JUNE 2022

DELAWARE VALLEY
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PLANNING COMMISSION

University City Multimodal Capacity Study

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DVRPC is funded through a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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Executive Summary

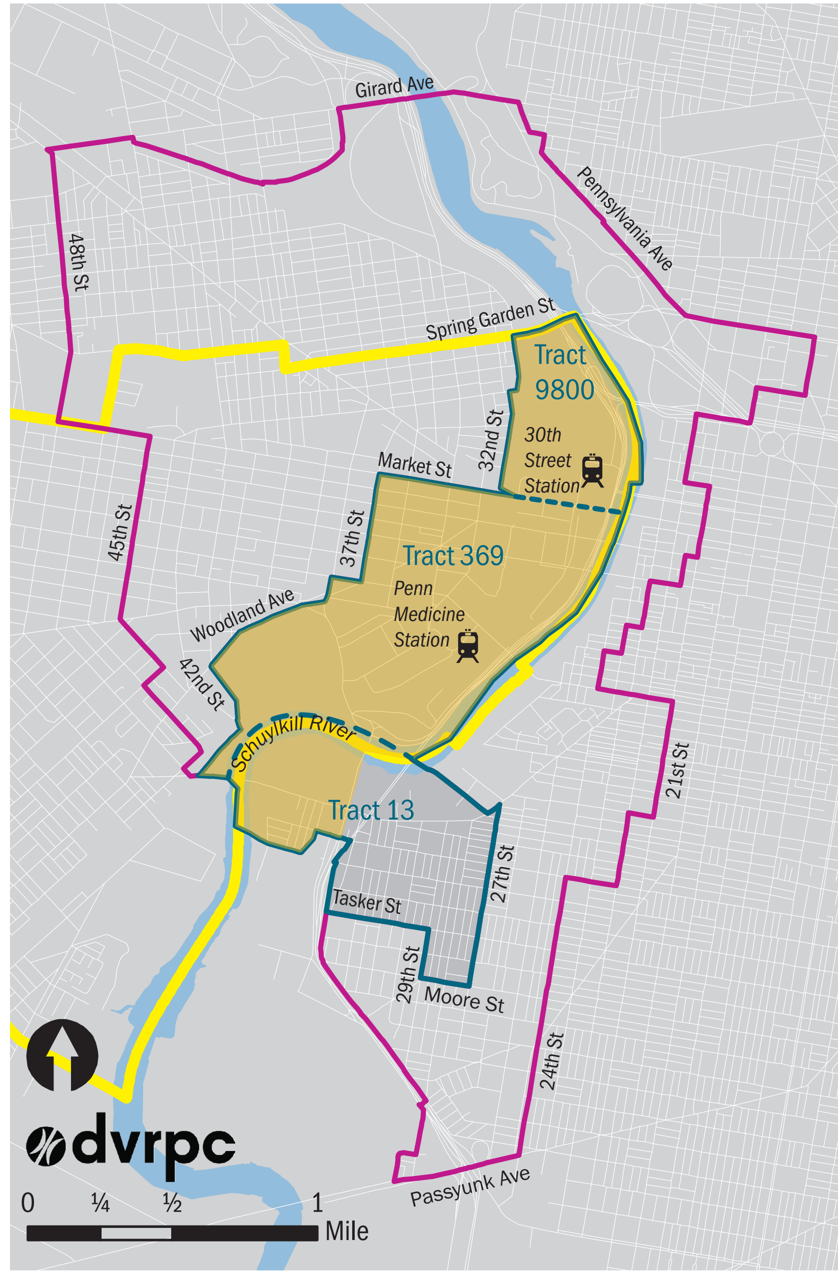
University City, with a multitude of recent and ongoing developments, is experiencing strain on the transport systems that serve the area. With millions of square feet of development currently in the pipeline and millions more anticipated, increased demand for transportation in the Study Area (defined in Figure 1, at right) is a foregone conclusion.

This study proceeds from the understanding that roadway capacity for this area is a limited resource, and that adding roadway capacity is exceedingly expensive, politically unfeasible, and detrimental to the environment. As such this analysis seeks to evaluate the existing and potential capacity of alternate modes to alleviate University City's existing and future transportation challenges.

The "Existing Conditions" chapter presents the following findings:

- The population of University City is younger, more White and Asian, more likely to rent, and more likely to live in non-family housing than residents of the city at large.
- The number of housing units within the study area dipped slightly after 2013 when there were aproximately 37,300 units but by 2019 had rebounded to 38,500 units.
- The vehicular road network is well connected to the highway network but there are substantial clusters of crashes at a handful of key locations.
- Parking occupancy is high in and around the Medical Campus and University of the Sciences.
- The bicycle network is extensive and growing. Bicycle crashes exhibit a few hotspots but seem to be declining.

Figure 1: University City Study Area



Primary Study Area
Primary Study Area Tracts
Secondary Study Area
University Southwest Planning District

Data: U.S. Census Bureau, American Community Survey (ACS) 2019 (5-year), PCPC 2013

Bikeshare ridership is reasonably consistent year over year, with a surprisingly high volume of bikeshare trips in 2020 in part due to the COVID-19 pandemic.
- Pedestrians are well served with an extensive sidewalk network, but a number of corridors account for most of the pedestrian crashes, including Market, Chestnut, and 34th streets.
- Transit ridership within the study area is reasonably high, with bus riders representing the single largest group of transit riders.

In short, the primary study area looks and operates about as one would expect from a well-connected, high-activity, high-density, urban area dominated by a major medical campus and two universities with their attendant students.

The "Development Scenarios" chapter details the assumptions made for evaluating potential futures. Scenarios were developed by reviewing existing plans and analyzing the current development pipeline. Although the lower-bound of the two visions would see roughly 70 percent of the total development of the high-development scenario, neither represents a minor change, with the moderate-growth scenario still representing approximately 10 million additional square feet of floor space by 2045.

Unsurprisingly, under all modeled scenarios the additional development adds congestion and delay that correlates positively with development intensity. Impacts are particularly pronounced on I-76 ramps and approaches, although several sections of the surface street grid also experience degradation. In all scenarios transit capacity is sufficient to absorb new riders, moreso if flexible scheduling in employment allows peak-spreading travel behaviors to persist. In light of the Southeastern Pennsylvania Transportation Authority's (SEPTA's) current work on Trolley Modernization, Bus Revolution, and Reimagining Regional Rail, it is expected that improved service will further future-proof transit access.

CHAPTER 1
Existing Conditions

Community Characteristics

Community characteristics inform not only our understanding of the current situation, but also what potential future travel needs may be. This is because household characteristics and composition affect travel behavior, to wit: childless households do not usually generate trips to school (teachers being the obvious exception).

