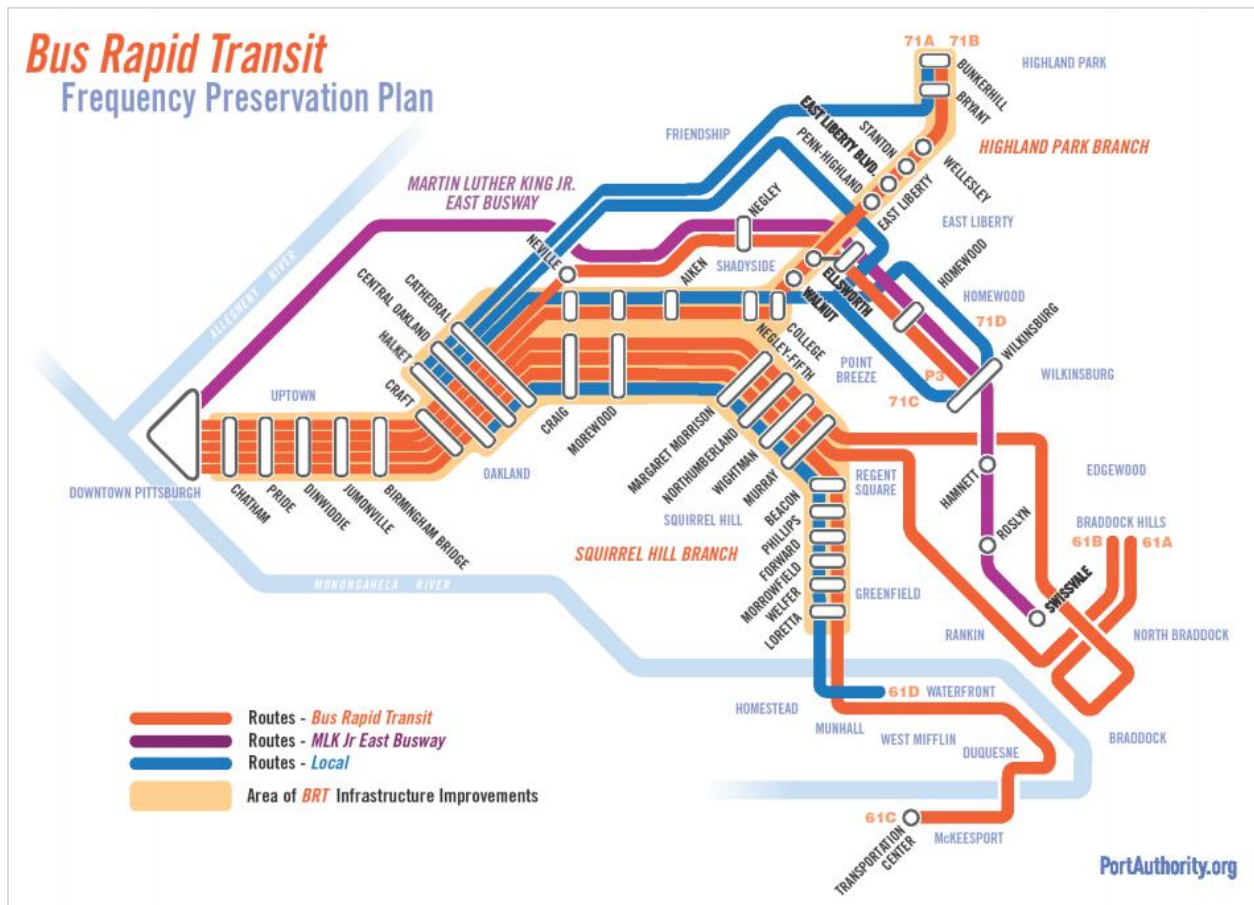
### COMMUNITY ECONOMIC DEVELOPMENT

Creating access to economic opportunities and amenities is a key consideration for PAAC when it looks to revise or expand its infrastructure and service. The busway expansion in 2003 has extended service into the Eastern suburbs, with a termination at Swissvale, which both reaches working class neighborhoods and provides access for Mon Valley residents to express service via the East Busway. PAAC's current process to develop new BRT service shows the priority that the Authority places on its role in promoting inclusive economic development.

While the BRT project drew initial headlines for its focus on the Oakland to Downtown corridor, it also produces significant benefits for equity and opportunity by connecting neighborhoods more efficiently to these employment centers through the development of the Highland Park and Squirrel Hill branches

and stations. PAAC has engaged in an extensive community process regarding the routing of the BRT and its interaction with existing service. After evaluating public concerns raised in the initial feedback in 2017, PAAC re-opened the design and input process in 2018 and has developed a revised plan that retains existing frequencies while improving travel speeds by connecting existing service into the BRT route (see Figure 2.13).

FIGURE 2.13: BUS RAPID TRANSIT FREQUENCY PRESERVATION PLAN



Source: PAAC (2018)

By extending rapid bus service through the East End via Highland Park, the BRT will provide service to East Liberty, Oakland and Downtown through routes to communities like Lincoln-Larimer that will now see vastly improved service and connections. In a similar way, via use of the busway and connections to the BRT, Mon Valley communities will have improved service to the core employment centers of the region. This can also serve to reduce congestion on the crowded Parkway East corridor, providing benefits to car commuters to Downtown (and beyond) and Oakland that might never ride the BRT line.

## ACCESS PARATRANSIT SERVICE

PAAC also sponsors the provision of paratransit services to residents in need of assistance through the ACCESS program. ACCESS provides door-to-door, advance registration, shared ride service that exceeds all minimum ADA requirements. The system delivers 1.5 million rides annually and delivers an on-time performance of 96%.

ACCESS is operated through a unique public-private partnership between PAAC and six service providers (five for-profit transportation companies and one non-profit human service agency) operating from seven distinct locations. Requests for service are routed through a decentralized brokerage, allowing for flexibility and avoiding the duplication of effort between providers.

PAAC sets service standards and service area assignments, and negotiates rates for service through a competitive bid and negotiation process. PAAC is also able to leverage distinct state and federal funding sources for paratransit services into a coordinated effort. ACCESS was the recipient of the United We Ride National Leadership Award in recognition of the effectiveness of the service and the coordination with which it is operated, which stands as a model for other agencies.

## ENVIRONMENTAL AND SAFETY IMPACTS

Public transit service is also an essential component to a sustainable environmental approach for the region. Transit service delivers far lower emissions for passenger by increasing the volume of passengers per vehicle by several orders of magnitude. It also reduces congestion, limiting the emissions of the private vehicles that are currently on the road relative to a scenario without transit, where cars would experience lengthier daily delays.

More broadly, transit service supports environmentally beneficial land use patterns. The density of activity and development in the Downtown and along established corridors enabled by transit reduces the need for additional sprawl onto green fields and valuable open space and reduces commute times. The patterns of development associated with transit are essential to managing growth in an environmentally sustainable way.

Beyond the inherent environmental benefits of public transit as a transportation mode described above, PAAC has deliberately pursued sustainability measures within its system and fleet. Key efforts include:

- **Alternative Fuel Vehicles:** PAAC was an early adopter of hybrid vehicles, taking delivery of six diesel-electric hybrid buses in 2005 and expanding to a current fleet of 32 hybrids, which have approximately 25% greater fuel efficiency than standard diesel coaches. The Authority has since evaluated fully non-diesel options to improve emissions performance further, including demonstrations of battery electric propulsion options. In 2017, PAAC was awarded a federal grant to purchase two 40-foot battery electric buses. These will be deployed on the 88 Penn Route, a short distance, high usage route. This pilot serves as the prelude to the deployment of electric buses along the new BRT corridor, which will be facilitated by the purchase of 25 electric buses and the installation of charging stations. In addition to buses, PAAC's light rail vehicles are equipped with regenerative braking, which feeds energy generated when the brakes are applied back into the electric power supply and distribution network.

- **Bicycles on Transit:** Through a mix of federal, state and foundation grant funding, PAAC has mounted bicycle racks on all of its buses. Riders can also bring bicycles on the light rail system and on the Monongahela Incline. Bike racks have been placed at transit stations throughout the network, including a covered and enclosed parking area at the new East Liberty Transit center, and wayfinding helps link riders to bike trails. These efforts not only connect transit to a non-emitting mode of travel, but also help address the “first and last mile” issues of getting riders to and from transit stops which can cause would be riders to instead take private vehicles.
- **ConnectCard Healthy Ride Partnership:** PAAC partnered with Healthy Ride to offer free unlimited 15-minute bike share rides for transit users. In addition to solving a transit user’s “first and last mile” problem, the ability to bike 15 minutes without additional cost could open new transit options for commuters, students, and residents. Because both Healthy Ride and ConnectCard use the same smart card technology, transit users can simply use their ConnectCards to rent a Healthy Ride bike.
- **Sustainability Initiatives:** PAAC has a dedicated sustainability initiative to integrate sustainability practices into capital planning and design and operations throughout the system. In addition to environmental impacts, a focus on energy usage also reduces PAAC’s operating costs. PAAC is also involved in the sustainability initiatives led by the City of Pittsburgh and other organizations.

In addition to the environmental benefits of transit, there are safety benefits for transit riders and the entire community served by public transit. According to a 2016 American Public Transportation Association (APTA), a commuter reduces his risk of being in an accident by over 90 percent just by taking public transit instead of commuting by car. Public transit use can make a community ten times safer by spurring compact development which reduces auto miles travelled, taking high-risk drivers like teens and seniors off the road, and reducing congestion.

## 2.3 IMPORTANCE TO THE COMMONWEALTH

PAAC's contributions to the regional economy are also contributions to Pennsylvania, since Allegheny County and the southwest region are integral to Pennsylvania's economy and tax base. Allegheny County makes an outsized contribution to Pennsylvania's employment base and to the general fund relative to its land area and population size. As discussed throughout this report, this productivity is enabled by the density of population and activity made possible by public transit.

Table 2.1 compares the land area, population, employment base and gross product of Allegheny County to the Commonwealth as a whole. While the county's population of 1.22 million comprises 9.6% of the population of the state, it accounts for 12.3% of the private employment in the state, and the county's economic product of \$93.3 billion accounts for 13.3% of the economy of Pennsylvania.

**TABLE 2.1: ALLEGHENY COUNTY SHARE OF PENNSYLVANIA LAND AREA, POPULATION AND ECONOMY**

Category	Allegheny County	Commonwealth of Pennsylvania	Allegheny Share of PA	Data Source
Land Area	730 sq miles	44,700 sq miles	1.6%	U.S Census Bureau (Census 2010)
Population	1.22 million	12.81 million	9.6%	U.S Census Bureau (2017)
Private Sector Employment	631,000 jobs	5.12 million jobs	12.3%	BLS QCEW (2017)
Gross Product	\$93.3 billion	\$702 billion	13.3%	IMPLAN (2015)

This productivity helps the region attract new investment into the state. This takes many forms, including investment capital, satellite offices for prominent national corporations (including GE, Disney, Google, Facebook and Uber) and federal research funding. These dollars represent various forms of net new investment in the state economy, which are then recirculated to extend beyond the direct beneficiaries.

Allegheny County's economic productivity also makes it an outsized contributor to Pennsylvania's general fund. Using data reported by the Pennsylvania Treasurer and proxy economic indicators where direct data is not available, it is possible to estimate the contribution of each county in Pennsylvania to the four major funding sources that comprise the Commonwealth's general fund (income tax, sales tax, business tax and estate and transfer tax).<sup>18</sup> Based on this analysis, Allegheny County contributed an estimated \$3.5 billion to Pennsylvania's \$31.7 billion general fund in FY 2017, or 11.2% of all revenue (see Table 2.2).

<sup>18</sup> See Appendix B for detail on the data sources, methodology and calculations underlying this analysis.

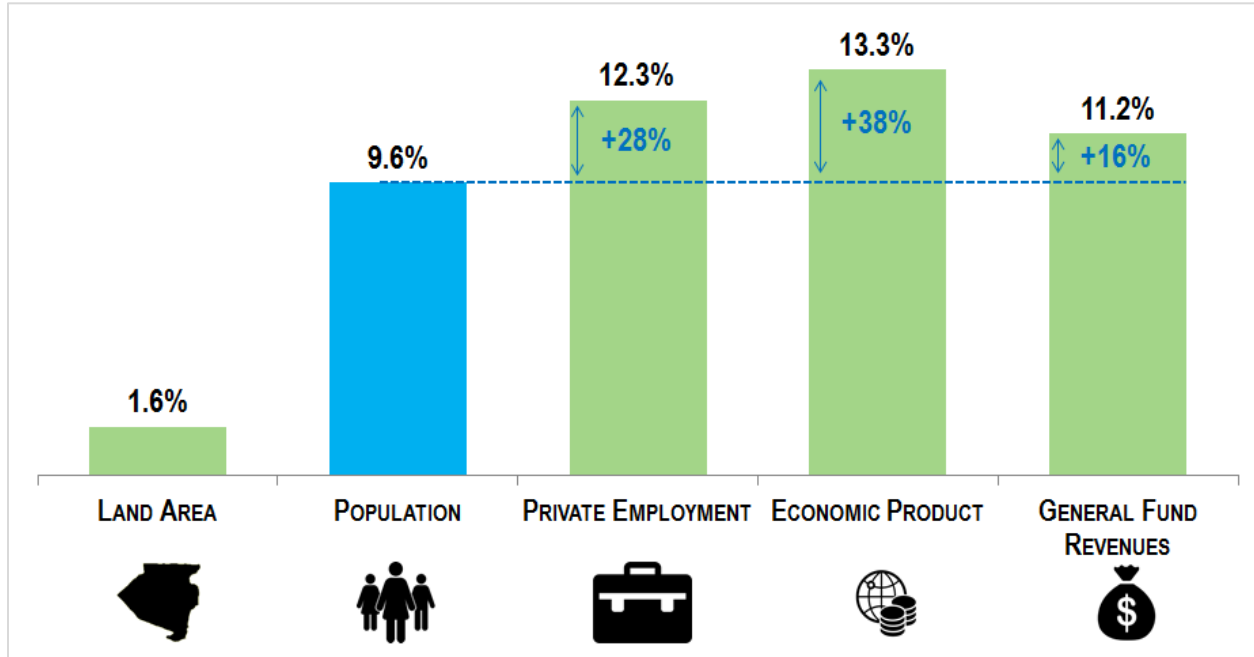
**TABLE 2.2: ALLEGHENY COUNTY ESTIMATED CONTRIBUTION TO PENNSYLVANIA GENERAL FUND, FY 2017**

Category	Allegheny County	Pennsylvania General Fund	Allegheny Share of PA
Income Tax	\$1.19 billion	\$11.49 billion	10.3%
Sales Tax	\$1.09 billion	\$9.86 billion	11.1%
Business Tax	\$640 million	\$4.81 billion	13.3%
Estate and Transfer Tax	\$175 million	\$1.55 billion	11.3%
Other Revenues	\$441 million	\$3.95 billion	11.2%
<b>General Fund Total</b>	<b>\$3.53 billion</b>	<b>\$31.67 billion</b>	<b>11.2%</b>
<b>Population (2017)</b>	<b>1,223,000</b>	<b>12,805,500</b>	<b>9.6%</b>

Sources: See Appendix B

Allegheny County is therefore an outsized contributor to both the state’s economy and its tax base on a per capita basis. Figure 2.14 below shows that relative to its share of statewide population, Allegheny County’s share of private employment is 28% higher, its share of economic output is 38% higher, and its share of general fund contributions is 16% higher. As described throughout the section, this outsized productivity is enabled by a density and efficiency of activity that is enabled by PAAC’s transit service.

**FIGURE 2.14: ALLEGHENY COUNTY SHARE OF STATEWIDE ACTIVITY**



Sources: See Appendix B



## 3.0 INVESTMENT AND PROPERTY VALUE IMPACTS

The competitive factors that make regions attractive to businesses go hand in hand with the factors that make it attractive to residents and attract investment and development. Spatial and statistical analyses show that PAAC service has a major impact on development patterns and property values within Allegheny County.

Development activity in recent years has clustered within areas with robust transit service. Large scale transit infrastructure projects like the North Shore Connector and East Liberty Station have led to significant private investment in the immediate areas. PAAC has worked to encourage transit-oriented development around its service, and the new Downtown-Uptown-Oakland-East End Bus Rapid Transit project is being conceived with an explicit focus on economic development opportunities for a variety of communities.

The benefits of transit service are also reflected in the single family residential housing market. Statistical analysis of transaction data throughout Allegheny County indicates a significant premium for proximity to high-quality transit service. These findings are consistent with the effect of transit services observed elsewhere, and reflect both the potential savings in transportation costs for nearby households and the economic possibilities generated by access to the dense concentrations of business and research activity.

Importantly, like economic competitiveness impacts, development and property value impacts from transit extend beyond PAAC's riders. When an area sees new investment or is made more attractive by transit service, all residents of the area see an appreciation in value whether or not they use the system directly. Further, these investments and appreciation result in a major contribution to the tax base of local governments and school districts, helping them to provide essential public services that benefit all residents. Conversely, reductions in the scope and quality of transit service will result in lower property values, reduced density and productivity, and decreased local tax revenues.

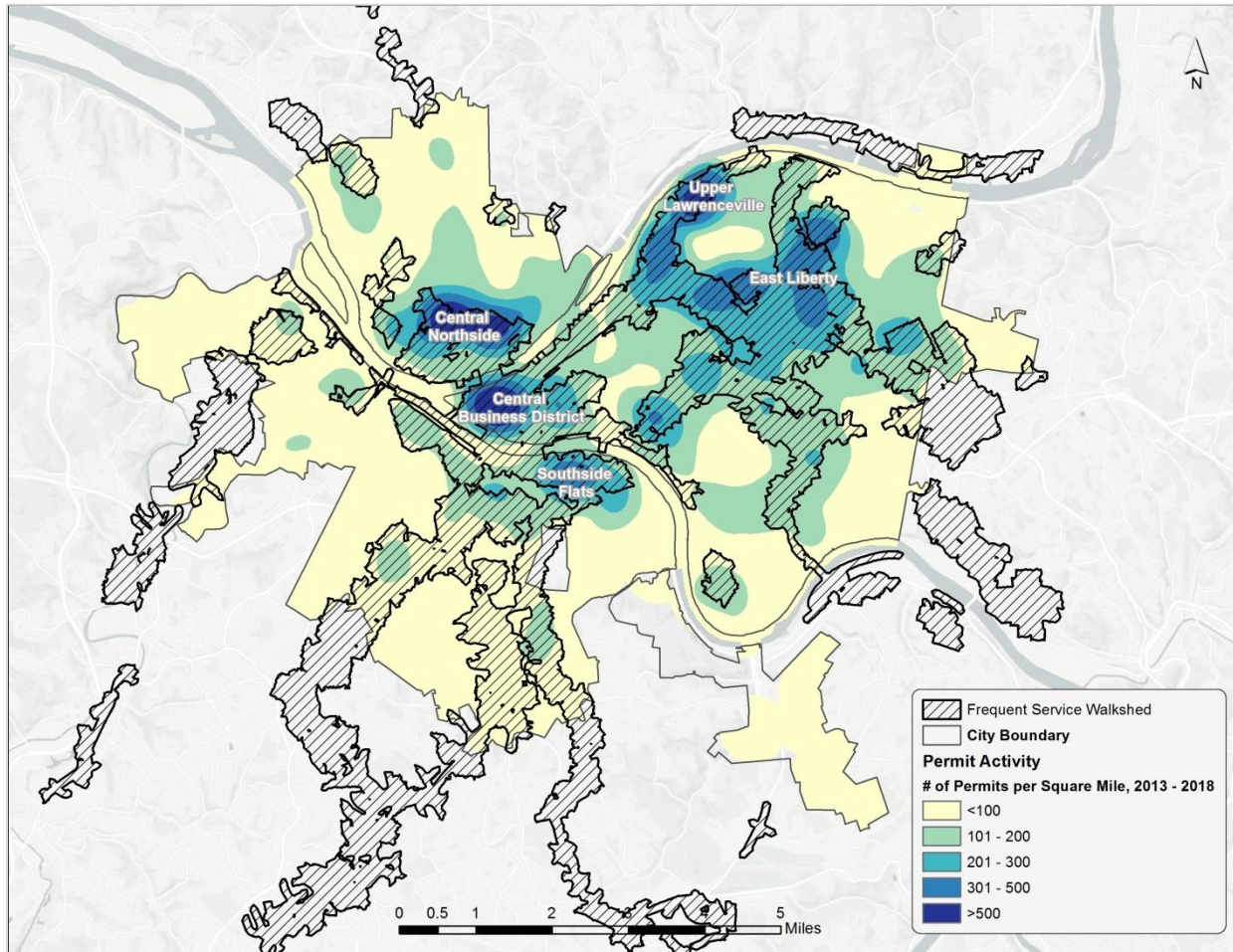
### 3.1 SHAPING DEVELOPMENT PATTERNS

Recent development patterns track closely with the areas served by transit and the major new investments undertaken by PAAC. Figure 3.1 below maps building permits issued by the City of Pittsburgh from January 2013 to June 2018. Out of nearly 6,500 permits, 64% (more than 4,100) fell within the walkshed of frequent transit service (which represents 33% of the land area in the city). Further, these permits accounted for 81% of the total construction value, representing \$1.11 billion out of \$1.39 billion in investment.

Many of those permits are clustered in areas notable for frequent service (the Golden Triangle), new service (North Side close to the North Side Connector) and new transit-oriented development in East Liberty (near the newly renovated East Busway station and TRID district). These developments, along with other transit-oriented development projects supported by PAAC, are helping to reinforce the historic relationship between transit and local economic activity. Increased activity over the long run will help to support PAAC ridership, provide access for commuters, visitors and shoppers, and help to

mitigate congestion in densely developed neighborhoods and business districts, and promote higher productivity in the region through agglomeration economies.

**FIGURE 3.1: SPATIAL DISTRIBUTION OF PITTSBURGH BUILDING PERMITS 2013-2018**



Source: City of Pittsburgh Department of Permits, Licenses and Inspections (PLI) (Jan 2013- Jun 2018), ArcGIS (2018)

Since the 1990's, PAAC staff has worked with the Southwestern Pennsylvania Commission (SPC), Allegheny County, Pittsburgh and other municipal officials to promote transit-oriented development (TOD) near its stations and facilities. In 2015, a TOD Manager was appointed, and an internal TOD advisory committee was formed to focus more attention on the opportunities that TOD could provide the agency in terms of supporting ridership and developing new sources of revenue while at the same time promoting productive development patterns. Authority staff created TOD guidelines for use by staff and stakeholders, providing best practices information to public and private interests to increase use of TOD in the region.

Several large-scale investments initiated and supported by PAAC provide examples of the ability of transportation service to drive investment and development in a variety of neighborhoods.

## NORTH SHORE CONNECTOR

PAAC opened its extension to the North Shore in 2012, and that new service has played an important role in supporting existing sports and recreation facilities, as well as an expanded business district that is growing between and around PNC Park and Heinz Field. The \$517 million, 1.2 mile extension of the light rail service has in effect expanded the borders of Downtown Pittsburgh beyond the historic Golden Triangle. The three stations on the North Shore have helped to open land that was formerly parking for the sports facilities to create a new street grid on the North Shore, with new office buildings, hotels, entertainment, and retail developments.

According to the Pittsburgh Downtown Partnership, more than \$120 million worth of building permits were issued for the North Shore from 2012 to 2017. Since the announcement of construction of the North Shore Connector, over 600,000 square feet of new office buildings have been built to support corporate headquarters and other business activities. The buildings have attracted major tenants, including Starkist, PJ Dick, Equitable Gas, the Pittsburgh Post-Gazette, SAP/Ariba, Pittsburgh Glass Works, Del Monte/Heinz, People's Natural Gas and the VA Administration. The North Shore has also proven to be a strong destination for entertainment, with a Hyatt Place Hotel and theme and destination restaurants and proximity to the sports stadiums, Carnegie Science Center and Rivers Casino.

The commercial development on the North Shore has helped to contribute to an increase of approximately 10,000 jobs in the areas served by the North Shore Connector. The stations also serve to reduce congestion in the Golden Triangle, as commuters from the northern suburbs park on the North Shore and ride into the CBD, and as attendees of sporting events who park Downtown and ride to the ballparks. As of 2016, actual ridership on the North Shore Connector was 11,100 trips per average weekday, of which 7,400 trips were made to Downtown Pittsburgh.

**FIGURE 3.2: NORTH SHORE ALLEGHENY STATION**



Source: PAAC

## EAST LIBERTY STATION

PAAC's 2015 completion of the redevelopment of the Martin Luther King Jr. East Busway's East Liberty Station was the cornerstone of Pennsylvania's first Transit Revitalization District (TRID). The station redevelopment includes a transit-oriented development with 360 market rate housing units, 43,000 square feet of commercial space, ample public space, and multimodal parking facilities. The East Liberty TRID diverts a portion of new tax revenue from redevelopment for use on local transit-related infrastructure improvements. This source, along with a federal TIGER grant, was used to finance the station project.

The revitalized \$15 million station, which also improved the connections between East Liberty and Shadyside, has helped to spur major reinvestment in the East Liberty business district. Fifteen minutes from Downtown Pittsburgh on the East Busway, the East Liberty Station redevelopment has also fueled reinvestment along Highland and Penn Avenues in the historic East Liberty commercial corridors.

Connectivity for the East Liberty neighborhood will be enhanced further with the development of the Oakland BRT's Highland Park and East Busway Branches, which will also run through East Liberty. The combination of Busway access to Downtown and BRT access to Oakland and Downtown (trips which take less than 15 minutes by bus even during rush hour) will only increase attention and investment in the East Liberty area.

FIGURE 3.3: EAST LIBERTY STATION



Source: PAAC

### **SOUTH HILLS VILLAGE – THE ASHBY AT SOUTH HILLS VILLAGE STATION**

As PAAC has seen the success of transit-oriented development near its lines and stations, it has begun to increase its direct involvement in the development of specific TOD projects that take advantage of Authority properties and facilities. One of the first examples of such a project outside the city of Pittsburgh is the Ashby at South Hills Village Station, a four-apartment-building residential development located on a former park and ride lot adjacent to the South Hills Village Station, the last stop on the Red and Blue lines of the light rail system. The Ashby is connected directly to the light rail station via a staircase. The complex also utilizes a shared parking agreement, where the Ashby residents can use a portion of the parking spaces in the adjacent park and ride facility, which was historically underutilized.

The project provides a financial model that PAAC can replicate in the future. Through a long-term lease with the developers, the Authority receives revenue for operations, and can better use land and parking facilities. Residents can reduce car usage while living in the suburbs and avoid parking costs with a direct ride into Downtown Pittsburgh. PAAC hopes to attract long-term ridership and catalyze future projects at or near its stations.

**FIGURE 3.4: THE ASHBY AT SOUTH HILLS VILLAGE STATION**



*Source: Rycon Construction*

## GLASSHOUSE

The Glasshouse apartments, across Carson Street from the Station Square light rail station, will open in the summer of 2019 and serve as focal point for new transit-oriented development projects along Pittsburgh's South Shore neighborhood. The new apartments provide multimodal access to Downtown, whether by light rail, bus, or walking across the Smithfield Street Bridge. The 320-unit complex is the first of a set of planned developments along the South Shore which are designed to create and support a new residential, commercial and activity district within Station Square.

Developer Trammel Crow is also considering a hotel on the property, which is adjacent to a set of additional redevelopment projects – renovation of the Freight House shops and offices at Station Square, the Distillery at South Shore, and the Highline project at the former River Walk Corporate Center (a historic former cargo warehouse). All these projects are close to the light rail station and served by PAAC bus service that connects the South Shore (and Downtown) with the South Side community along East Carson Street.

**FIGURE 3.5: RENDERING OF GLASSHOUSE AT STATION SQUARE**



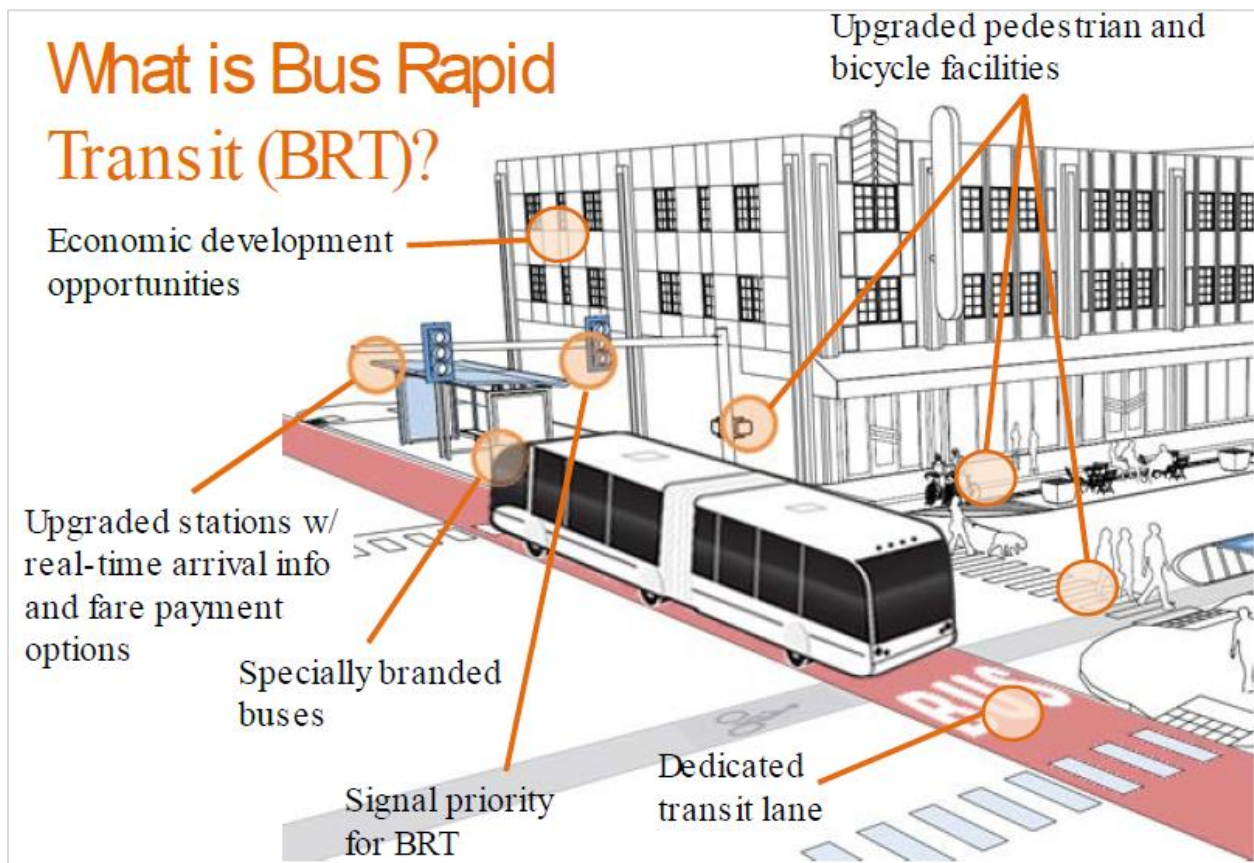
*Source: Glasshouseapts.com*

## FUTURE DEVELOPMENT: DOWNTOWN-UPTOWN-OAKLAND-EAST END BRT

Working in partnership with the Urban Redevelopment Authority of Pittsburgh (URA), the City of Pittsburgh and Allegheny County, PAAC is advancing the Downtown-Uptown-Oakland-East End Bus Rapid Transit (BRT) Project. Originally proposed in the 2007 Transit Development Plan, the BRT project will provide an improved east-west connection between Downtown Pittsburgh, Uptown, Oakland, and other East End neighborhoods. It will also be a demonstration of the power of transit connections – connecting important business districts, but also connecting underserved communities with the job opportunities that will allow for better participation in regional economic opportunities.

Many improvements and modifications across the entire system are part of the BRT project including physical infrastructure changes in the Downtown-Uptown-Oakland BRT Core and the addition of new stations in Highland Park and Squirrel Hill. The goal of the project is to improve transit travel time between these communities, reduce transit travel time variability, and provide greater mobility through the crowded corridor. Over the long term, fast, reliable transit service in the corridor will support integrated transportation, land use and economic goals in a cost-effective manner while maximizing the corridor's capacity.