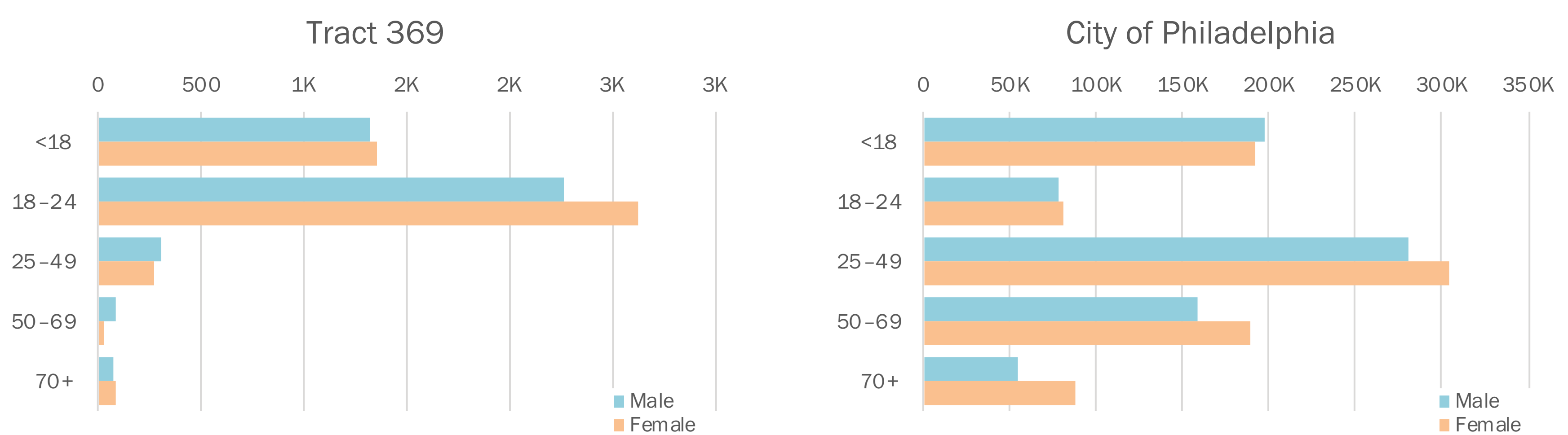
Demographics

The primary study area in University City comprises Census Tract #369, a small portion of Tract #9800, and the portion of Tract #13 west of I-76 which is dominated by the Pennovation Center. Tract 9800 encompasses 30th Street Station and extends northward into the secondary study area to include portions of Fairmount Park on both sides of the Schuylkill River.

A substantially greater number of people live in Tract 369 than Tract 9800 (approximately 6,0000 and 400 respectively) or the sliver of residential neighborhood south of Pennovation.

Figure 2 below compares the age distributions for Tract 369 (primary study area) and the City of Philadelphia, showing an inverse pattern: people between the ages of 18 and 24 are the largest group in Tract 369 and the smallest group citywide.

Figure 2: Distribution of Residents by Age and Sex: Comparison of Census Tract 369 versus City of Philadelphia

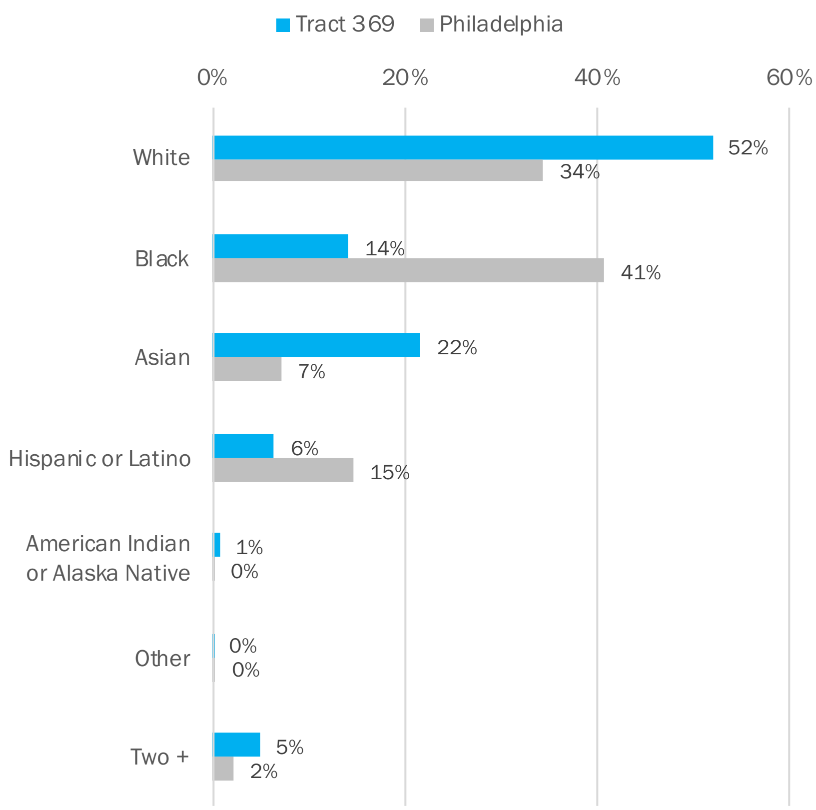


Data: U.S. Census Bureau, American Community Survey (ACS) 2019 (5-year)

Figure 3 below compares the race and ethnicity distributions of Census Tract 369 and the City of Philadelphia. It shows that the primary study area skews more White/Asian and less Black/Hispanic than the city at large.

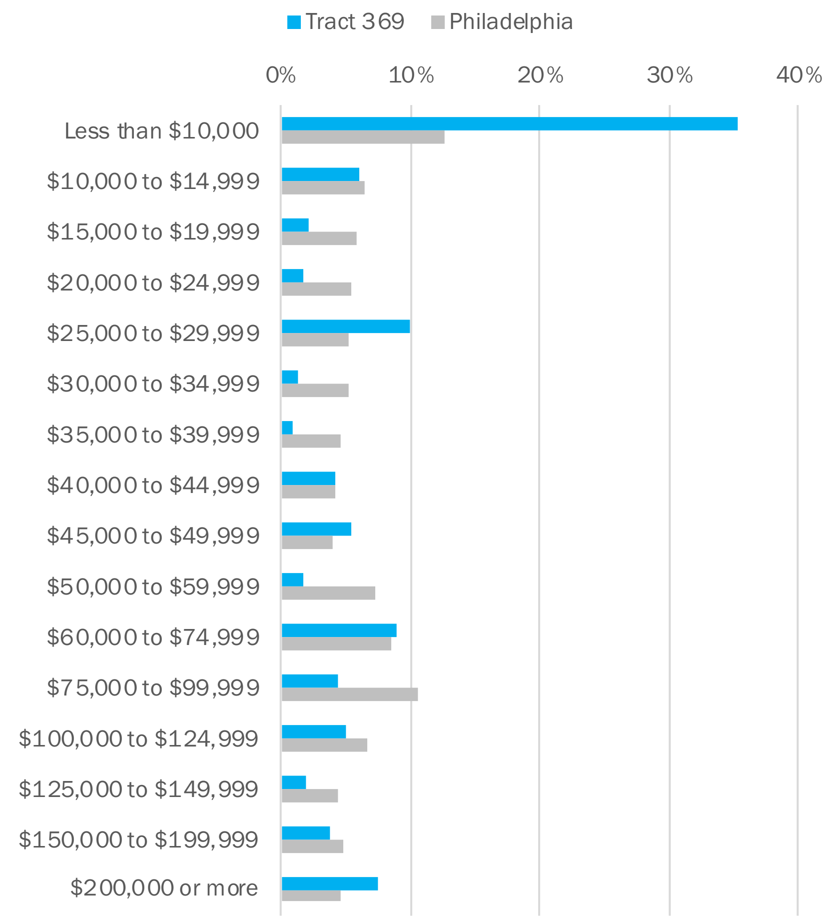
Figure 4 below compares the income of residents of Census Tract 369 with residents of the City of Philadelphia. It shows that those making less than $10k account for approximately 35 percent of all workers who live in Tract 369, compared to approximately 12 percent citywide. This is likely due to students working part-time jobs while attending college.