FIGURE 3.6: BUS RAPID TRANSIT



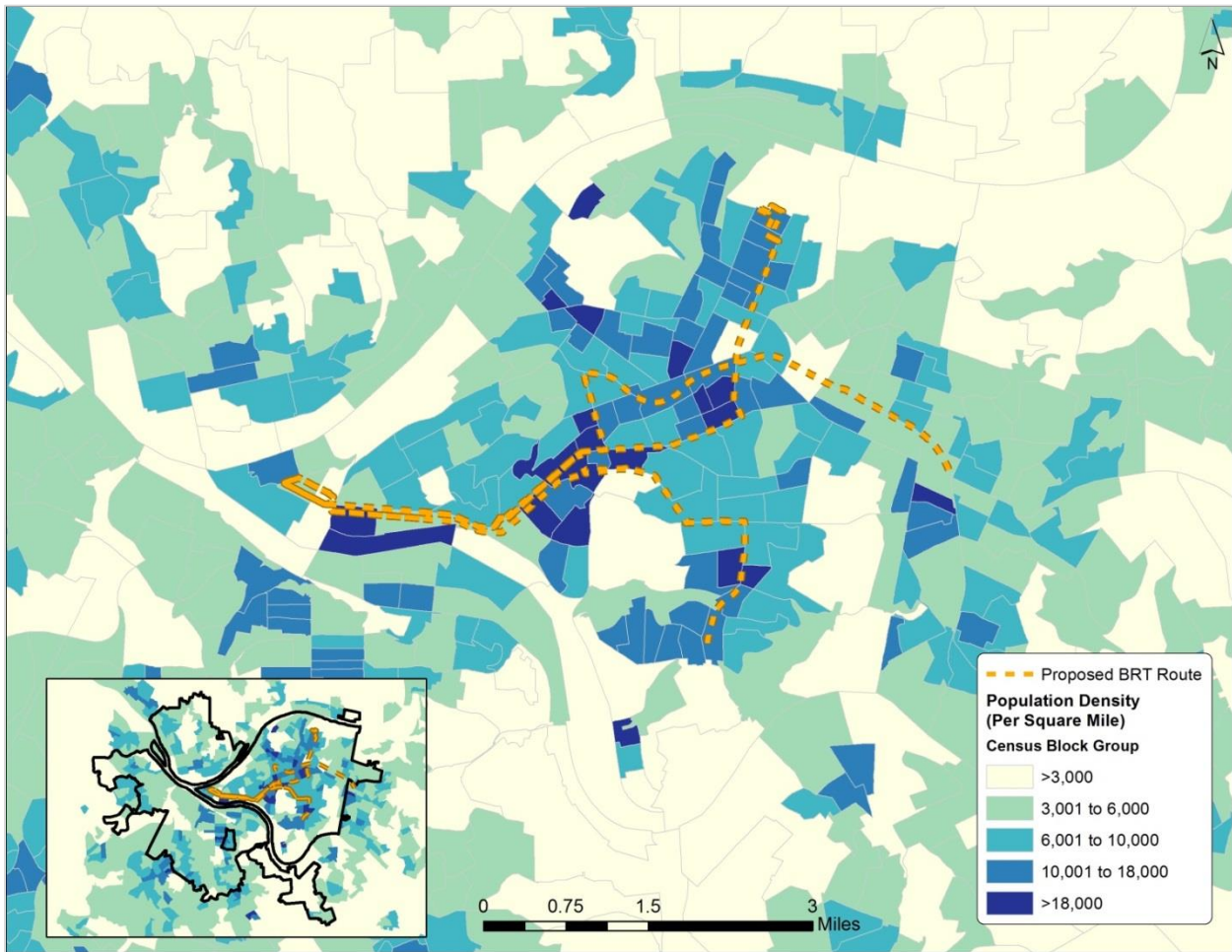
Source: PAAC (2018)

The \$195 million project will include:

- BRT Core improvements that extend a total of 7.4 miles using existing surface streets and 3.8 miles of the East Busway
- 40 new station pairs (80 platforms) with enhanced / branded stations, dedicated transit lanes, transit signal priority, curb bump outs, real time bus arrival information, and 25 new branded all-electric articulated buses.

This will be PAAC’s largest new project since the completion of the North Shore Connector, bringing a significant volume of construction activity to the region through a mix of federal, state, county and local funding sources. As shown in Figure 3.7, the project will service some of the densest population areas of the county, magnifying its impact.

**FIGURE 3.7: PROPOSED BRT ROUTE AND POPULATION DENSITY**



Source: ACS (2016), ArcGIS (2018)



The BRT projects serves as a microcosm for many of the economic benefits detailed throughout this report:

- It represents a significant capital project for the region, supporting direct and spillover activity in the local economy during the construction period and enhanced operations and ridership once it is completed.
- The fast and frequent service that it will provide will enhance the connections between and the attractiveness of the region's two major employment centers and hubs of the region's knowledge economy.
- Residents throughout the region will be better connected to the economic opportunities and amenities available in these centers, supporting economic development in these communities.
- Transit-oriented development will be feasible in response to new demand in areas with access to this improved service.

### 3.2 RESIDENTIAL PROPERTY VALUE PREMIUM

Benefits from PAAC service are captured by households through transit's impacts on housing values. Access to high-frequency public transportation confers benefits to residents including improved accessibility and reduced travel costs and time. Households value these amenities, and accordingly are willing to pay a premium for houses located near robust transit service.

Residential property transactions provide direct observations of property value as agreed to by a willing buyer and seller at a given point in time and location. A hedonic regression analysis can parse from hundreds of thousands of transactions across Allegheny County the additional value conferred by proximity to PAAC service, holding constant the other characteristics of the property.

Positive property value effects are identified within the half-mile walkshed of frequent service and additional value at greater distances from PAAC's light rail and busway stations. This value premium represents a significant economic asset for homeowners, whether or not they are users of the system. Nearby homeowners who are also riders can realize a significant annual savings in their transportation costs, in addition to improved access to employment opportunities and amenities.

#### **DATA AND ANALYTICAL APPROACH**

Hedonic regression models are the most popular technique used to estimate the effects of transit on residential property values. Hedonic modeling can provide estimates of the relative average impact that any housing or neighborhood attribute contributes to property valuations while statistically holding all other variables constant. When executed correctly, hedonic modeling offers valuable information about the relative contribution of property characteristics, such as access to transit service, to the value of real property. Prior studies using this technique have found positive impacts for properties in proximity to

PAAC's East Busway,<sup>19</sup> as well as positive values from a range of public transit types in other regions, including commuter rail in southeastern Pennsylvania<sup>20</sup> and bus rapid transit service in Eugene, Oregon.<sup>21</sup>

Hedonic regression modeling was conducted using data from more than 203,000 transactions of single-family homes in Allegheny County from 1980 to 2018.<sup>22</sup> Properties within the County are divided into quadrants following the natural boundaries created by the rivers to represent different transit and housing market characteristics, and three separate models are estimated (for the North, combined East/West and South areas) to capture differences in housing markets and service types.<sup>23</sup> The regression estimation conservatively excludes residential housing in the major employment centers of Downtown, Oakland, and the North Shore. Within these areas, values are driven by a mix of locational factors (above and beyond the physical characteristics of the housing stock) that make it difficult to disentangle the specific contribution of transit service, although clearly transit service is an important part of the amenity package associated with these locations.

The model uses the "Frequent Service Walkshed" defined by PAAC to represent areas with robust transit service. In addition, the distance from each light rail and busway station to nearby houses is calculated using GIS techniques, and houses are grouped by distance band out to two miles for light rail stations and three miles for busway station. The presence of Park and Ride lots at light rail stations is also modeled. Percentage premiums are modeled in an additive fashion, such that a property that is within the frequent service walkshed and also proximate to a busway station will have its premium calculated as the sum of the walkshed premium and the additional value of fixed guideway (BRT and Light Rail) station proximity. Similarly a light rail station with parking will convey the aggregate premium of the station and the additional value of parking availability.<sup>24</sup>

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<sup>19</sup> Perk, Victoria and Catalá, Martin. "Land use Impact of Bus Rapid Transit -Effects of BRT Station Proximity on Property Values along the Pittsburgh Martin Luther King, Jr. East Busway." *Federal Transit Administration* (2009).

<sup>20</sup> "SEPTA Drives the Economy of Pennsylvania." *Econsult Solutions, Inc.* (2018)

<sup>21</sup> Perk, Victoria, et. Al. "Impacts of Bus Rapid Transit (BRT) on Surrounding Residential Property Values. *National Institute for Transportation and Communities* (NTIC).

<sup>22</sup> As detailed throughout this report, transit proximity would also be expected to convey value on commercial or multifamily housing properties. Hedonic techniques are less suited to these markets, due primarily to the infrequency and more complex nature of transactions relative to single family housing. Therefore, this analysis pertains only to single family residential properties, and value premiums on other property types would be above and beyond the values calculated here.

<sup>23</sup> See Figure C.1 in Appendix C for precise quadrant boundaries.

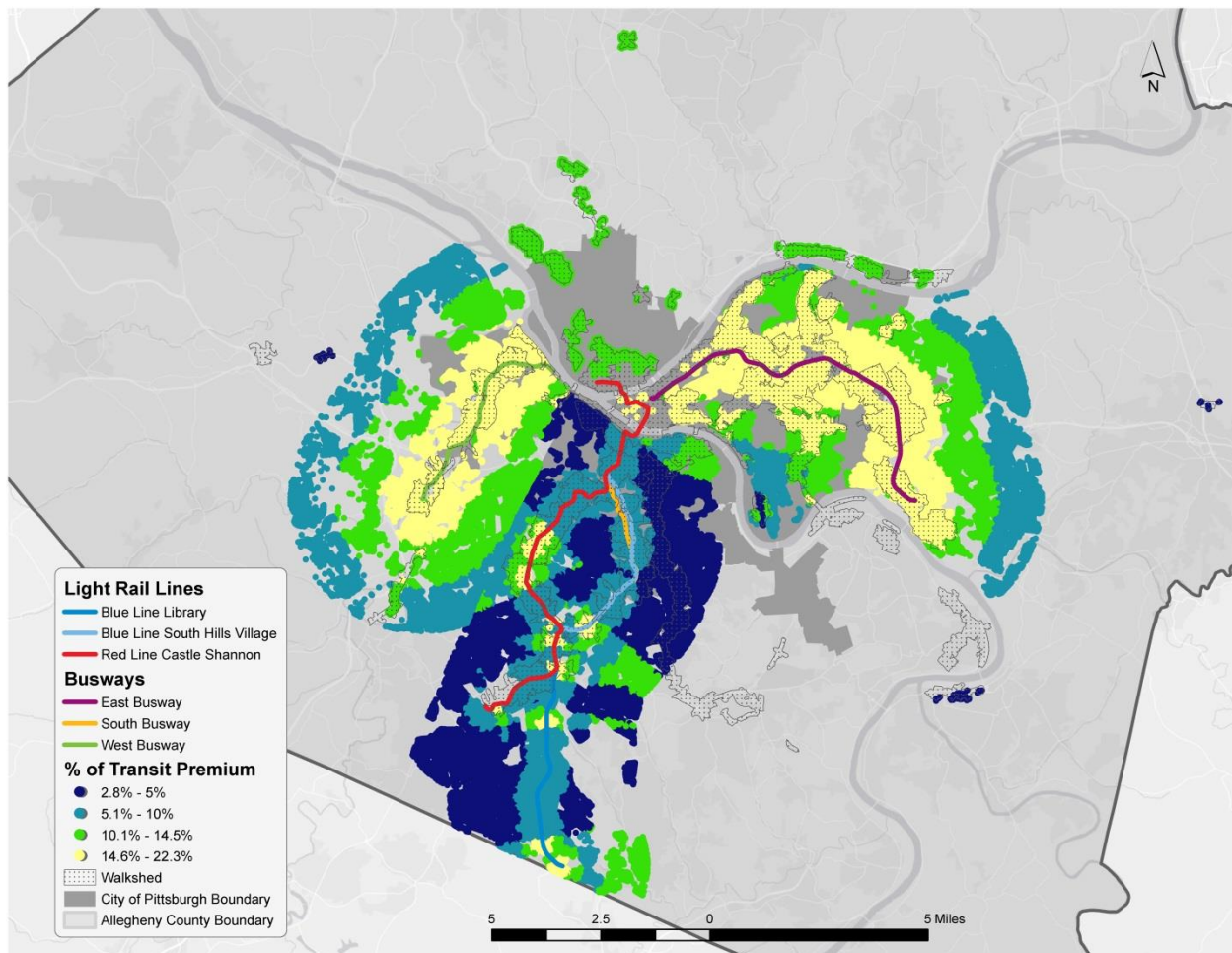
<sup>24</sup> See Appendix C for more complete detail on the data and methodology utilized in this analysis.

## PROPERTY VALUE PREMIUM

PAAC service has positive effects on property values within the frequent service walkshed and around light rail and busway stations. Figure 3.8 below maps the percentage premium (as a share of housing value) estimated for each property within the service catchment.

- Premiums from the busways in the east and west quadrants range from 6% to 20% and extend out to three miles.
- Premiums from light rail in the south quadrant range from 3% to 14% and extend out to two miles.
- Premiums from the frequent service walkshed vary across the system reaching as high as 13% in the north quadrant.

**FIGURE 3.8: DISTRIBUTION OF PROPERTY VALUE PREMIUM FROM PAAC SERVICE**

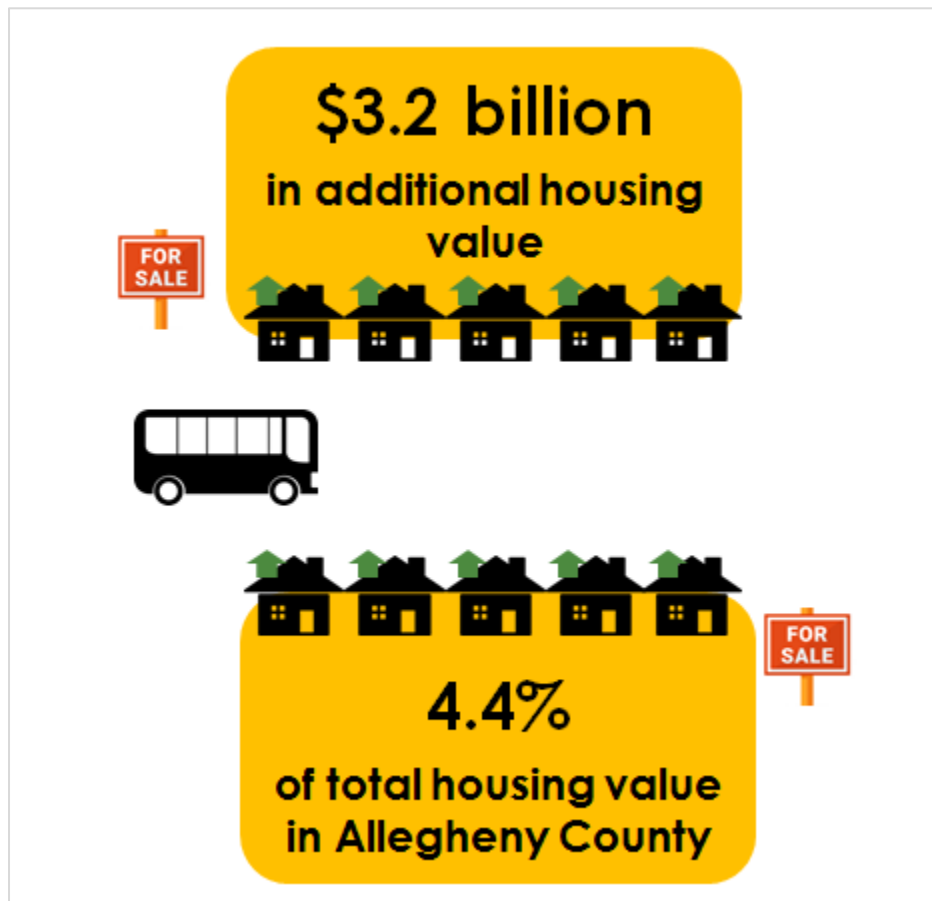


Sources: See Appendix C

In aggregate, the housing value premium attributable to proximity to PAAC service is estimated at \$3.2 billion (see Figure 3.9). This estimate implies that if PAAC's service were discontinued, houses within close proximity of this high value service would immediately see a decrease of this amount in the market value of their homes.<sup>25</sup>

This \$3.2 billion premium represents 4.4% of all property value in Allegheny County. Importantly, this percentage includes those areas of the county that are not served by frequent transit, and therefore receive no premium in this calculation. Among houses within the catchment of frequent service (those shaded in Figure 3.8 above), the average premium is 11.8%, or nearly \$15,000 per house.

**FIGURE 3.9: PROPERTY VALUE PREMIUM FROM PROXIMITY TO PAAC SERVICE**



Sources: See Appendix C

<sup>25</sup> Over the long-run, losses would likely be even greater due to contraction in the regional economy without PAAC, which would lead to reduced demand, impacting the value of all properties in the region (not just those near transit). This estimate should therefore be understood as a conservative representation of the value of PAAC service.

Table 3.1 below shows more detailed figures for the total residential housing market and transit proximate housing market within the separate areas analyzed and for the county as a whole. The area served by the east and west busway receives the largest premium in both percentage and absolute terms, accounting for \$2.4 billion in additional value, or more than \$19,000 per house.

**TABLE 3.1: PROPERTY VALUE PREMIUM FROM PROXIMITY TO PAAC SERVICE BY AREA**

Metric	Allegheny County	South Light Rail	East/West Busway	North
Total Residential Housing Value	\$71.6 billion	\$13.7 billion	\$34.5 billion	\$23.4 billion
Total Residential Properties	515,345	128,121	248,758	138,466
Transit Proximate Properties	215,911	82,535	125,745	7,631
<b>Transit Premium</b>	<b>\$3.17 Billion</b>	<b>\$626 Million</b>	<b>\$2.43 Billion</b>	<b>\$109 Million</b>
Average Premium (\$)	\$14,681	\$7,580	\$19,345	\$14,283
Share of Total Home Value	4.4%	4.6%	7.1%	0.5%

Sources: See Appendix C

### TRANSPORTATION COST SAVINGS

For new homebuyers, the transit premium represents an additional upfront cost. The premium can also increase the annual property taxes for new and existing homeowners by increasing the value of their homes.<sup>26</sup> However, transit proximity offers significant financial benefits for a household to offset these costs. First, it allows them to readily access the economic opportunities associated with the region's dense employment clusters, which are generally well-served by these frequent transit lines. Second, it allows them to save on annual transportation costs if they utilize transit service in place of other more expensive transportation options. As discussed in Section 2.2, it is more appropriate to consider costs for housing and transportation in tandem, since locational attributes of housing are linked to transportation costs. Basic financial analysis illustrates that the transportation savings from PAAC service can easily justify the additional housing value estimated above.

Savings from access to robust PAAC service can most easily be derived by comparing the cost of riding transit to the cost of owning and operating a car. Transit riders derive two types of savings relative to car owners:

- Purchase cost savings, to the extent that households do not need to purchase a private vehicle, purchase fewer vehicles than they otherwise would (such as downsizing from two cars to one), or purchase a less expensive vehicle than they otherwise would (since their transportation needs are less robust;) and
- Ongoing savings on vehicle operating costs including insurance, fuel and repairs, which vary with the amount of usage.

<sup>26</sup> Section 3.3 below discusses the tax revenue implications from the perspective of state and local governments and school districts.

An unlimited-ride pass for PAAC costs \$97.50 per month, or less than \$1,100 annually. Average costs for different components of car ownership and operation are published annually by AAA.<sup>27</sup>

AAA translates upfront costs into annual costs by estimating depreciation (the decline in asset value of a car each year) as well as financing cost. For a medium sedan driving 15,000 miles per year,<sup>28</sup> depreciation and finance costs are a combined \$3,800 per year. Alternately, these costs can be evaluated through a car lease, which also effectively translates a purchase cost into an annual payment. A typical lease with an upfront payment of \$1,000 and monthly payments of \$250 over two years would result in a similar cost of \$3,500 per year.<sup>29</sup>

Additional costs to operate a vehicle estimated by AAA include insurance, license / registration / taxes, fuel and maintenance and repairs. The first two categories are estimated on a fixed basis, with average costs for a medium sedan estimated at a combined \$1,840. Fuel and maintenance costs are estimated per mile, and for a medium sedan driving 15,000 miles per year total \$2,540. Annual operating costs for these four categories total \$4,380.

Table 3.2 compares these transportation costs to the annual unlimited pass cost for PAAC (which requires no upfront investment). Using the lease scenario, the differential in purchase costs is \$3,500 annually, and the difference in ongoing cost is \$3,310, for a total difference of \$6,810.

**TABLE 3.2: ESTIMATED ANNUAL TRANSPORTATION OWNERSHIP AND OPERATING COSTS**

Cost Type	Car	Transit	Differential
Purchase (lease scenario)	\$3,500	\$0	\$3,500
Ongoing	\$4,380	\$1,070	\$3,310
Total	\$7,880	\$1,070	\$6,810

Sources: AAA (2017), PAAC unlimited pass fare (2018)

This differential may not be fully realized by each transit users. For example, households using transit may still maintain the same number of vehicles that they otherwise would, or may have occasional car needs realized through a ridesharing or car sharing provider in addition to transit costs. However, the operational savings alone expressed above are more than sufficient to justify the upfront housing value premium calculated in Section 3.2.

As shown above, the average value premium for houses near transit service is approximately \$15,000. Transaction data from 2017 shows that around 7% of Allegheny County's housing stock was sold, a

<sup>27</sup> Your Driving Costs: How much are you really paying to drive?" AAA (2017).

<sup>28</sup> The "medium sedan" category, which includes popular vehicles like the Ford Fusion, Honda Accord and Toyota Camry, falls below the average costs calculated by AAA across a range of vehicle types. 15,000 annual miles represents the midpoint of the three scenarios (10,000, 15,000 and 20,000) modeled by AAA. For the sake of simplicity, these assumptions are used throughout.

<sup>29</sup> Calculated as  $\$250 \times 12 = \$3000$  in monthly payments +  $\$1000/2 = \$500$  in upfront costs per year.

rate that indicates that the average house turns over approximately every 15 years. Therefore, in nominal terms, a household that realizes a savings of \$1,000 annually in transportation cost over a 15 year period could realize the initial premium of \$15,000. A more sophisticated reflection of annual savings into current value using a capitalization rate of 6% indicates that an annual savings of about \$1,550 would be required to yield a current asset value increase of \$15,000.<sup>30</sup> Savings above this figure can cover other costs like additional property taxes, and ultimately yield net gains to residents. Similar dynamics apply to renters, who pay a higher rent due to the amenity premium associated with this location, but can realize even larger savings in transportation costs on a monthly and yearly basis.

Importantly, when the initial premium is recouped by homeowners who ride the system through annual savings, the increase in overall value remains at the point of sale, so long as other potential buyers in the future still value that amenity. Therefore, a reduction in service would result in a capital loss to homeowners, while increases in service quality or coverage increase privately held value. The increase in asset value applies associated with transit applies whether or not homeowners use the system, and helps residents build wealth through what is typically their most important financial asset.

### 3.3 TAX REVENUE IMPACTS FROM PROPERTY VALUE PREMIUM

The additional housing value generated by PAAC service also increases the tax base for local governments and school districts, which generally rely on property-based taxes as their primary source of revenue. Incremental increases in property values and sales prices due to the amenity value of transit can be thought of as leading to additional government revenue, or as alleviating the need for increases in property tax rate to generate the same level of government funding.

Housing value premiums contribute to the real estate tax base in two measurable ways:

- Allegheny County, and its municipalities and school districts collect real estate taxes annually based on assessed property value, which is inclusive of the premium for transit proximity to the extent that assessments are reflective of market conditions at the time they are undertaken.
- When a transaction of property occurs, the Commonwealth and local municipalities and school districts collect real estate transfer taxes based on the transaction price. These sales prices are also inclusive of the transit premium, which increases the sales price and therefore the base to which the tax is applied.

Estimates of the annual impact of the value premium on property tax collections begin by estimating the portion of taxable value attributable to the transit premium. The percentage premium for each property estimated in Section 3.2 above is applied to the assessed value of each property, according to Allegheny County assessment data, to yield estimates of the assessed value premium in dollar terms

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<sup>30</sup> The capitalization rate reflects both the time value of money and the opportunity costs of an investment in terms of other returns that it could yield. Due to these factors, an investment of \$15,000 would need to yield a return greater than \$1,000 over 15 years to be attractive within a marketplace. The capitalization rate is used to calculate a sufficient return to induce investment.

for each property.<sup>31</sup> Next, the property tax rates for the municipality and school district corresponding with each property, as well as the Allegheny County rate, are applied to each property. In aggregate, the residential property value premium of \$3.2 billion from transit service is estimated to generate \$71.2 million in annual property taxes, with the majority (\$40.7 million) going to local school districts.

Estimates of the annual impact of property value premiums on real estate transfer tax revenues are generated based on observed transaction data from 2017. Within the calendar year, more than 35,000 residential properties were sold, or about 7% of the residential housing stock of Allegheny County. The sale price of these properties totaled \$6.1 billion, of which 3.9%, or \$239 million, is estimated to be generated by transit based on the property level estimates generated in Section 3.2. The applicable state and local tax rates by jurisdiction are applied to each of these properties to yield tax revenue estimates. In aggregate, the residential property value premium from transit service is estimated to generate \$8.8 million in annual real estate transfer taxes, with the City of Pittsburgh as the largest recipient (\$3.8 million).

Combined, the property value premium from PAAC service is estimated to generate \$80 million in, school district, municipal, county and state tax revenues annually (see Table 3.3).

**TABLE 3.3: ANNUAL REAL ESTATE TAX AND REAL ESTATE TRANSFER TAX IMPACTS FROM PROPERTY VALUE PREMIUM (\$M)**

Tax Type	School Districts	City of Pittsburgh	Other Municipalities	Allegheny County	Commonwealth of Pennsylvania	Total
Real Estate Tax Revenue	\$40.7	\$11.2	\$7.1	\$12.2	--	\$71.2
RE Transfer Tax Revenue	\$2.0	\$3.8	\$0.6	--	\$2.4	\$8.8
<b>Combined (\$ Millions)</b>	<b>\$42.7</b>	<b>\$15.0</b>	<b>\$7.7</b>	<b>\$12.2</b>	<b>\$2.4</b>	<b>\$80.0</b>

Sources: See Appendix C

<sup>31</sup> Note that the premiums are initially calculated in Section 3.2 as a percentage of market value, since the hedonic regression by its construction is based on observed market activity. Market values have likely increased since the last county-wide reassessment, meaning that assuming a market value for all residential properties would overstate the taxable base, and therefore the revenue associated with the premium. More broadly, the irregularity of assessments implies that new value generated from transit service may not be reflected in the tax base immediately. However, the PAAC service measured was broadly in place as of the last re-assessment in 2013, and new value will be captured in future re-assessments.



## SUMMARY OF FINDINGS

This report identifies and quantifies the varied and significant economic impacts of the Port Authority of Allegheny County (PAAC), the county’s unified provider of transit services. PAAC’s service network includes light rail, bus, incline and paratransit service, which are key elements of the region’s transportation infrastructure network. PAAC’s employment and expenditure activity, the transportation service it provides and the public-serving assets it maintains are significant contributors to the local and state economy in a variety of ways.






### PAAC EXPENDITURE IMPACTS

PAAC has a significant employment and procurement footprint in the region and the state. Its expenditures support the day-to-day operations of its service network, and its capital investments serve to develop and improve public-serving infrastructure. These expenditures in turn generate spillover impacts throughout PAAC’s supply chain, and throughout the local economy as employees recirculate a portion of their earnings as household spending.

In aggregate, PAAC’s \$489 million in direct expenditures lead to \$440 in indirect and induced impacts. Combined, each year PAAC generates \$929 million in economic impact in the Pennsylvania economy, supporting 6,240 jobs with \$484 million in earnings.

### ANNUAL ECONOMIC IMPACT OF PAAC OPERATING AND CAPITAL EXPENDITURES

	 <b>Output</b>	 <b>Employment</b>	 <b>Earnings</b>
<b>Operations</b>	\$726 million	5,020 FTE Jobs	\$418 million
<b>Capital Investments</b>	\$203 million	1,220 FTE Jobs	\$66 million
<b>Total</b>	\$929 million	6,240 FTE Jobs	\$484 million

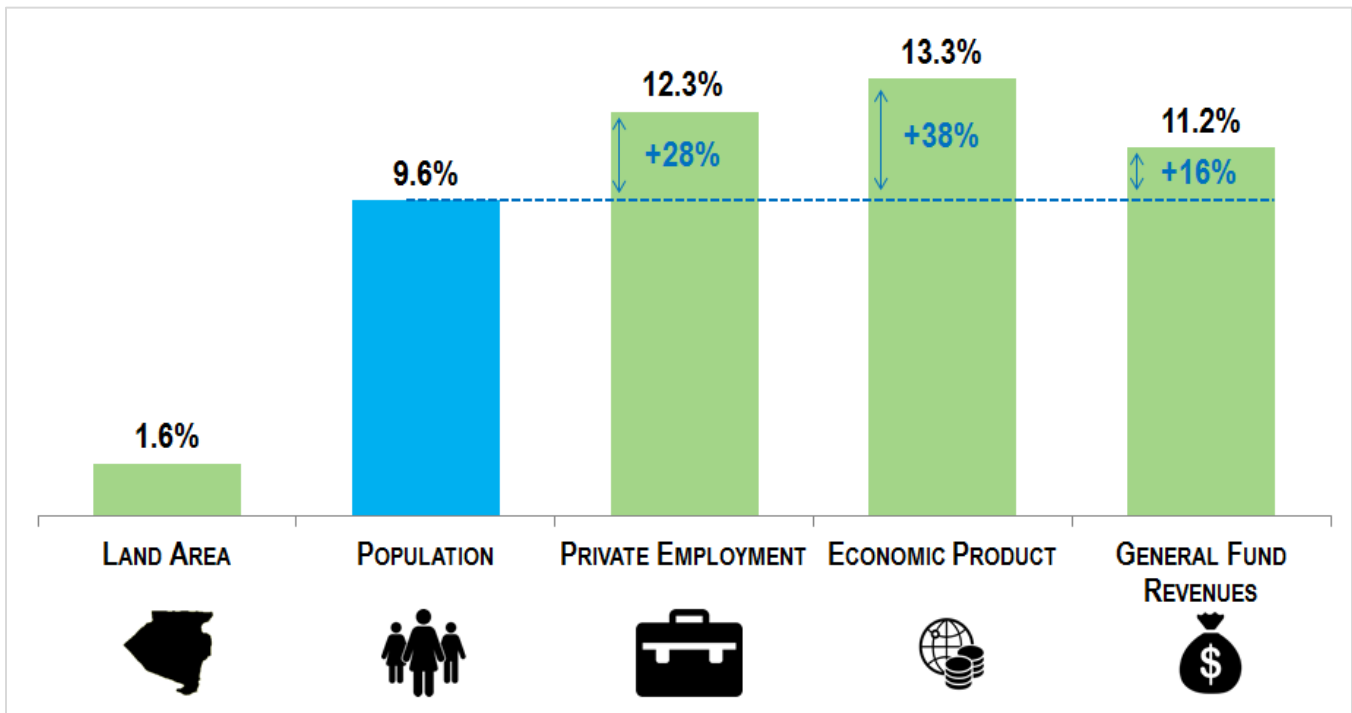
*Averaged impact FY 2015-2018 within Pennsylvania (in \$2018)*

### ECONOMIC COMPETITIVENESS AND EQUITABLE GROWTH IMPACTS

Regions compete on a national and global scale to attract the investment and talent that drive growth. PAAC’s service network enables the dense clusters of activity that yield productivity gains in the modern knowledge economy. It is also integral to sharing these gains equitably by connecting residents to economic opportunity and amenities. Benefits from enhanced competitiveness accrue to residents across the region, whether or not they are direct users of the PAAC system.

PAAC’s contributions to the regional economy are also contributions to Pennsylvania. The density and productivity enabled by transit help the region to attract investment on a national and global scale and help make Allegheny County an outsized contributor to Pennsylvania’s economy and tax base relative to its land area and population.

ALLEGHENY COUNTY SHARE OF STATEWIDE ACTIVITY

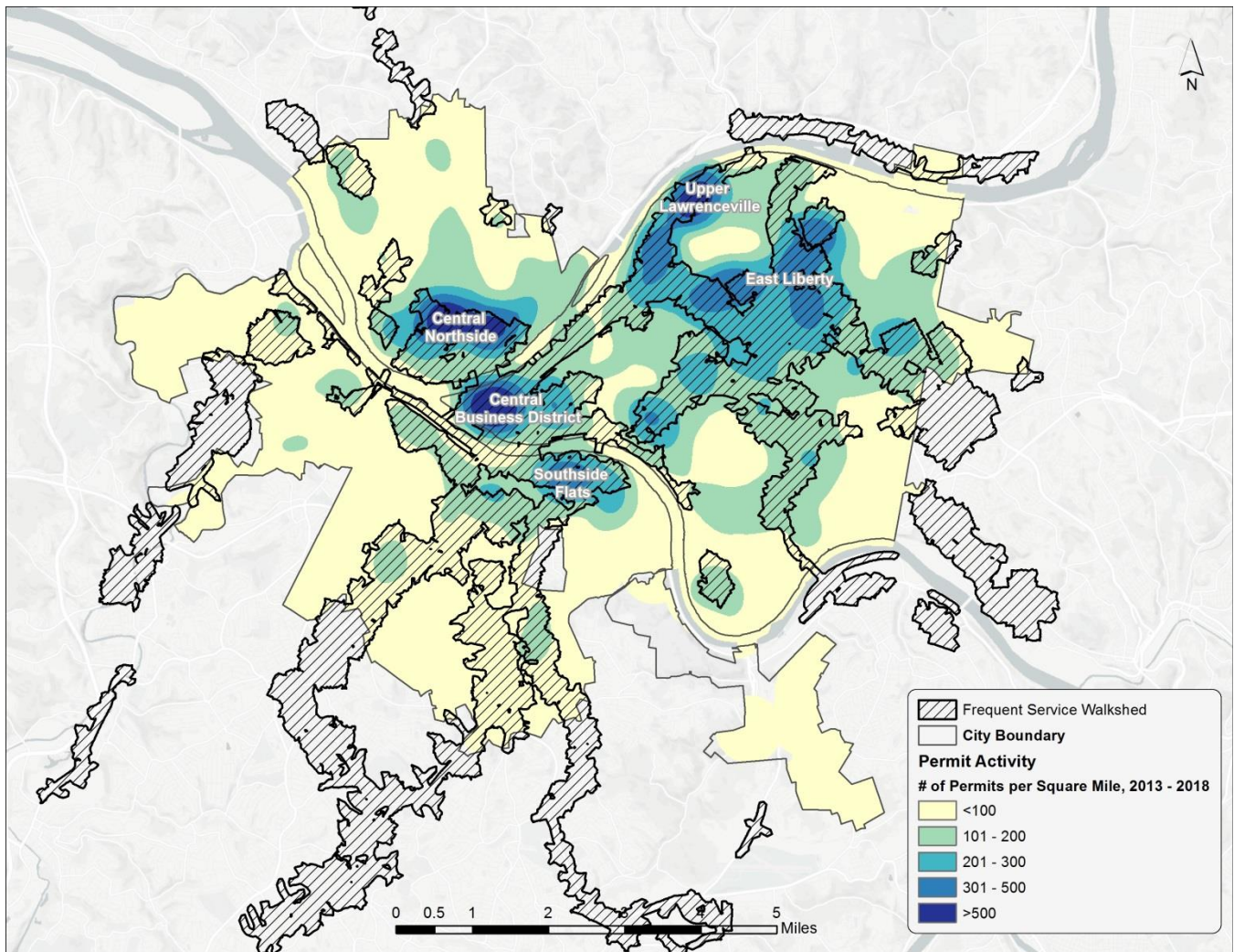


**INVESTMENT AND PROPERTY VALUE IMPACTS**

PAAC’s service network and infrastructure assets increase residential and commercial demand, shaping patterns of investment and development. PAAC has consistently worked to encourage Transit-Oriented Development around its stations and service hubs, and the Authority’s new Bus Rapid Transit project is proceeding with an explicit focus on the economic development opportunities it will engender for a variety of communities.