Figure 3: Race and Ethnicity: Tract 369 versus Philadelphia



Data: U.S. Census Bureau, ACS 2019 (5-year), B03002

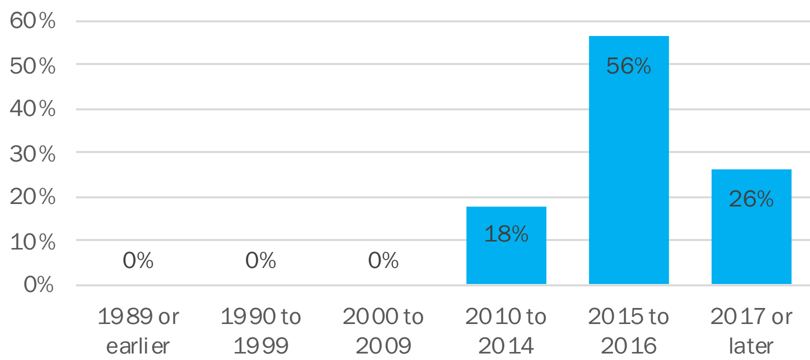
Figure 4: Median Household Income: Tract 369 versus Philadelphia



Data: U.S. Census Bureau, ACS 2019 (5-year), B19001

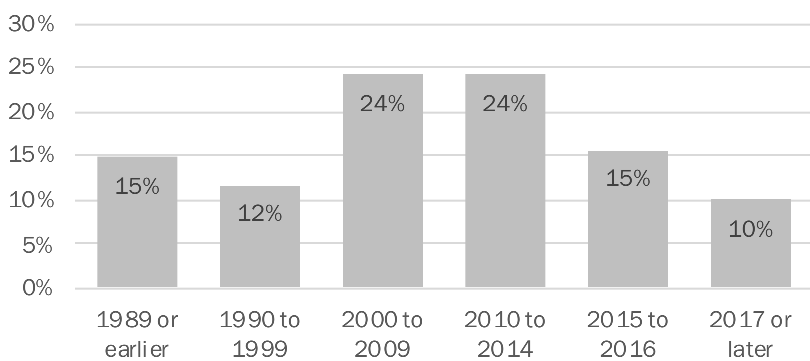
Figures 5 and 6 below compare the year residents moved into Tract 369 and the City of Philadelphia, respectively. It shows that all* residents of Tract 369 moved in after 2010, 82 percent of whom arrived in 2015 or later, while only 25 percent of residents citywide arrived in 2015 or later.

Figure 5: Year Moved in, Tract 369



Data: U.S. Census Bureau, ACS 2019 (5-year), B25026

Figure 6: Year Moved in, Philadelphia

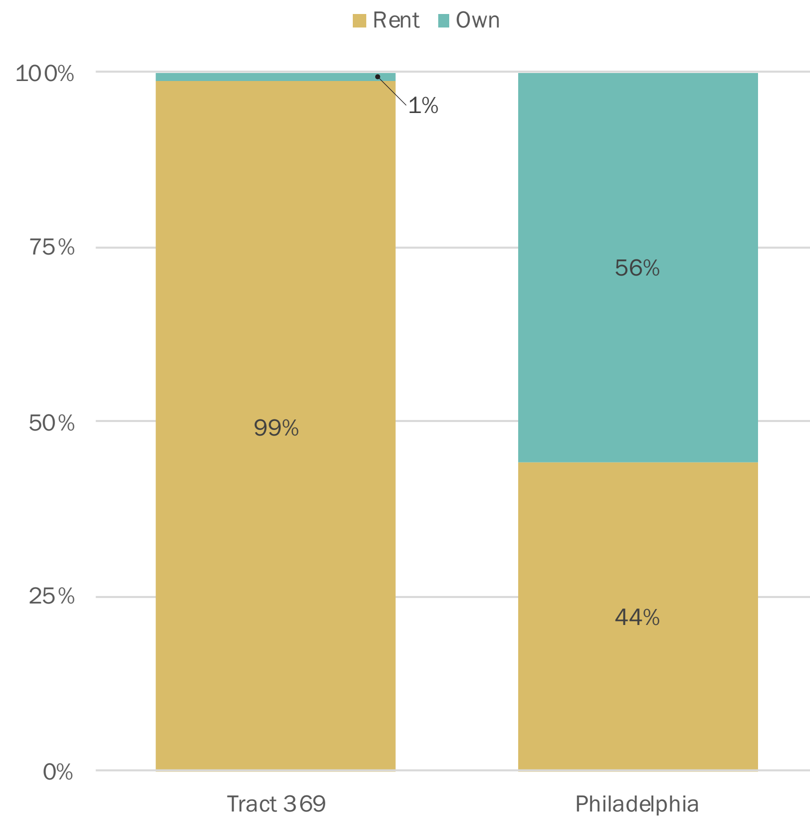


Data: U.S. Census Bureau, ACS 2019 (5-year), B25026

** Note: The 0% ACS estimate for Tract 369's three earliest time bins each come with a 0.87% margin of error*

Figure 7 below compares homeownership and rental rates within Tract 369 and the City of Philadelphia. It shows that almost all residents of the primary study area rent their housing, whereas only 44 percent rent citywide.

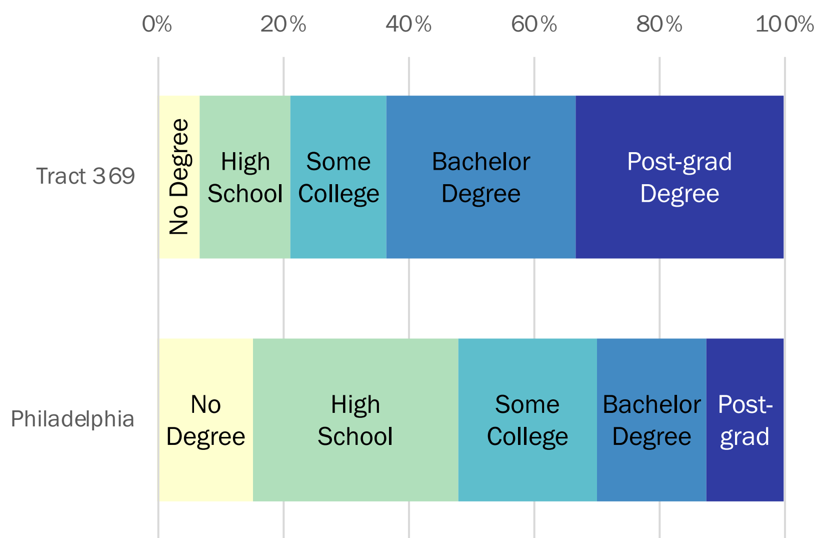
Figure 7: Ownership of Occupied Units: Tract 369 versus Philadelphia



Data: U.S. Census Bureau, ACS 2019 (5-year), B25026

Figure 8 below compares the level of education attained by residents of Tract 369 with the City of Philadelphia. It shows that residents of Tract 369 tend to have higher-level degrees than residents of the city at large, with 64 percent of residents in Tract 369 with at least a bachelor's degree, compared to 30 percent citywide.