Spatial patterns in recent building activity in Pittsburgh (as reflected by buildings permits over the past five years) align closely with the areas that enjoy frequent transit service. Clusters of activity are evident near the sites of recent large-scale PAAC investments on the North Shore and in East Liberty.

**SPATIAL DISTRIBUTION OF PITTSBURGH BUILDING PERMITS**

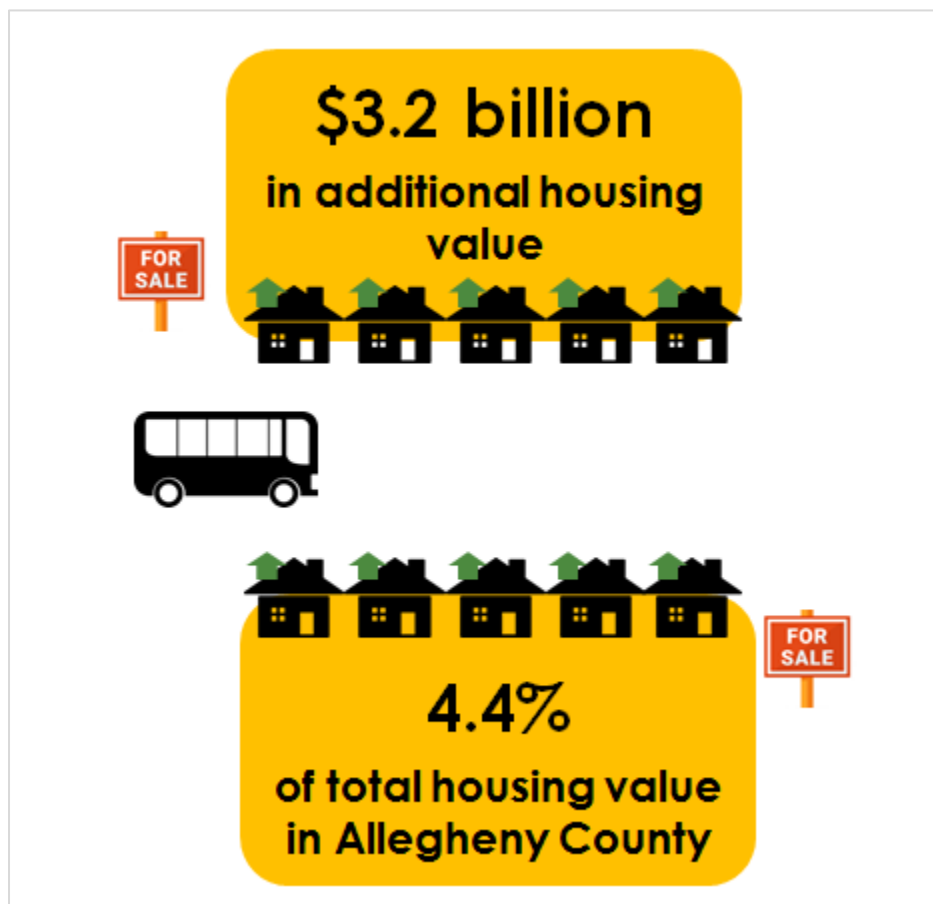


Source: City of Pittsburgh Department of Permits, Licenses and Inspections (PLI) (2013-2018), ArcGIS (2018)

The economic and amenity value that PAAC provides is also reflected in the residential housing market. Locations near high-quality transit benefit from both the potential savings in household transportation costs and the economic opportunities generated by efficient access to dense concentrations of business and research activity.

Statistical analysis of transaction data throughout Allegheny County indicates a significant premium for proximity to robust service. Proximity to PAAC service is estimated to add \$3.2 billion in residential property value for residential homeowners, representing 4.4 percent of total single-family housing value in Allegheny County.

**PROPERTY VALUE PREMIUM FROM PROXIMITY TO PAAC SERVICE**



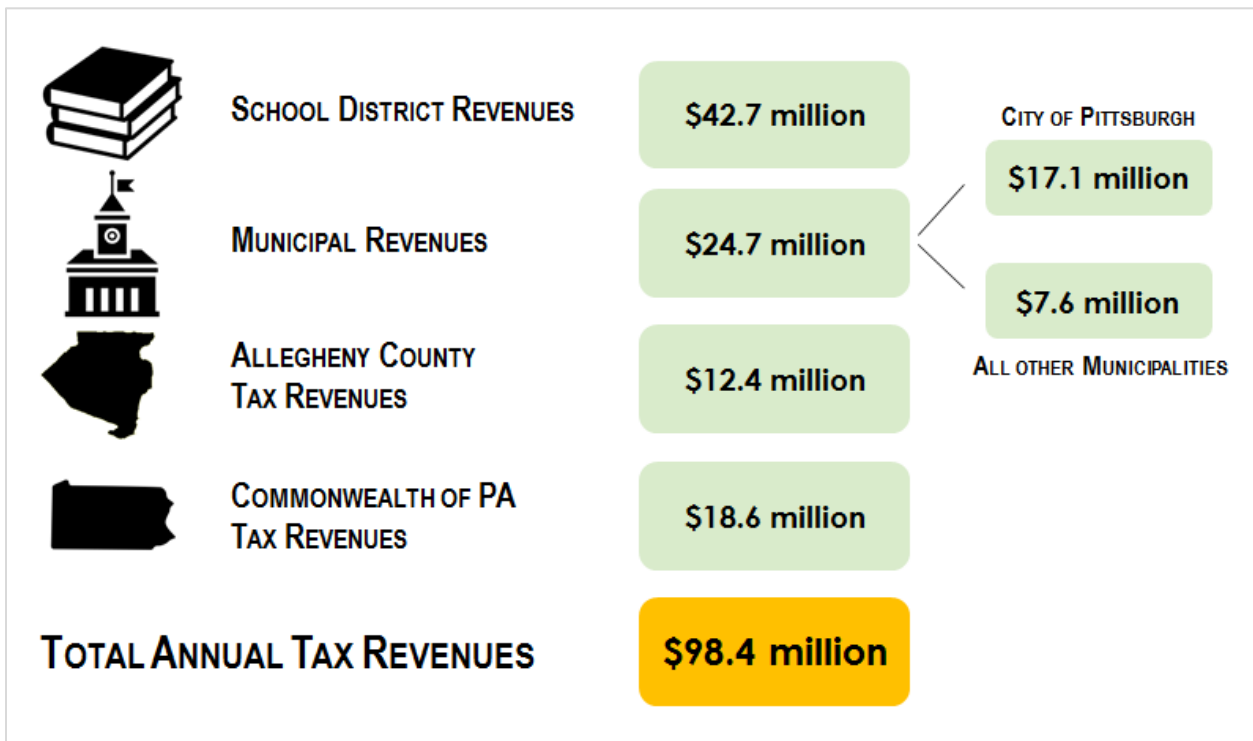
Note that the total property value impact of PAAC service is larger, because commercial value impacts are not included in the figure above. Without transit, current Downtown property values would be unsustainable.

### TAX REVENUE IMPACTS

PAAC’s contributions to the local economy also generate tax revenues for state and local governments and school districts, which in turn use those resources to provide essential services for residents. While PAAC is itself a tax-exempt institution, the earnings associated with its expenditures are largely taxable, as is the spillover activity it creates in the private economy. In addition, the residential property value premium from proximity to PAAC service increases the property tax base and real estate transfer tax collections for Allegheny County and its municipalities and school districts.

Aggregate tax impacts from PAAC expenditures and residential property value impacts are estimated at \$98.4 million annually for state and local government and school districts.

**ANNUAL LOCAL AND STATE TAX REVENUES FROM PAAC EXPENDITURES AND RESIDENTIAL PROPERTY VALUE PREMIUM**



## APPENDIX A – METHODOLOGY: ECONOMIC OUTPUT

Economic impact calculations are generated by estimating the initial amount of direct activity occurring within Allegheny County, the ten-county region and Commonwealth of Pennsylvania in each category, and then using input-output models to translate this direct economic activity into the total amount of economic activity that it supports within those geographies. The total activity includes “spillover” impacts generated by spending on goods and services and by spending of labor income by employees. This section summarizes the methodologies and tools used to construct, use, and interpret the input-output models needed to estimate total economic impact of PAAC’s capital investments and ongoing operations.

### SCOPE OF ANALYSIS

The analysis seeks to quantify the current annual level of economic activity associated with PAAC. To do so, it seeks to use the most appropriate and recent data available for each component of the analysis. In some cases, these data represent the most recent available year (often 2017), while in other cases, an average of multiple years is used to provide for greater data reliability. For example, current capital investment impacts are modeled based on an average of three years of activity (FY 2015-2018) to avoid allowing any large scale project taking place in a given year to distort the calculation. To provide for a parallel methodology, operating impacts are calculated in the same manner. Throughout the analysis, the approach seeks to quantify the most representative available inputs for PAAC’s *current* impact level, rather than aligning precisely to a specific twelve-month period. Impacts for the FY 2015-2018 period are expressed in inflation-adjusted dollars (\$2018) to allow for an appropriate calculation of annual average.

Data utilized throughout this report are largely provided by PAAC, and match publicly reported budgetary figures. Other data has been derived from public sources, such as property data provided by the county government, and federal government data on demographics and employment.

Economic impacts are calculated for Allegheny County, for the ten-county southwest region (Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties) and for the Commonwealth of Pennsylvania. Calculations include direct impacts, which are modeled within the geography in which they occur, as well as indirect and induced impacts, which capture spillover effects within the relevant geographies. Tax revenue impacts from direct and spillover activity are calculated for the City of Pittsburgh, Allegheny County, and Commonwealth of Pennsylvania.

## A.1 DIRECT ACTIVITY FROM CAPITAL INVESTMENTS

PAAC provided information on annual capital expenditures by contract type for Fiscal Years 2015-2018. Expenditures were converted to current dollars using the Consumer Price Index from the Bureau of Labor Statistics.<sup>32</sup> Annualized expenditure amounts in \$2018 were then averaged for the FY 2015-2018 period, yielding an annual average of \$164 million in nominal terms and \$171 million in \$2018 (see Table A.1).

**TABLE A.1: ANNUAL PAAC CAPITAL INVESTMENTS (NOMINAL AND \$2018)**

<b>Fiscal Year</b>	<b>Nominal Spend (\$M)</b>	<b>Inflation-Adjusted Spend (\$2018 M)</b>
2015	\$147.1	\$158.4
2016	\$175.3	\$186.2
2017	\$199.8	\$207.0
2018	\$132.9	\$132.9
<b>2015-2018 Avg</b>	<b>\$163.8</b>	<b>\$171.1</b>

Sources: PAAC Annual Budgets (nominal), Bureau of Labor Statistics Consumer Price Index (inflation)

Budget detail provided by PAAC was utilized to categorize the expenditures by type.<sup>33</sup> The direct construction activity modeled within the analysis takes place within Allegheny County and is therefore considered local, regardless of where contractors or employees may be headquartered or reside.<sup>34</sup> However, some large scale capital purchases may be sourced from outside of the region (most notably vehicle replacements, which are largely sourced externally). These non-local materials are excluded from the regional economic impact.

The sum of activity from all capital categories represents the total volume of direct activity that is modeled within the local economy. Modeled expenditures represent 61 percent of total expenditures (see Table A.2).

<sup>32</sup> This calculation is done by applying the ratio between the CPI-U index in 2018 and the activity year to the nominal values, which expresses the purchasing power in \$2018 terms.

<sup>33</sup> Note that while a small number of direct PAAC employees are categorized to capital activities, all PAAC employee costs are modeled within the operating impacts described in Section A.2 below.

<sup>34</sup> These leakages are accounted for in the modeling of indirect and induced spending, as described in Section A.3 below.

**TABLE A.2: MODELED CAPITAL INVESTMENTS (FY 2015 – FY 2018 AVERAGE, IN \$2018)**

Category	IMPLAN Sector <sup>35</sup>	Average Annual (\$M)	Amount Modeled
Debt Service	N/A	\$27.0	\$0.0
Revenue Vehicle Replacement	N/A	\$39.3	\$0.0
Fixed Guideway & Facility Improvements	56 & 62	\$58.1	\$58.1
Support Programs	452	\$14.2	\$14.2
Operating Capitalizations	64	\$29.7	\$29.7
New System Initiatives	58	\$2.8	\$2.8
<b>Total Capital Investment (\$2018M)</b>		<b>\$171.1</b>	<b>\$104.9</b>
<b>Total Modeled (%)</b>			<b>61%</b>

Sources: PAAC Purchasing Data, IMPLAN

## A.2 DIRECT ACTIVITY FROM ONGOING OPERATIONS

Operating activity for the same FY 2015-2018 time period is modeled based on budget detail provided by PAAC. All expenditures are converted to current dollars based on Consumer Price Index from the Bureau of Labor Statistics. Annualized expenditure amounts in \$2018 were then averaged for the FY 2015-2018 period (yielding an annual average of \$405 billion in nominal terms and \$422 billion in \$2018) (see Table A.3).

**TABLE A.3: ANNUAL PAAC OPERATING EXPENDITURES (NOMINAL AND \$2018)**

Fiscal Year	Nominal Spend (\$M)	Inflation-Adjusted Spend (\$2018 M)
2015	\$388.5	\$418.3
2016	\$398.5	\$423.1
2017	\$412.9	\$427.8
2018	\$419.8	\$419.8
<b>2015-2018 Avg</b>	<b>\$404.9</b>	<b>\$422.2</b>

Sources: PAAC Annual Budgets (nominal), Bureau of Labor Statistics Consumer Price Index (inflation)

Expenditures are sorted by category based on PAAC's budget information. Deductions from these annual expenditures by category are taken to remove spending that does not take place within the modeled geography (County, region and Commonwealth).

<sup>35</sup> 56: Construction of new highway and streets, 58: Construction of other new nonresidential structures, 62: Maintenance and repair construction of nonresidential structures, 64: Maintenance and repair construction of highways, streets, bridges, and tunnels, 452: Computer systems design services.



All employee compensation paid by PAAC is considered local, since work activity takes place within Allegheny County.<sup>36</sup> The remaining purchases of materials and services were reviewed to determine the extent to which they were sourced within the region and Commonwealth. For some large scale goods, direct purchasing data was available to determine the proportion taking place within the geography. For other goods, the local purchase percentage estimated by IMPLAN modeling software for the relevant categories was used to estimate the proportion of expenditures taking place within the region (see Table A.4).

**TABLE A.4: LOCAL PURCHASE PROPORTIONS BY GEOGRAPHY AND SECTOR (FY 2015 – FY 2018 AVERAGE, IN \$2018)**

Category	Total Expense (\$2018M)	Allegheny County		Southwest Region		Commonwealth of PA	
		Local Purchase %	Modeled Expenditures (\$2018M)	Local Purchase %	Modeled Expenditures (\$2018M)	Local Purchase %	Modeled Expenditures (\$2018M)
Materials and Supplies	\$24.5	45%	\$11.0	58%	\$14.3	65%	\$15.8
Provision for Injuries & Damages	\$4.3	100%	\$4.3	100%	\$4.3	100%	\$4.3
Purchased Services	\$13.3	45%	\$6.0	58%	\$7.8	65%	\$8.6
Utilities	\$6.1	99%	\$6.1	100%	\$6.1	100%	\$6.1
Other Expenses	\$8.7	45%	\$3.9	58%	\$5.1	65%	\$5.6
ACCESS (Shared Ride) Service	\$29.3	100%	\$29.3	100%	\$29.3	100%	\$29.3
Fuel & Lubricants	\$21.3	0%	\$0.0	0%	\$0.0	0%	\$0.0
Tires & Tubes	\$2.1	0%	\$0.0	83%	\$1.7	83%	\$1.7
Propulsion Power	\$3.0	100%	\$3.0	100%	\$3.0	100%	\$3.0
Interest Expense	\$0.1	0%	\$0.0	0%	\$0.0	0%	\$0.0
<b>Total</b>	<b>\$112.6</b>		<b>\$63.6</b>		<b>\$71.6</b>		<b>\$74.4</b>

Sources: PAAC Purchasing Data, IMPLAN

Through this approach, it is estimated that 67 percent of materials and services in the FY 2015-2018 period were purchased within the region, and 74 percent within the Commonwealth. These local expenditures are summed with labor and fringe benefits to yield total modeled expenditures. Modeled expenditures represent 88 to 91 percent of total operating expenditures (varying by geography) (see Table A.5).