Figure 8: Educational Attainment: Tract 369 versus Philadelphia

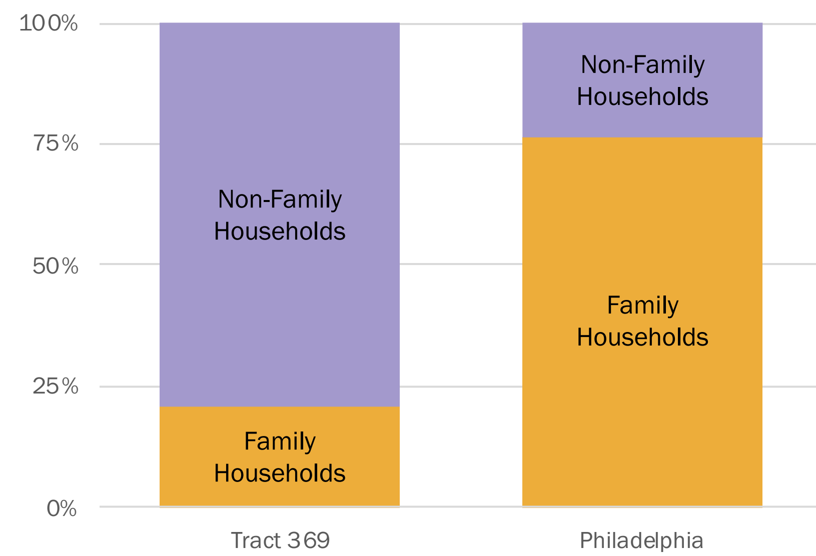


Data: U.S. Census Bureau, ACS 2019 (5-year), B15002

Figure 9, at right, compares the populations of Tract 369 and the City of Philadelphia by household type. The U.S. Census Bureau defines non-family households as those where no one is related to each other, whereas family households have at least two members who are related in some way. In Tract 369, over three-quarters of residents live in non-family housing, whereas only 23 percent of residents citywide live in non-family housing.

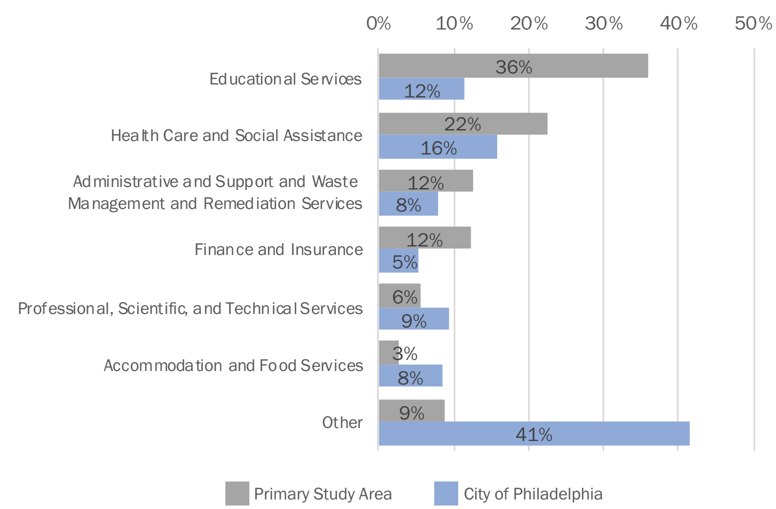
Figure 10, at right, identifies the primary employment sectors within the study area, with Educational Services and Health Care together comprising 58 percent of all jobs.

Figure 9: Population by Household Type: Tract 369 versus Philadelphia



Data: U.S. Census Bureau, ACS 2019 (5-year), B11002

Figure 10: Primary Study Area Employment by Sector



Data: National Establishment Time-Series, 2015

Table 1 below identifies the scores that Census Tracts 369 and 9800 received using a city-specific implementation of DVRPC's "Indicators of Potential Disadvantage" (IPD) analysis methodology. As opposed to DVRPC's regional IPD analysis, this specific IPD analysis compares census tracts within Philadelphia and scores tracts relative to other city tracts. IPD scores are based on statistical distributions of tract values within a set geography and the number of standard deviations from the mean in which a given tract value falls. Full information on IPD purpose and method can be found at: https://www.dvrpc.org/webmaps/ipd/.

The IPD analysis identifies populations of interest under Title VI of the Civil Rights Act and the Executive Order on Environmental Justice signed by President Bill Clinton. Data from the U.S. Census ACS 2014–18 5-year estimates were used to quantify these populations at the census tract level. The values in Table 1, particularly for Tract 369, are reflective of the primarily student populations housed there compared to Philadelphia as a whole. The "Above Average" Low Income value is a result of full-time students rarely having full-time employment.

Table 1: IPD Relative to City of Philadelphia

Population	Census Tract 369	Census Tract 9800
Youth	Well Below Average	Below Average
Older Adults	Below Average	Well Below Average
Female	Average	Above Average
Racial Minority	Below Average	Average
Ethnic Minority	Average	Average
Foreign-Born	Above Average	Above Average
Limited English Proficiency	Average	Average
Disabled	Well Below Average	Well Below Average
Low Income	Above Average	Below Average

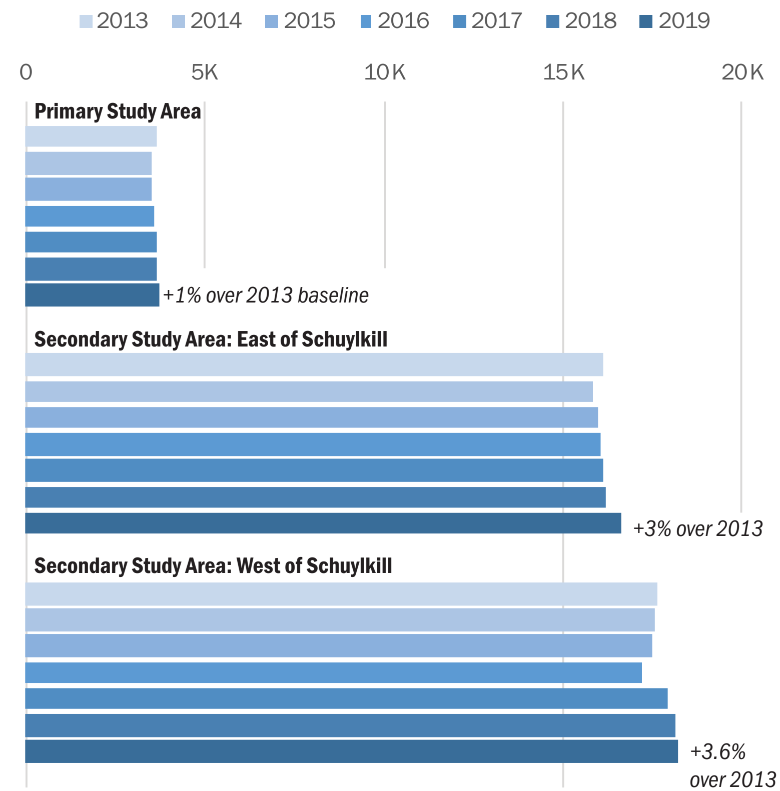
Data: DVRPC analysis of U.S. Census Bureau data

Housing Unit Development

The number of housing units between 2013 and 2019 was analyzed within the primary study area, as well as within the two secondary study areas on the east and west sides of the Schuylkill River.

As Figure 11 below shows, in all cases the number of available housing units dropped from 2013 levels for a few years before rebounding. By 2019 all three zones had surpassed their 2013 levels by 1 to 3 percent.

Figure 11: Number of Housing Units Since 2013



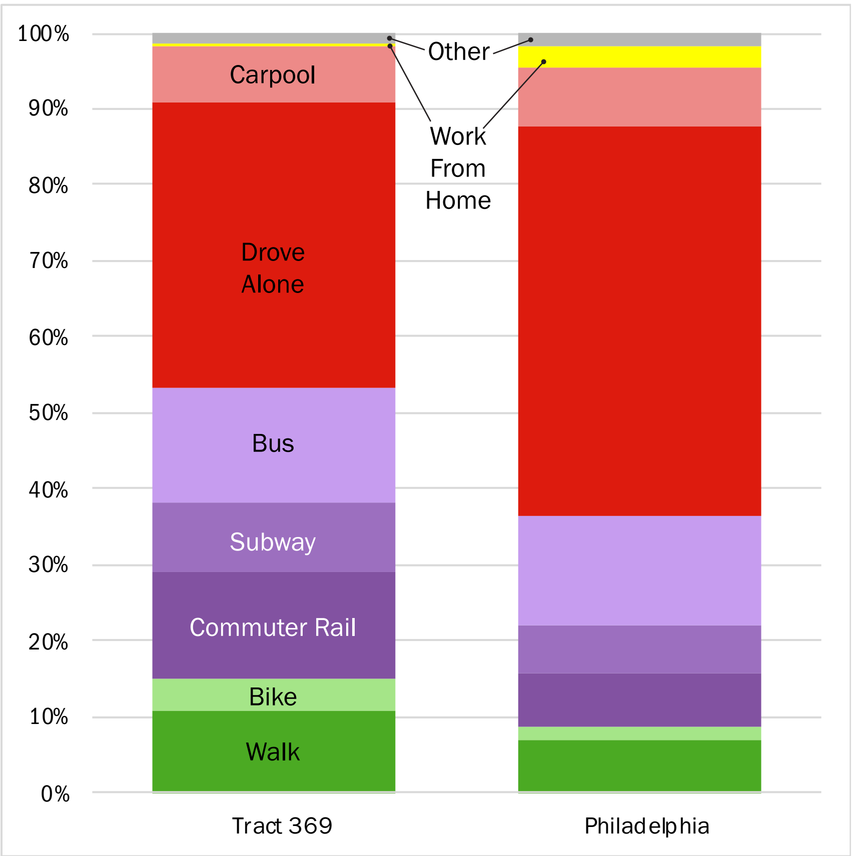
Data: U.S. Census Bureau, ACS 2019 (5-year), B25001

Journey to Work

Figure 12 below compares the mode of travel to work for people **who work** in Tract 369 and the City of Philadelphia. This dataset is provided by the U.S. Census Bureau's Census Transportation Planning Product, and the most recent year of available data is 2016. This graph shows that driving alone is the single most-common commute mode for workers in Tract 369, although there are larger shares of walking, subway, and commuter rail than the profile of workers in the city at large.

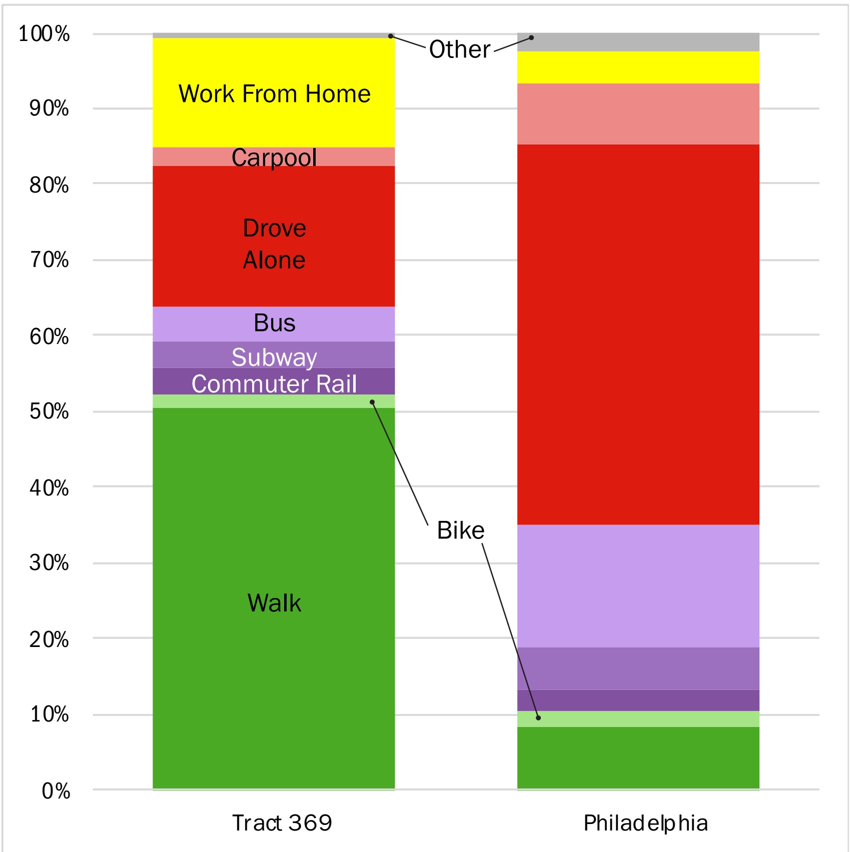
Figure 13 below compares the mode of travel to work for people **who live** in Tract 369 and the City of Philadelphia. It shows that people living within Tract 369 are substantially more likely to walk to work and less likely to drive alone, with approximately half of all workers walking to work. It is worth noting that post-pandemic behaviors and the return of expensive energy are likely to conspire to change these patterns going forward.