<sup>36</sup> Leakage of induced spending due to employees that live outside of the region or Commonwealth is accounted for the impact modeling described below.

**TABLE A.5: MODELED OPERATING EXPENDITURES (FY 2015 – FY 2018 AVERAGE, IN \$2018)**

Category	Allegheny County	Southwest Region	Pennsylvania
Labor and Fringe (\$M)	\$309.7	\$309.7	\$309.7
Materials and Services	\$112.6	\$112.6	\$112.6
<i>Local</i>	57%	64%	66%
<i>Non-Local (excluded)</i>	(43%)	(36%)	(34%)
Modeled Activity (\$M)	\$63.6	\$71.6	\$74.4
<b>Total Modeled (\$2018M)</b>	<b>\$373.3</b>	<b>\$381.2</b>	<b>\$384.1</b>
<b>Total Modeled (%)</b>	<b>88%</b>	<b>90%</b>	<b>91%</b>

Sources: ESI Analysis of PAAC Budget Data

### A.3 ECONOMIC AND FISCAL MODELING

Expenditures within a given geography give rise to “spillover” impacts when those dollars are recirculated to suppliers and to employees within the local, regional and state economy. In so doing, they also support additional employment and earnings, and generate tax revenue for local governments and for the Commonwealth.

ESI has constructed an input-output model of the local, regional and state economy using IMPLAN software to estimate the total impact of these net expenditures. The detail that follows explains briefly the theory behind input-output modeling, the mechanics of utilizing it to estimate economic and employment impacts, and then fiscal model utilized to estimate tax revenue impacts from PAAC’s economic activity.

#### INPUT-OUTPUT MODELING: OVERVIEW

Economic impact estimates for annualized capital and operating activity are generated by utilizing input-output models to translate an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. In an inter-connected economy, every dollar spent generates two spillover impacts:

- First, some amount of the proportion of that expenditure that goes to the purchase of goods and services gets circulated back into an economy when those goods and services are purchased from local vendors. This represents what is called the “indirect effect,” and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.
- Second, some amount of the proportion of that expenditure that goes to labor income gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This represents what is called the “induced effect,” and reflects the

fact that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of the spillover impacts to all industries of a dollar spent in any one industry. Thus, PAAC’s total economic impact is the sum of its own direct economic footprint, plus the indirect and induced effects generated by that direct footprint (see Table A.6).

**TABLE A.6: ECONOMIC IMPACT MODELED BY GEOGRAPHY**

<b>Geography</b>	<b>Direct Activity</b>	<b>Indirect / Induced Activity</b>
Allegheny County	Allegheny County	Direct: Allegheny → Spillover: Allegheny + Direct: Rest of SW → Spillover: Allegheny + Direct: Rest of PA → Spillover: Allegheny
Rest of SW Region	SW Region (net of Allegheny County)	Direct: Allegheny → Spillover: Rest of SW + Direct: Rest of SW → Spillover: Rest of SW + Direct: Rest of PA → Spillover: Rest of SW
Rest of Pennsylvania	PA (net of SW)	Direct: Allegheny → Spillover: Rest of PA + Direct: Rest of SW → Spillover: Rest of PA + Direct: Rest of PA → Spillover: Rest of PA
Pennsylvania (total)	Allegheny + SW Region + Rest of PA	Allegheny + SW Region + Rest of PA

**INPUT-OUTPUT MODEL MECHANICS**

To model the impacts resulting from the direct expenditures ESI developed a customized economic impact model using the IMPLAN input/output modeling system. IMPLAN represents an industry standard approach to assess the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes within a county its surrounding area.

IMPLAN has developed a social accounting matrix (SAM) that accounts for the flow of commodities through economics. From this matrix, IMPLAN also determines the regional purchase coefficient (RPC), the proportion of local supply that satisfies local demand. These values not only establish the types of goods and services supported by an industry or institution, but also the level in which they are acquired locally. This assessment determines the multiplier basis for the local and regional models created in the IMPLAN modeling system. IMPLAN takes the multipliers and divides them into 536 industry categories in accordance to the North American Industrial Classification System (NAICS) codes.

The IMPLAN modeling system also allows for customization of its inputs which alters multiplier outputs. Where necessary, certain institutions may have different levels of demand for commodities. When this occurs, an “analysis-by-parts” (ABP) approach is taken. This allows the user to model the impacts of direct economic activity related to and institution or industry with greater accuracy. Where inputs are

unknown, IMPLAN is able to estimate other inputs based on the level of employment, earnings, or output by an industry or institution.<sup>37</sup>

## TAX REVENUE IMPACTS

The direct, indirect and induced economic output from PAAC's capital investments and annual operations produce increases in various tax bases, which in turn lead to increased tax revenue collections for local governments and for the Commonwealth. While IMPLAN produces estimates of these tax revenue amounts, ESI's does not utilize these results directly. Instead, we utilize a custom fiscal model that relies on the known relationships between various types of economic activity and tax collections (i.e. effective tax rates) to translate the increases in activity estimates by IMPLAN into attendant tax revenue results. These calculations are performed independently for the City of Pittsburgh and Commonwealth of Pennsylvania.

For a non-profit entity such as PAAC, care must also be given to ensure that taxable and non-taxable activity types are properly distinguished. Most notably, PAAC's direct activity is not subject to any sales, income or property tax. However, income generated by PAAC's employment footprint is subject to local wage tax and Pennsylvania income tax. In addition, the indirect and induced impact of PAAC's activity as it ripples throughout the economy occurs broadly within the private sector of the economy, and is therefore understood to be tax generating.

Table A.7 below details tax revenue generation estimates by activity type and tax type. The City of Pittsburgh does not have a sales tax and the Allegheny County does not have an income or business tax, meaning that those categories are not applicable for those jurisdictions. Further, as a non-profit, the direct operating activity of PAAC is exempt from sales or business tax. However, capital activity is largely conducted through private contractors, meaning that all capital activity is treated as taxable.

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<sup>37</sup> Economic impacts from direct, indirect and induced activity are detailed within Section 1 of this report.

**TABLE A.7: TAX REVENUE GENERATED BY ACTIVITY TYPE (FY 2015 – FY 2018 AVERAGE, IN \$2018)**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Allegheny County</b>	<b>Commonwealth of Pennsylvania</b>
<i>Operations - Direct</i>			
Income / Wage Tax (\$M)	\$1.29	N/A	\$5.13
Sales Tax (\$M)	N/A	Exempt	Exempt
Business Tax (\$M)	Exempt	N/A	Exempt
<b>Operations – Direct Total (\$M)</b>	<b>\$1.29</b>		<b>\$5.13</b>
<i>Operations – Indirect/Induced</i>			
Income / Wage Tax (\$M)	\$0.42	N/A	\$2.13
Sales Tax (\$M)	N/A	\$0.10	\$2.44
Business Tax (\$M)	\$0.21	N/A	\$0.81
<b>Operations – Indirect/Induced Total (\$M)</b>	<b>\$0.63</b>	<b>\$0.10</b>	<b>\$5.38</b>
<i>Capital Investments</i>			
Income / Wage Tax (\$M)	\$0.08	N/A	\$3.98
Sales Tax (\$M)	N/A	\$0.05	\$1.31
Business Tax (\$M)	\$0.07	N/A	\$0.44
<b>Capital Investments – Direct Total (\$M)</b>	<b>\$0.16</b>	<b>\$0.05</b>	<b>\$5.73</b>
<i>Total</i>			
Income / Wage Tax (\$M)	\$2.		\$11.24
Sales Tax (\$M)		\$0.15	\$3.75
Business Tax (\$M)	\$0.28		\$1.25
<b>Total (\$M)</b>	<b>\$2.07</b>	<b>\$0.15</b>	<b>\$16.24</b>

It is important to note that while the Pittsburgh economy is wholly contained within the Pennsylvania economy, the City and Commonwealth governments are separate and distinct entities with distinct tax bases and revenues. Therefore, fiscal impacts do not overlap – each represents distinct tax revenues generated to the respective governments.

In addition, it is acknowledged that PAAC's operations and capital investments also generate taxable activity within and therefore tax revenues to additional jurisdictions besides the City of Pittsburgh and Commonwealth of Pennsylvania, including within suburban jurisdictions throughout Pennsylvania and in neighboring states. These amounts are much smaller than the ones calculated here, and are excluded for this analysis to be conservative. Finally, no estimate of the catalytic impacts of PAAC's presence in the city and region (such as investment by private sector entities) are included in these tax revenue calculations.

## APPENDIX B – METHODOLOGY: SHARE OF THE COMMONWEALTH

### B.1 PENNSYLVANIA GENERAL FUND

The share of Pennsylvania’s general fund attributable to both Allegheny County and to the ten-county southwestern region (Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties) are estimated utilizing government and private data sources to allocate the geographic source of revenues for each of the major general fund revenue sources. The tables below detail the data sources utilized to estimate the county by county contribution to each revenue source, and the proportion of Commonwealth revenues estimated to originate in Allegheny County and in southwestern Pennsylvania.

Collectively, sales tax, income tax, corporation tax and estate and realty transfer tax revenue comprised 88 percent of Pennsylvania’s general fund revenues in FY 2016-2017. The weighted average of the contribution to these major funding sources is used to extrapolate the remaining 12 percent of general fund revenues to estimate the total contribution of Allegheny County and the southwest region.

#### INCOME TAX

Income tax revenue is the largest single revenue source for the Pennsylvania general fund, accounting for 37 percent of general fund revenue (or \$11.5 billion). Data from the Pennsylvania Treasury available in the statistical supplement to the Pennsylvania FY 2016-2017 Tax Compendium tracks the remittance of personal income tax by county.<sup>38</sup> Data from calendar year 2015 indicates that Allegheny County accounts for 10.3 percent of Pennsylvania income tax collections and the southwest region as a whole accounts for 19.3 percent (see Table B.1).

**TABLE B.1: CONTRIBUTION TO PENNSYLVANIA INCOME TAX REVENUE (2015)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
<b>Income Tax (\$M)</b>	<b>\$11,491</b>	<b>\$1,187</b>	<b>10.3%</b>	<b>\$2,216</b>	<b>19.3%</b>

**Data Sources / Method**

Income Tax Paid

Income Tax Paid by County – Pennsylvania Treasury (2015)

#### SALES TAX

Sales tax revenue represents about one-third of Pennsylvania’s general fund (or \$9.9 billion). This includes all general sales tax collections in addition to motor vehicle, liquor, and other sales taxes. Based on data from the Pennsylvania Treasury, it is estimated that Allegheny County accounts for 11.1

<sup>38</sup> For the full report, see: <<http://www.revenue.pa.gov/GeneralTaxInformation/News%20and%20Statistics/Pages/Reports%20and%20Statistics/Tax-Compendium.aspx>>

percent of all sales tax revenues to the Commonwealth and the southwestern Pennsylvania region accounts for 20.7 percent (see Table B.2).

**TABLE B.2: ESTIMATED CONTRIBUTION TO PENNSYLVANIA SALES TAX REVENUE (FY 2016-2017)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
Sales Tax Remittance (\$M)	\$4,462	\$503	11.3%	\$999	22.4%
Motor Vehicle Sales Tax Remittance (\$M)	\$1,367	\$144	10.5%	\$304	22.3%
Miscellaneous/LCB Sales Tax (\$M)	\$4,035	\$446	11.1%	\$739	18.3%
<b>Total (\$M)</b>	<b>\$9,863</b>	<b>\$1,093</b>	<b>11.1%</b>	<b>\$2,042</b>	<b>20.7%</b>

**Data Sources / Method**

*Note: Columns may not sum due to rounding*

Sales Tax Remittance

Direct Remittance by County – Pennsylvania Treasury (FY 2017)

Motor Vehicle Remittance

Direct Remittance by County – Pennsylvania Treasury (FY 2017)

Miscellaneous/LCB

Geographic Shares based on Taxable Income by County – PA Treasury (FY 2017)

## CORPORATION TAX

Corporation tax revenues account for about 16 percent of Pennsylvania's general fund (or \$4.8 billion). Pennsylvania Treasury data does not directly collect corporation tax revenues by originating location, and such an analysis would run into challenges due to the inconsistent relationship between the location of business activity and the physical address where corporations are headquartered (which itself may be chosen for advantageous tax purposes). Accordingly, the southwestern Pennsylvania share of the gross regional product (GRP) as reported by the IMPLAN economic software modeling package is utilized to allocate corporation tax revenues by geographic location. It is estimated that Allegheny County alone generates 13.3 percent of Pennsylvania's corporation taxes. 21.4 percent of Pennsylvania corporation tax revenue originates from business activity in the southwest region (see Table B.3).

**TABLE B.3: ESTIMATED CONTRIBUTION TO PENNSYLVANIA CORPORATION TAX (FY 2016-2017)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
<b>Corporation Tax (\$M)</b>	<b>\$4,814</b>	<b>\$640</b>	<b>13.3%</b>	<b>\$1,030</b>	<b>21.4%</b>

**Data Sources / Method**

Corporation Tax

Geographic Shares based on Gross Regional Product (IMPLAN 2015)

## ESTATE AND REALTY TRANSFER TAX

Finally, inheritance/estate tax and realty transfer tax revenues account for about 5 percent of Pennsylvania's general fund (or \$1.5 billion). The Pennsylvania Treasury reported collections of each of these taxes by county for FY 2016-2017. Combined, Allegheny County generates 11.3 percent of revenues from these two sources for the Commonwealth, while the southwest region represents 20.0 percent (see Table B.4).

**TABLE B.4: CONTRIBUTION TO PENNSYLVANIA ESTATE AND REALTY TRANSFER TAX (FY 2016-2017)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
Estate Tax Remittance (\$M)	\$969	\$120	12.4%	\$209	21.6%
Realty Transfer Tax Remittance (\$M)	\$579	\$55	9.6%	\$101	17.4%
<b>Total (\$M)</b>	<b>\$1,548</b>	<b>\$175</b>	<b>11.3%</b>	<b>\$310</b>	<b>20.0%</b>
<b>Data Sources / Method</b>		<i>Note: Columns may not sum due to rounding</i>			
Estate Tax Remittance	Direct Remittance by County – Pennsylvania Treasury (FY 2017)				
Realty Transfer Tax Remittance	Direct Remittance by County – Pennsylvania Treasury (FY 2017)				

## TOTAL CONTRIBUTION

Together, these four sources represented 88 percent of Pennsylvania's general fund revenues (\$27.7 billion out of \$31.7 billion) in FY 2016-2017. Therefore, when aggregated they serve as a reliable indicator of Allegheny County and the southwest region's proportional contribution to the general fund. In total, Allegheny County is estimated to generate 11.2 percent of the Commonwealth's general fund and the southwestern region as a whole is estimated to generate 20.2 percent (see Table B.5).

**TABLE B.5: CONTRIBUTION TO MAJOR PENNSYLVANIA GENERAL FUND REVENUES (FY 2016-2017)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
Income Tax (\$M)	\$11,491	\$1,187	10.3%	\$2,216	19.3%
Sales Tax (\$M)	\$9,863	\$1,093	11.1%	\$2,042	20.7%
Corporation Tax (\$M)	\$4,814	\$640	13.3%	\$1,030	21.4%
Estate and Realty Transfer Tax (\$M)	\$1,548	\$175	11.3%	\$310	20.0%
<b>Sum (\$M)</b>	<b>\$27,716</b>	<b>\$3,095</b>	<b>11.2%</b>	<b>\$5,598</b>	<b>20.2%</b>

*Note: Columns may not sum due to rounding*

*Taxes represented account for 90 percent of Pennsylvania General Fund Revenue (FY 2017)*



The proportion of Commonwealth revenues generated by Allegheny County and the southwest region from the four major general fund revenue sources is then applied to the remaining revenue sources (for which direct geographic information is not available) to extrapolate the County and region's contribution to the full general fund. Allegheny County's 11.2% share of the \$31.7 billion in total revenue implies a contribution of \$3.5 billion to the general fund. The region's 21.2% share implies a contribution of \$6.4 billion to the general fund (see Table B.6).