Figure 12: Worker Commute Travel Mode: Tract 369 vs Philadelphia



Data: U.S. Census Bureau, CTPP 2016 (5-year), A202105

Figure 13: Resident Commute Travel Mode: Tract 369 vs Philadelphia



Data: U.S. Census Bureau, ACS 2019 (5-year), B08006

Infrastructure Networks

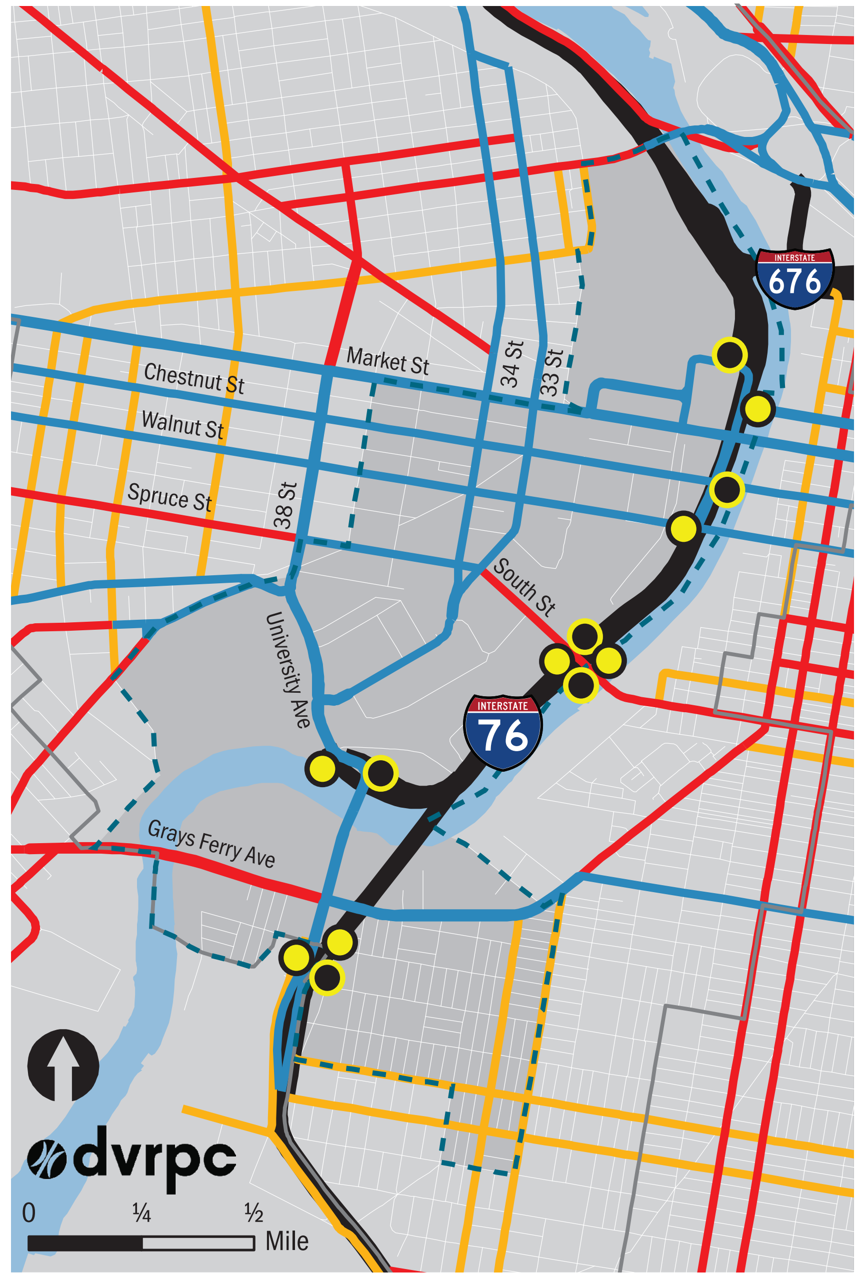
Roadway Functional Class

The study area, as shown in Figure 14, is traversed by a multitude of high-volume roadways classified as principal arterials, including corridors that run east-west (Market, Chestnut, Walnut, and Spruce streets), as well as north-south (33rd and 34th streets).

There are many connections to the highway network, with multiple sets of access ramps between the study area and I-76/I-676 (Schuylkill and Vine Street expressways, respectively). In addition, eight bridges provide connections over the Schuylkill River, from north to south:

- Spring Garden Street.
- JFK Boulevard.
- Market Street.
- Chestnut Street.
- Walnut Street.
- South Street.
- 34th Street / University Avenue.
- Grays Ferry Avenue.

Figure 14: Roadway Functional Class



Functional Classification
- Interstate
- Principal Arterial
- Minor Arterial
- Major Collector

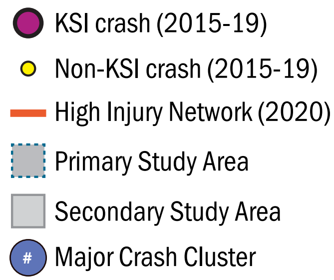
Highway Access Ramps
- On Ramp
- Off Ramp

Other Layers
- Primary Study Area
- Secondary Study Area

Data: PennDOT

Motor Vehicle Collisions

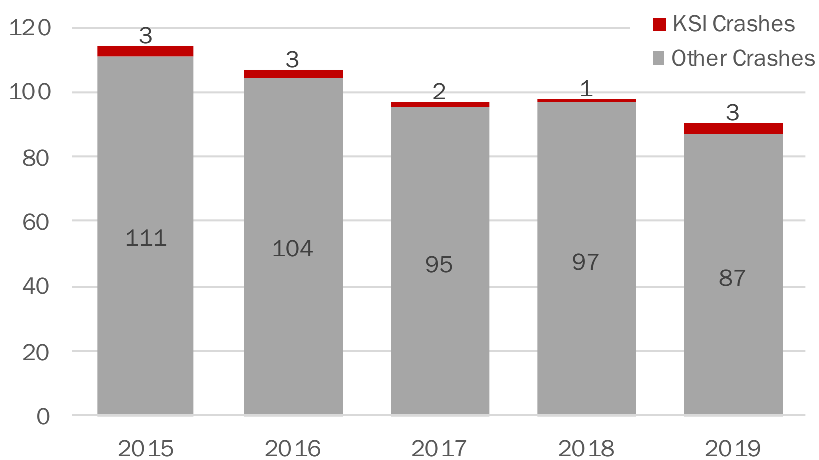
Figure 16 at right illustrates the geographic location of motor-vehicle-only collisions from the past five years of available data (2015-2019) , highlighting locations where someone was killed or severely injured (KSI). Major clusters occurred at:



1. Grays Ferry Avenue & S 34th Street.
2. University Avenue & I-76 ramps.
3. 38th Street at a number of cross streets, including Spruce, Chestnut, and Market streets.
4. Spring Garden Street & N 31st Street.

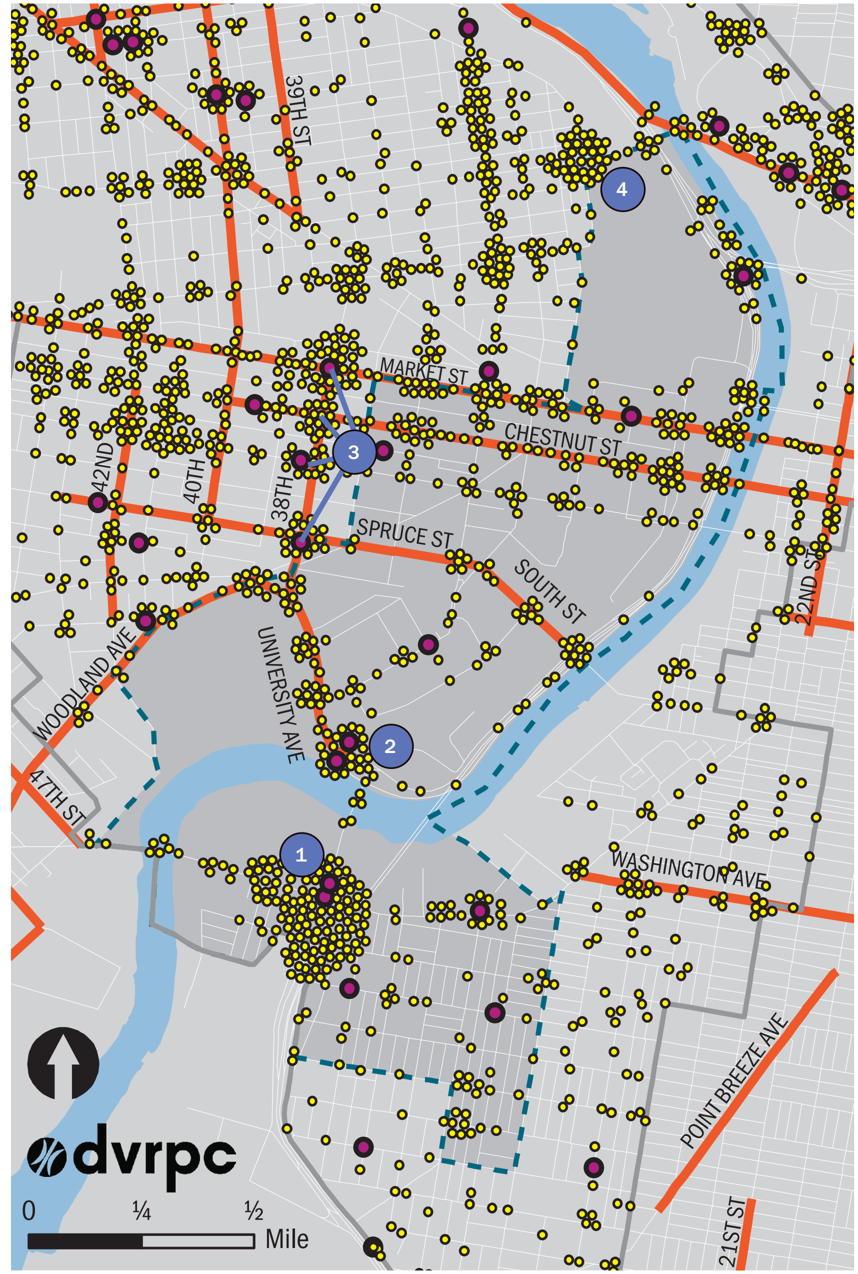
Figure 15 below identifies the number of KSI and non-KSI motor-vehicle-only collisions in the primary study area by year, showing a gradual reduction in collisions over the past five years of available data.

Figure 15: Primary Study Area Motor-Vehicle-Only Collisions by Year



Data: PennDOT

Figure 16: Motor-Vehicle-Only Crashes



Data: City of Philadelphia, PennDOT

Parking Occupancy

The Philadelphia City Planning Commission (PCPC) inventoried parking within University City in 2017 and found that 70 percent of all parking was occupied across the entire study area. Table 2 at right summarizes PCPC's findings.

Of the public parking facilities, Figure 17 shows that occupancy was highest in the Powelton Village neighborhood at 92 percent occupied.

Figure 18 shows that private parking facilities were more occupied around the Medical Campus and USciences neighborhoods.

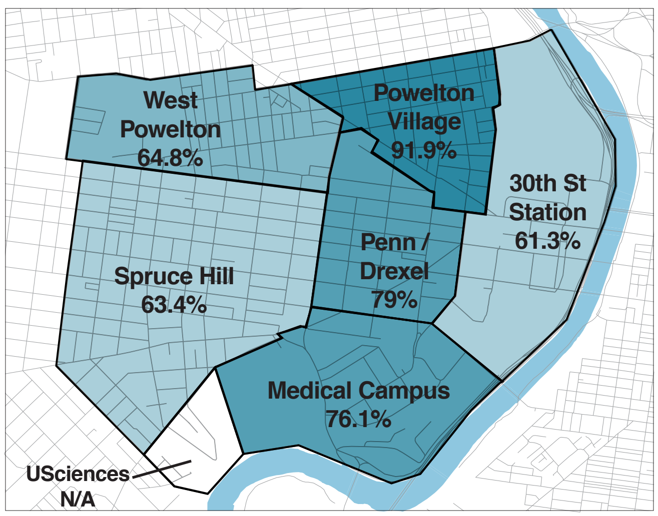
Table 2: Parking Occupancy Rates

Occupancy Rate
By Area

Area	Public Occupancy	Private Occupancy
30th St Station	61.3%	60.5%
Penn/Drexel	79%	62%
Medical Campus	76.1%	79.9%
West Powelton	64.8%	13.6%
Spruce Hill	63.4%	67.5%
USciences	N/A	86.3%
Powelton Village	91.9%	58.5%
ALL University City	70.1%	69.8%

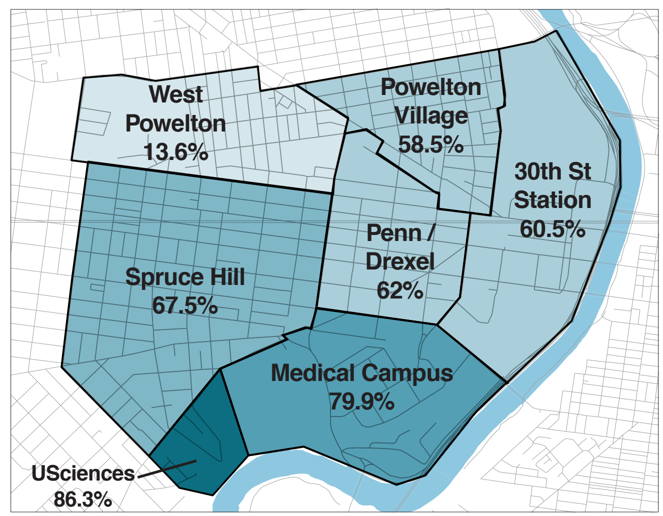
Source: PCPC University City Parking Inventory, 2017

Figure 17: Public Daytime Parking Occupancy Rates



Source: PCPC University City Parking Inventory, 2017

Figure 18: Private Daytime Parking Occupancy Rates



Source: PCPC University City Parking Inventory, 2017

Bicycle Network

Figure 19 shows University City's dense bicycle network with lanes on all major East-West arterials, many of them buffered or protected. There are many connections between University City and Center City, with six bridges over the Schuylkill River featuring bicycle facilities (Chestnut Street, Walnut Street, South Street, S 34th Street / University Avenue, and Grays Ferry Avenue).