**TABLE B.6: ESTIMATED TOTAL CONTRIBUTION TO PENNSYLVANIA GENERAL FUND REVENUES (FY 2017)**

	Pennsylvania	Allegheny County	Allegheny Share of PA	Southwest Region	Southwest Share of PA
General Fund Revenue from Major Sources (\$M)	\$27,716	\$3,095	11.2%	\$5,598	20.2%
General Fund Revenue – Remainder (\$M)	\$3,953	\$441	11.2%	\$799	20.2%
<b>General Fund Revenue – Total (\$M)</b>	<b>\$31,669</b>	<b>\$3,536</b>	<b>11.2%</b>	<b>\$6,396</b>	<b>20.2%</b>

*Note: Columns may not sum due to rounding*

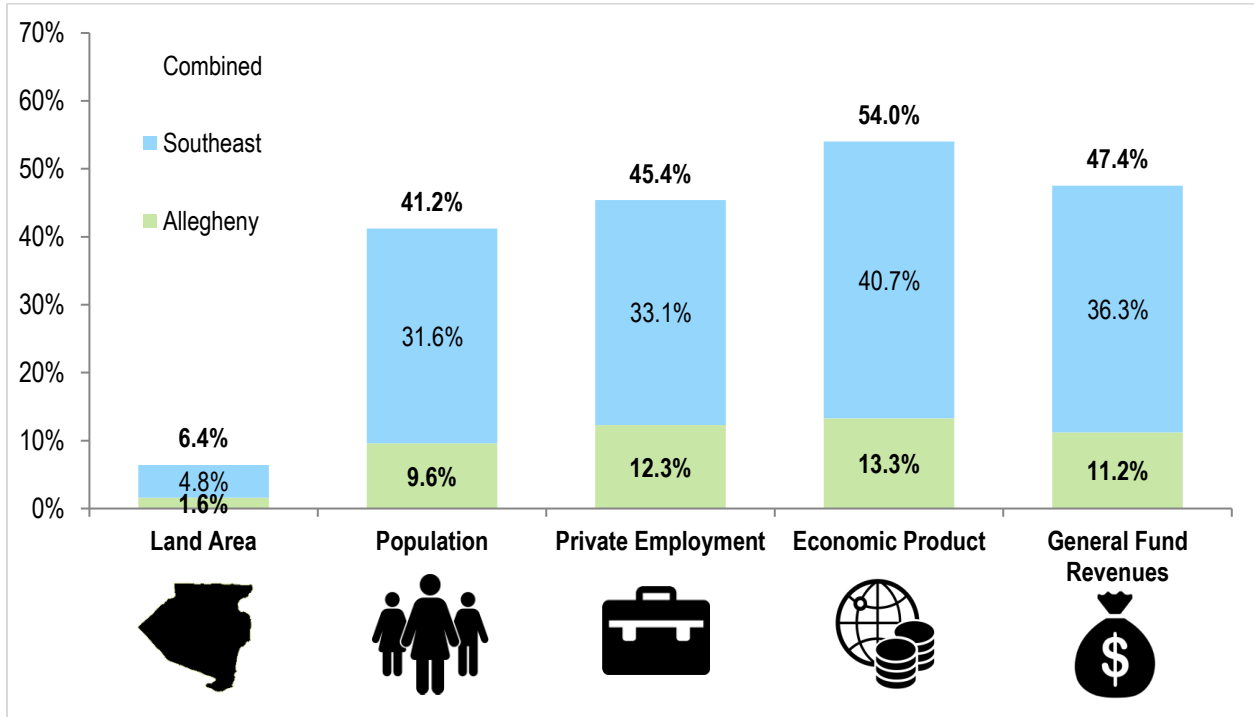
### COMBINED SOUTHWEST AND SOUTHEAST CONTRIBUTION

The southeast region of the state (Philadelphia and its suburbs) also exhibits outsized employment, gross product and tax revenue contributions relative to its population and land area. This area, which is served by the Southeastern Pennsylvania Transportation Authority (SEPTA), exhibits similar dynamics in terms of land use patterns and reliance on transit. Figure B.1 below combines the shares of the state activity shown above for Allegheny County with shares for the five-county southeast region served by SEPTA, which are calculated using the same methodology detailed above.<sup>39</sup> Together, these six counties represent 54% of the economic product and 45% of the employment base of Pennsylvania, while generating 47% of the Commonwealth's general fund tax revenues.

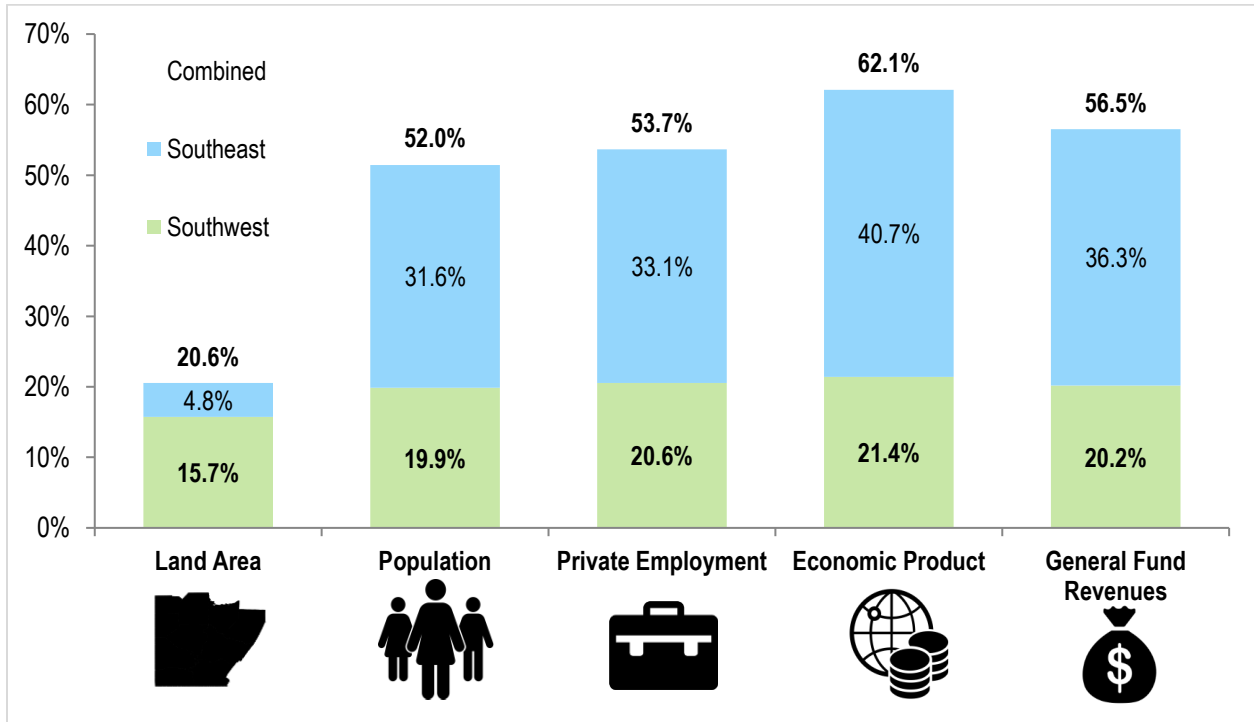
Figure B.2 extends the analysis to the full 10-county southwest region. Together, the southeast and southwest represent more than half of the state's population (52%) on just 21% of the land area. These areas represent 62% of the state's gross product, 57% of its general fund revenues, and 54% of its private employment.

<sup>39</sup> Bucks, Chester, Delaware, Montgomery and Philadelphia counties.

**FIGURE B.1: ALLEGHENY COUNTY AND SOUTHEAST ACTIVITY AS SHARE OF PENNSYLVANIA**



**FIGURE B.2: SOUTHWEST AND SOUTHEAST ACTIVITY AS SHARE OF PENNSYLVANIA**



## APPENDIX C – METHODOLOGY: PROPERTY VALUE IMPACTS

Public transit service confers economic benefits for a region and its economy writ large. Some of the value of those benefits is captured by private households through transit's impacts on property value. This additional value in turn increases the tax base of Allegheny County and its municipalities and school districts.

The impacts of PAAC service on residential property values are measured in this report through statistical analysis of hundreds of sales transactions throughout Allegheny County. Residential property transactions provide direct observations of property value as agreed to by a willing buyer and seller at a given point in time and location. A statistical technique called hedonic regression analysis can parse from these transactions the additional value conferred by a specific amenity, such as proximity to transit service, holding constant the other characteristics of the property.

Access to high frequency public transportation confers benefits to residents including improved accessibility and reduced travel costs and time. Given the finite supply of houses located near stations or frequent service routes, economic theory holds that those individuals that value access to public transportation, and the benefits provided, will bid up the prices of homes located near this service. The extent of the value of these benefits will be affected by the proximity and the utility of the service, including the potential economic opportunities and amenities that it connects to, and the potential transportation cost savings that it enables.

Positive property value effects are identified within the half-mile watershed of frequent transit service and additional value at greater distances from light rail and busway stations. This approach is utilized to map the incremental value attributable to PAAC service out of the estimated market value of every residential property in the county (with a value of zero for those houses that are not within a frequent service catchment). These aggregate estimates are used to define the portion of total value attributable to PAAC service, and to calculate the implications of this premium on property tax and real estate transfer tax rate, based on the applicable rates in each jurisdiction.

This appendix describes in detail the methodology and calculations utilized to isolate the impacts of PAAC service on residential property values in Allegheny County, including the data utilized, the modeling approach, and detailed impact results.

### C.1 ANALYTICAL APPROACH

Hedonic regression models are the most popular technique used to estimate the effects of transit on residential property values. Hedonic modeling can provide estimates of the relative average impact that any housing or neighborhood attribute contributes to property valuations while statistically holding all other variables constant. When executed correctly, hedonic modeling offers valuable information about the relative contribution of property characteristics, such as access to commuter rail service, to the value of real property.

A 2009 study by Victoria Perk and Martin Catalá for the FTA quantified the impacts of stations along PAAC's East Busway on the values of surrounding single-family homes using hedonic modeling.<sup>40</sup> This study found significant positive impacts from proximity to the busway, with impacts declining by distance away from the station. Similarly, a 2017 study by Perk, Catalá and additional researchers for the National Institute of Transportation and Communities found positive impacts from proximity to Bus Rapid Transit (BRT) service in Eugene, Oregon. This analysis was repeated longitudinally in 2005, 2010 and 2016, with premiums in each case descending with distance from stations, and the level of the premium growing over time.

ESI has analyzed the impact of proximity to commuter rail operated by SEPTA in the suburban counties of Bucks, Chester, Delaware and Montgomery outside of Philadelphia.<sup>41</sup> Rail stations have a significant positive effect on nearby stations, increasing slightly from the innermost ring (within a half mile) to the band between a half and one mile, then decline as distance increases. Impacts also increase in a relatively linear pattern with station quality (as measured by an index of service frequency, peak level service, and parking availability).

This study utilizes a hedonic regression model to analyze the impact of the proximity to frequent service and fixed route service (light rail and busways) in Allegheny County, hypothesizing a positive relationship between proximity to transit service and the value of single-family residential properties. The hypothesis is assessed using the following hedonic regression model:

$$\text{House Value}_i = f(S, L, N, T, \text{Transit})$$

Where:

**S** is the vector of structural characteristics of the house, including total square feet of the house, lot size, the number of bathrooms, the number of bedrooms, the age of the house, whether or not the house is new construction, style, condition of the house and the heating system of the house.

**L** is a vector of the locational attributes of the house as measured by the distance to the central business district.<sup>42</sup>

**N** is a vector of neighborhood socioeconomic characteristics measured at the Census Tract level. These include population density, median household income and other demographic variables.

**T** is a vector of variables indicating the year and season at the time of the transactions.

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<sup>40</sup> Perk, Victoria and Catalá, Martin. "Land use Impact of Bus Rapid Transit -Effects of BRT Station Proximity on Property Values along the Pittsburgh Martin Luther King, Jr. East Busway." *Federal Transit Administration* (2009).

<sup>41</sup> "SEPTA Drives the Economy of Pennsylvania." *Econsult Solutions, Inc.* (2018)

<sup>42</sup> The location of central business district is selected as the location of Market Square.

*Transit is vector of variables that measure that proximity of the house to the closest light rail station or busway station, the presence of parking at the closest light rail station, and whether the property is within a frequent service walkshed defined by PAAC.*

Premiums are measured within the half-mile walkshed of frequent service and at greater distances for light rail (up to two miles) and busway (up to three miles) stations.<sup>43</sup> Estimates exclude residential housing in the major employment centers of Downtown, Oakland, and the North Shore.<sup>44</sup> Within these areas, values are driven by a mix of locational factors (above and beyond the physical characteristics of the housing stock) that make it difficult to disentangle the specific contribution of transit service.

The hedonic model estimates the value of accessibility generated by PAAC service under current conditions. As discussed throughout this report, the regional economy and development activity would be diminished absent this service. This in turn would have a further impact on property values, since the attractiveness of homes throughout the county would be reduced. As such, these impacts should be thought of as a lower bound estimate of the property value impacts that would result in the long run from the elimination of PAAC frequent service.

## C.2 DATA

The regression model uses data for over 203,000 transactions of single-family homes in Allegheny County. The transactions range from 1980 to 2018 which covers the period before and after the housing crash in 2007. The impact of the housing crash on house prices was accounted for by including a series of variables that control for the year that each property was sold. The data includes the sale price and date, the attributes of the individual house and the address of each property. Housing characteristics from 2018 Allegheny County Property Assessment Data was then used for predicting the impact values using the model.

Properties are divided in to quadrants to represent different transit and housing market characteristics, following the natural boundary created by the Allegheny, Monongahela and Ohio rivers (see Figure C.1).<sup>45</sup>

- The north quadrant, between the Ohio and Allegheny rivers, features areas of frequent bus service, but does not have any fixed route transit lines.
- The east quadrant, located between the Allegheny and Monongahela rivers, and the west quadrant, located northwest of the Ohio river, are served by the busways and frequent bus service.

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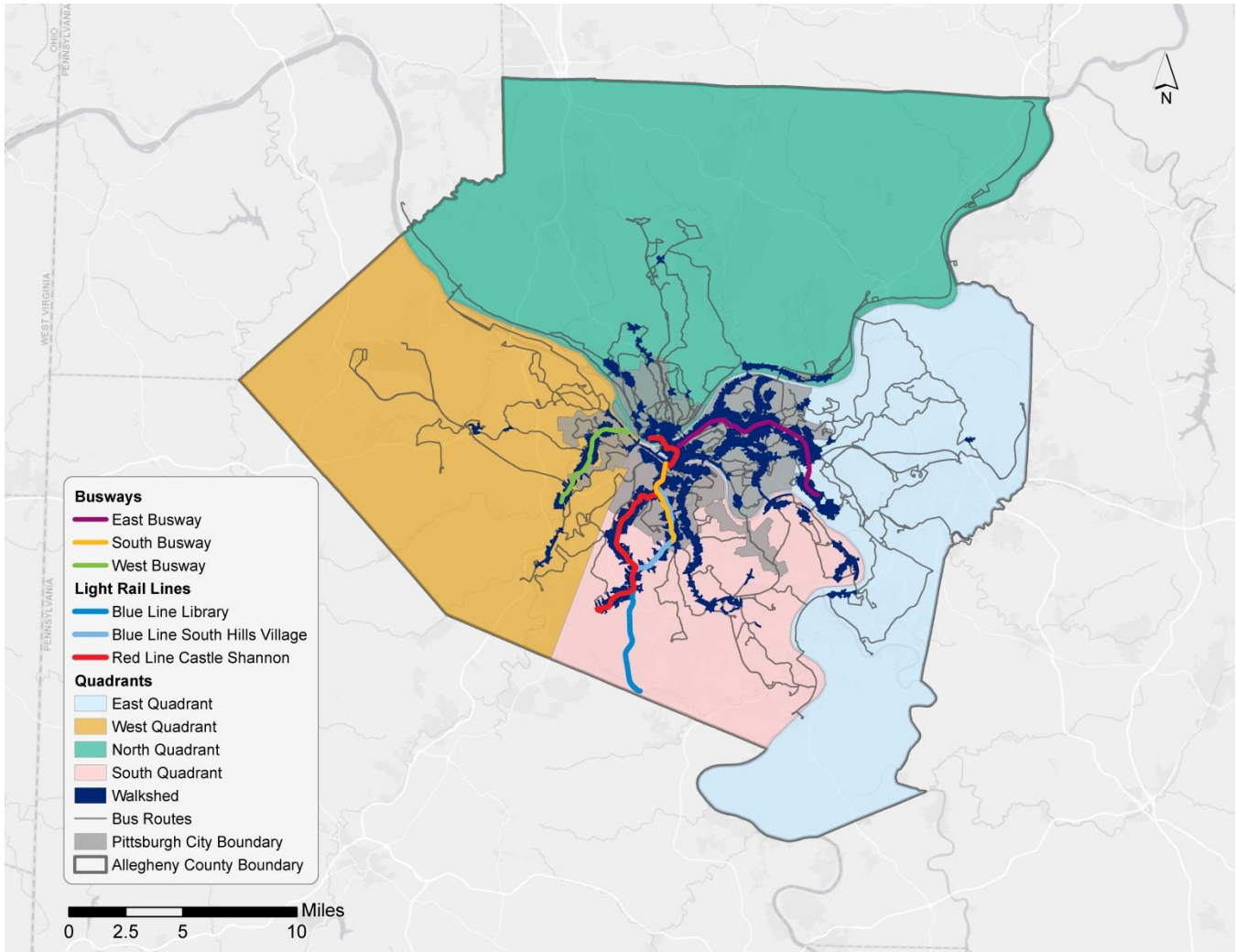
<sup>43</sup> Importantly, proximity to transit stations can also impose nuisance effects, such as noise and increased local congestion, on nearby neighbors. These potential dampening effects will be reflected in the analysis to the extent that they are reflected in pricing patterns.

<sup>44</sup> The employment centers include five city-defined neighborhoods: Central Business District, North Shore, Central Oakland, North Oakland, and West Oakland.

<sup>45</sup> The 2009 study of the east busway by Perk and Catalá used a similar approach, including only properties located between the Allegheny and Monongahela Rivers in the model.

- The south quadrant is served by the light rail system, as well as frequent bus service. The south quadrant and west quadrant are split between the midpoint from west busway to the red line.

**FIGURE C.1: MODELED ALLEGHENY COUNTY HOUSING QUADRANTS**



Equations are uniquely estimated for each of these three areas to capture differences in housing markets and service types. Models account for proximity to three service types 1) walkshed of frequent service, 2) light rail stations (with and without parking), 3) busway stations.

The “Frequent Service Walkshed” defined by Port Authority is used to represent areas with robust transit services. Walksheds are defined by PAAC using GIS techniques within  $\frac{1}{4}$  mile around a transit stop or the  $\frac{1}{2}$  mile around a transit stations, accounting for topographical features where necessary. Frequent service is defined as those stations where transit vehicles come, on average, every fifteen minutes for fifteen hours of the day, and every thirty minutes for an additional five hours of the day,

every day of the week. Walk sheds are thus areas within a five minute walk of a bus stop or a ten minute walk of a light rail, incline or busway station featuring frequent service.

Next, the Euclidean distance of each transaction to nearby light rail and busway stations was calculated. A common method to account for the distance to a transit station is to classify each property into various distance bands. For the light rail model, each transaction was classified into one of the following five groups measured by distance to the station: less than one-quarter mile; between one-quarter and one-half mile; between one-half and one mile; between one and two miles and greater than two miles. Park and Ride lots, which provide free lots for commuter parking, are incorporated in the light rail model to evaluating the impact of parking availability.

For busways, each transaction was classified into one of the following six groups measured by distance to the station: less than one-quarter mile; between one-quarter and one-half mile; between one-half and one mile; between one and two miles; between two and three miles and greater than three miles.

### C.3 INCREMENTAL EFFECTS OF PAAC SERVICE

Three models are estimated separately to differentiate the impacts of frequent service, light rail stations and busway stations.

- Transactions in south quadrant estimate the impact of proximity to light rail used to model the impact of light rail;<sup>46</sup>
- Transactions in the east and west quadrants are modeled to determine the impact of busway stations and of the frequent service walkshed;
- Transactions in the north quadrant are used to estimate the impact of the frequent service walkshed.

The coefficients on the structure, location, and neighborhood characteristics have the expected signs and are all statistically significant. Of primary interest for this analysis is the relationship between the service types, distance bands and house prices.

Table C.1 shows transit premium for light rail stations in the south quadrants as a percentage of housing value. The premium shows a decreasing pattern as distance increases from the station, with impacts still apparent out to two miles. Parking provides an additional premium at all distances, but is especially valued for properties 1 – 2 miles away from stations, a distance at which driving is central to providing access to the stations.

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<sup>46</sup> No statistically significant additive value was identified for the frequent service walkshed within this quadrant. This is likely due to the fact that the walkshed is largely co-mingled with the distance buffer around light rail stations, which provide frequent service, meaning the value is likely subsumed within the light rail premiums shown.

**TABLE C.1: LIGHT RAIL RESIDENTIAL PROPERTY VALUE IMPACTS BY DISTANCE FROM NEAREST STATION (SOUTH QUADRANT)**

Station Type	< 1/4 Mile	1/4 - 1/2 Mile	1/2 - 1 Mile	1 - 2 Miles
Without Parking	7.7%	6.7%	4.5%	2.8%
With Parking	13.9%	11.7%	6.4%	12.9%

Table C.2 shows the transit premium from east and west busways. Busway premiums also generally decline with distance, although the closest houses (within one-quarter mile) are less valued than those between one-quarter and one-half mile.<sup>47</sup> Value premiums near busway stops are apparent out to three miles, and are generally larger than the premiums around light rail.

In addition, houses within the frequent service walkshed receive additional premiums within these areas. For those houses that are proximate to a busway station and live within a walkshed, value premiums are roughly 3 percentage points higher at each distance than for those that are proximate to busway stations but outside of the walkshed.<sup>48</sup> For houses that are not within three miles of a busway station but are within a walkshed of frequent service within this area, the value premium is 4.4%.

**TABLE C.2: RESIDENTIAL PROPERTY IMPACTS BY DISTANCE FROM BUSWAYS STATION AND WALKSHED (EAST AND WEST QUADRANTS)**

Service Type	< 1/4 Mile	1/4 - 1/2 Mile	1/2 - 1 Mile	1 - 2 Miles	2-3 Miles	Walkshed Only
Out of Walkshed	12.1%	17.1%	14.1%	13.2%	5.7%	--
In Walkshed	15.5%	20.2%	17.3%	16.5%	9.6%	4.4%

In the north quadrant, homes within the walkshed of frequent service have an observed premium of 12.6% (see Table C.3). Due to the lack of service by light rail and busways, accessibility of the frequent bus service becomes more valuable than it does in other areas.<sup>49</sup>

**TABLE C.3: WALKSHED RESIDENTIAL PROPERTY IMPACTS (NORTH QUADRANT)**

Service Type	Value Premium
In Walkshed	12.6%

<sup>47</sup> Note that this pattern is not unusual, since fixed route transit service may have some disamenity value (concurrently with amenity value from service) to those in its immediate vicinity, such as noise, traffic around stations, or interruption of the street grid. The positive value observed indicates that on net, the amenity value significantly outweighs the negative, but that the net amenity value is stronger at slightly greater distances, where access to the service is almost as good but disamenity effects are lower.

<sup>48</sup> Note that while some of the residents within 1/2 mile of busway stations are in the walkshed of the busway station itself, those between 1/2 mile and 3 miles from busways stations but also within a walkshed are by definition close to frequent service by another means (typically buses on surface streets). The increased value premium indicates that both of these services are valued, and that the combination is more valuable than proximity to one service type alone.

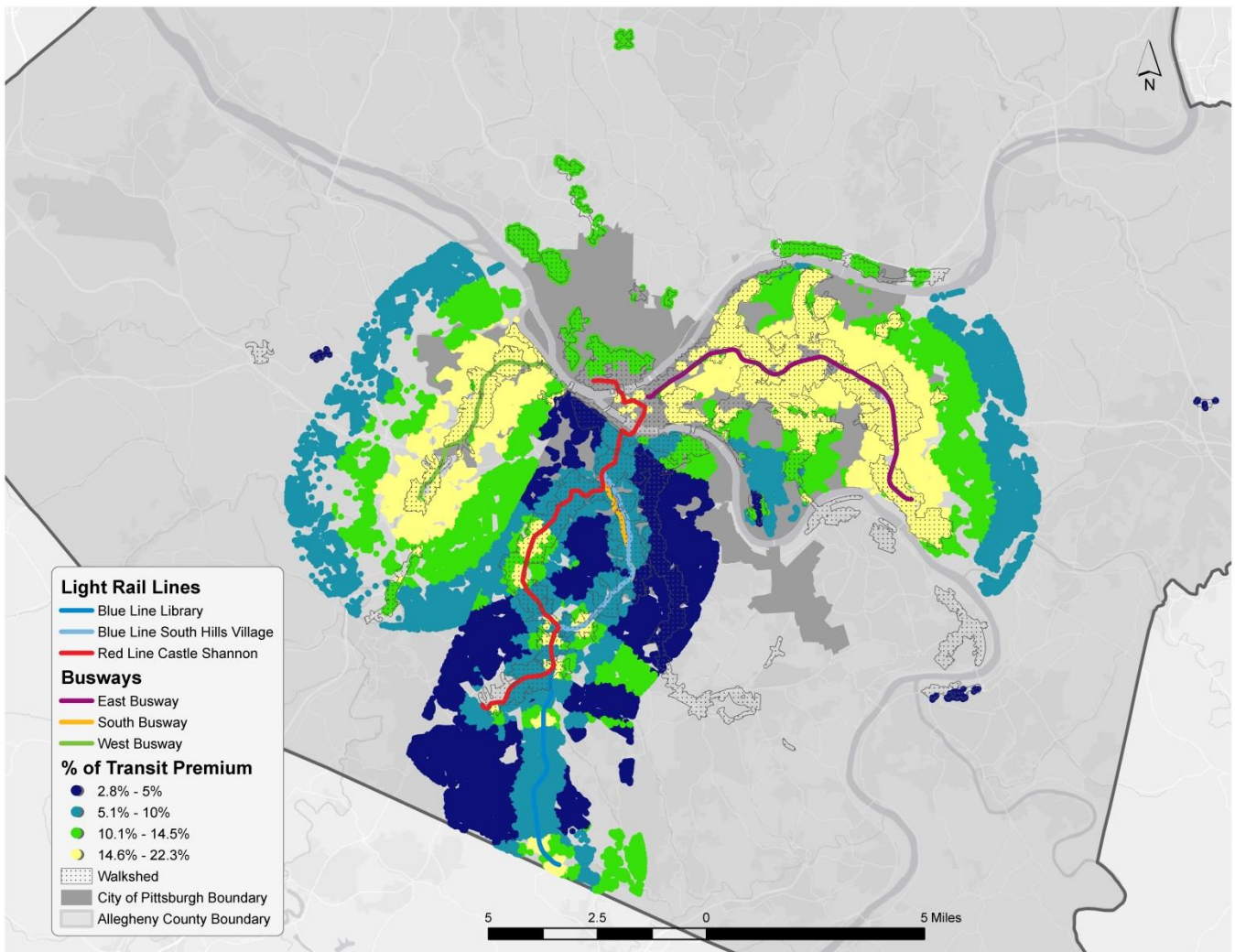
<sup>49</sup> Note that relatively few properties are served by frequent transit in this quadrant relative to other areas, due to the lack of fixed route service.



Figure C.2 below visualizes these impacts from proximity to service across Allegheny County. Percentage premiums are shown using colors to reflect different value bands. As shown in the tables above, the highest premiums are evident in close proximity to the fixed route (light rail and busway) service, with premiums declining at further distances.

Areas in gray on the map do not receive any modeled premium. Values are assigned to residential homes only a point by point basis, meaning that gaps in proximate areas may reflect topographical features or industrial areas that do not contain any residential housing.

**FIGURE C.2: DISTRIBUTION OF PROPERTY VALUE PREMIUM FROM PAAC SERVICE**



## C.4 AGGREGATE IMPACTS

The percentage premiums from service proximity can be expressed as aggregate property value impacts. To do so, the relationships derived from the hedonic regression analysis are used to estimate housing values for all detached single family houses in the county. These values are best thought of as estimated “market values,” and may differ from assessed values.

For all homes within the catchment area of frequent service or fixed routes, the incremental value attributed to transit proximity is estimated (as described in Section C.3 above), and a revised housing value absent that increment is calculated. The difference between aggregate housing values and “no transit” housing values in a given geography represent the incremental housing value attributable to proximity to transit service. Said another way, transit attributable value can be understood as the incremental loss of housing values that would occur if these PAAC services were discontinued.

Table C.4 below shows aggregate value increments in each of the area analyzed and in total across Allegheny County. The total premium for single family residential properties in proximity to PAAC service is estimated at \$3.2 billion. This represents an average premium of 11.8%, or nearly \$15,000 for houses located within the catchment of measured service.

**TABLE C.4: AGGREGATE HOUSING VALUE IMPACTS FROM PROXIMITY TO PAAC SERVICE**

Metric	Allegheny County Total	South Light Rail	East/West Busway	North
Transit Proximate Properties	215,911	82,535	125,745	7,631
<b>Total Transit Premium</b>	<b>\$3.17 Billion</b>	<b>\$626 Million</b>	<b>\$2.43 Billion</b>	<b>\$109 Million</b>
Avg Transit Premium (%)	11.8%	6.6%	14.7%	13.4%
Avg Transit Premium (\$)	\$14,681	\$7,580	\$19,345	\$14,283

Table C.5 below shows this premium relative to overall housing value in Allegheny County. The 216,911 properties located in proximity to transit represent about 42% of the 515,345 single family homes in the County. The transit premium of \$3.2 billion accounts for 4.4% of the total estimated housing value of \$72 billion in Allegheny County.

**TABLE C.5: TRANSIT PREMIUM AS A SHARE OF TOTAL HOUSING VALUE**

Metric	Allegheny County	South Light Rail	East/West Busway	North
Total Residential Housing Value	\$71.6 billion	\$13.7 billion	\$34.5 billion	\$23.4 billion
Total Residential Properties	515,345	128,121	248,758	138,466
Transit Proximate Properties	215,911	82,535	125,745	7,631
<b>Transit Premium</b>	<b>\$3.17 Billion</b>	<b>\$626 Million</b>	<b>\$2.43 Billion</b>	<b>\$109 Million</b>
<b>Share of Total Home Value</b>	<b>4.4%</b>	<b>4.6%</b>	<b>7.1%</b>	<b>0.5%</b>

## C.5 TAX IMPACTS

This housing value premium value is crucial to the tax base of local governments and school districts, which typically rely on real estate-related taxes as their primary source of revenue. Incremental increases in property values and sales prices due to the amenity value of transit can be thought of as leading to additional government revenue, or as alleviating the need for increases in property tax rate to generate the same level of government funding.

Tax revenue impacts from the housing value premium occur in two different ways:

- The county, the cities and the school districts collect real estate taxes annually based on the assessed property value and their respective millage rate.
- When a transaction of property occurs, the Commonwealth, the cities and the school districts collect real estate transfer taxes based on the transaction price and their real estate transfer tax rates.

The premium calculated above represents the share of total housing value that can be statistically attributed to proximity to transit service. For a given house, this same proportion of housing value should be reflected in the tax base.

In practice, this relationship may be inexact due to the imperfect match between assessed values and market values. Allegheny County conducted a county-wide reassessment in 2013, and houses are not regularly reassessed in the absence of a uniform re-assessment process. However, the core PAAC service network assessed in this study was similar to its current form as of 2013, suggesting that these premiums should be encapsulated in the assessed values.

To estimate the impact on assessed values, the percentage premium calculated as a share of the estimated market value is applied to the total assessed value of each house to generate a revised contribution in dollar terms to assessed value. This approach ensures that assessed value contributions are not overstated due to systematic differentials between assessed and market values (which have likely risen in aggregate over the past five years). Next, the property tax rates for the municipality and school district corresponding with each property, as well as the Allegheny County rate, are applied to each property.

The value premium from proximity to PAAC service is estimated to add a total of \$71.2 million tax revenue annually to applicable jurisdictions. Among them, the Allegheny County receives \$12.2 million tax revenue from transit premium; cities receive \$18.3 million; and school districts receive \$40.7 million.

**TABLE C.7: ANNUAL REAL ESTATE TAX IMPACTS FROM PROPERTY VALUE PREMIUM (\$M)**

Tax Type	School Districts	City of Pittsburgh	Other Municipalities	Allegheny County	Commonwealth of Pennsylvania	Total
Real Estate Tax Revenue	\$40.7	\$11.2	\$7.1	\$12.2	--	\$71.2

Value premiums in dollar terms can be calculated in a more straightforward manner for the real estate transfer tax, which uses the observed transaction price as the base. Data from the Allegheny County assessor's office shows that more than 35,000 residential properties in the county were sold in 2017, at a total sale price of \$6.1 billion. The unique premiums for each of those properties (as calculated in the regression model described above) is applied to each of these transactions, yielding an estimate that \$239 million in market value (or 3.9% of total sale price) was attributable to proximity to PAAC service.

Within calendar year 2017, more than 35,000 residential properties were sold, or about 7% of the residential housing stock of Allegheny County. The sale price of these properties totaled \$6.1 billion, of which 3.9%, or \$239 million. The applicable state and local tax rates by jurisdiction are again applied to each of these properties to yield tax revenue estimates.

Based on this sales data, the transit premium is estimated to have contributed \$8.8 million in tax revenue in 2017, of which \$2.4 million went to the Commonwealth, \$4.4 million to municipalities, and \$2 million to the school districts (see Table C.8).

**TABLE C.8: ANNUAL REAL ESTATE TRANSFER TAX IMPACTS FROM PROPERTY VALUE PREMIUM (\$M)**

Tax Type	School Districts	City of Pittsburgh	Other Municipalities	Allegheny County	Commonwealth of Pennsylvania	Total
RE Transfer Tax Revenue	\$2.0	\$3.8	\$0.6	--	\$2.4	\$8.8

## APPENDIX D – ABOUT ECONSULT SOLUTIONS, INC. (ESI)

This report was produced by Econsult Solutions, Inc. (“ESI”). ESI is a Philadelphia-based economic consulting firm that provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, development, public policy and finance, community and neighborhood development, planning, as well as expert witness services for litigation support.



For over 15 years, ESI has helped transit agencies solve their most pressing issues using highly tailored economic analyses and deep public and private experience, coupled with insightful business and strategy recommendations. Our solutions have resulted in increased funding, investments with greater impact, better technology integration, and stronger community relations.

Our transportation clients include AMTRAK, the Southeastern Pennsylvania Transportation Authority (SEPTA), Port Authority Trans-Hudson (PATH), Philadelphia International Airport (PHL) and the Washington Metropolitan Transit Authority (WMATA).