In addition to the bicycle facilities, University City contains 8 active Indego bike share stations, and is surrounded by additional stations on all sides of the study area.

Planned bicycle network improvements within the study area include:

- connections to/around 30th Street Station.
- two additional bridge connections (JFK Boulevard and Grays Ferry Swing Bridge).
- improvements to S 32nd Street and River Fields Drive.
- expansion of the Indego service area westward.
- improvements along Walnut Street.
- improvements on the Chestnut Street Bridge.

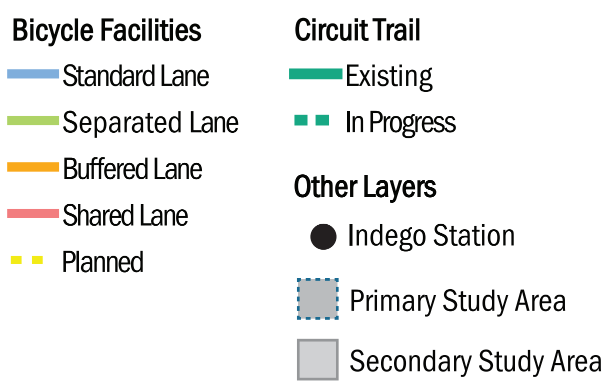
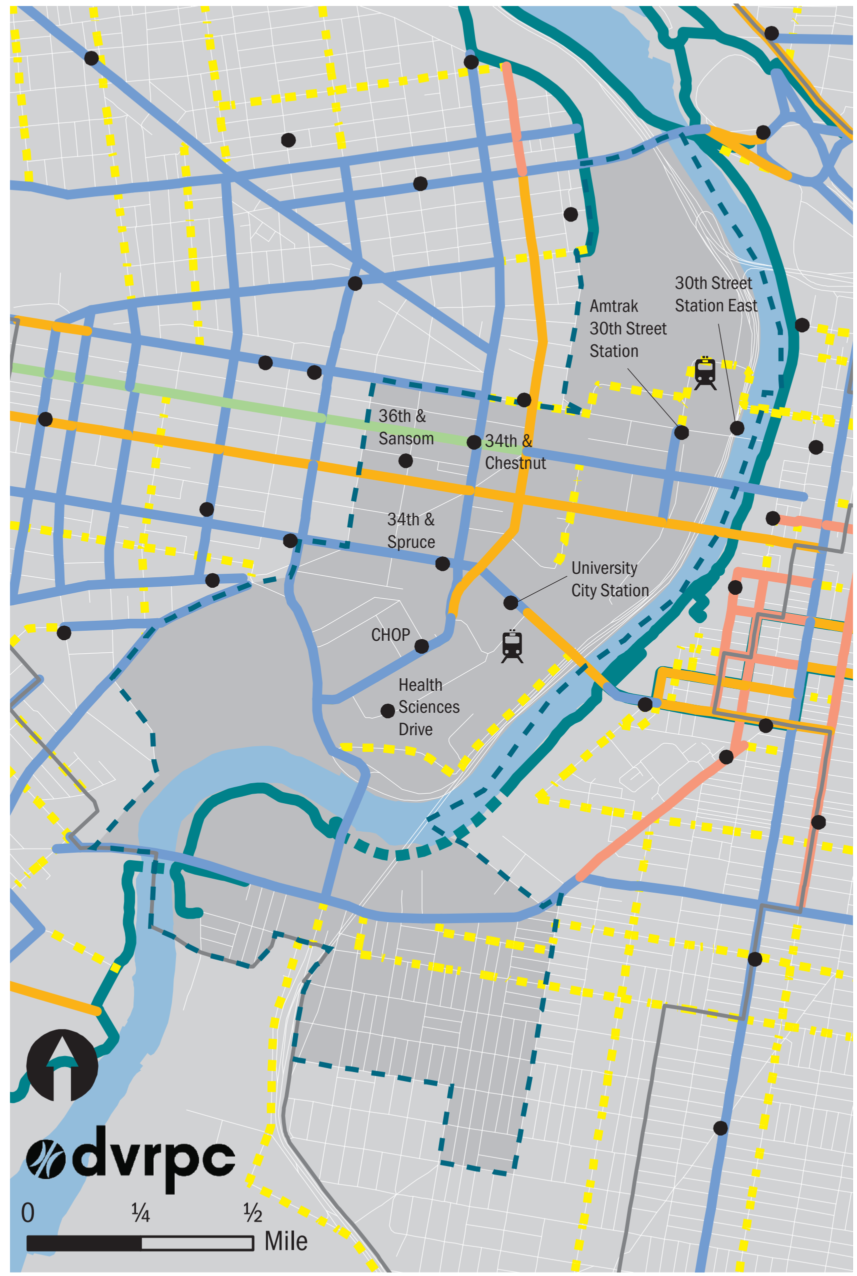


Figure 19: Bicycle Network



Data: City of Philadelphia, Bicycle Transit Systems

Bicycle Collisions

Figure 20 below identifies the number of bicyclist-involved collisions in the primary study area by year, showing that 2019 had 44 percent fewer crashes than 2015.

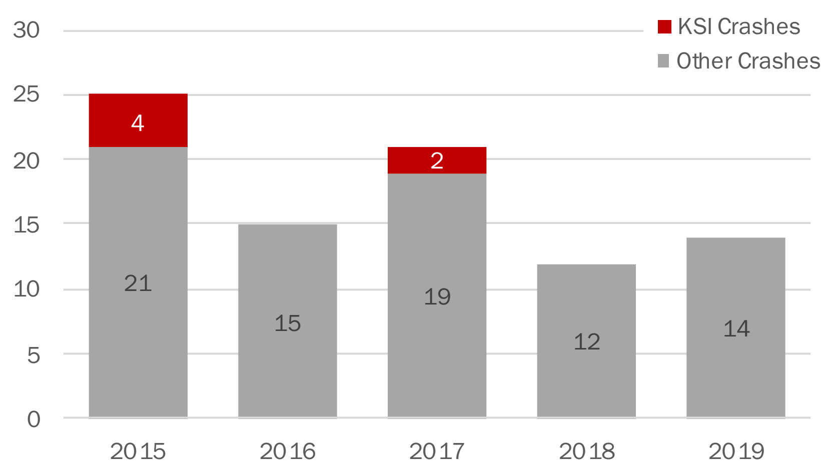
Figure 21 at right illustrates the geographic location of bicyclist-involved collisions (2015-2019) within the primary and secondary study areas, highlighting KSI collision locations.

Major clusters occurred at:

1. 34th Street and Spruce/South streets.
2. 38th Street & Spruce Street.

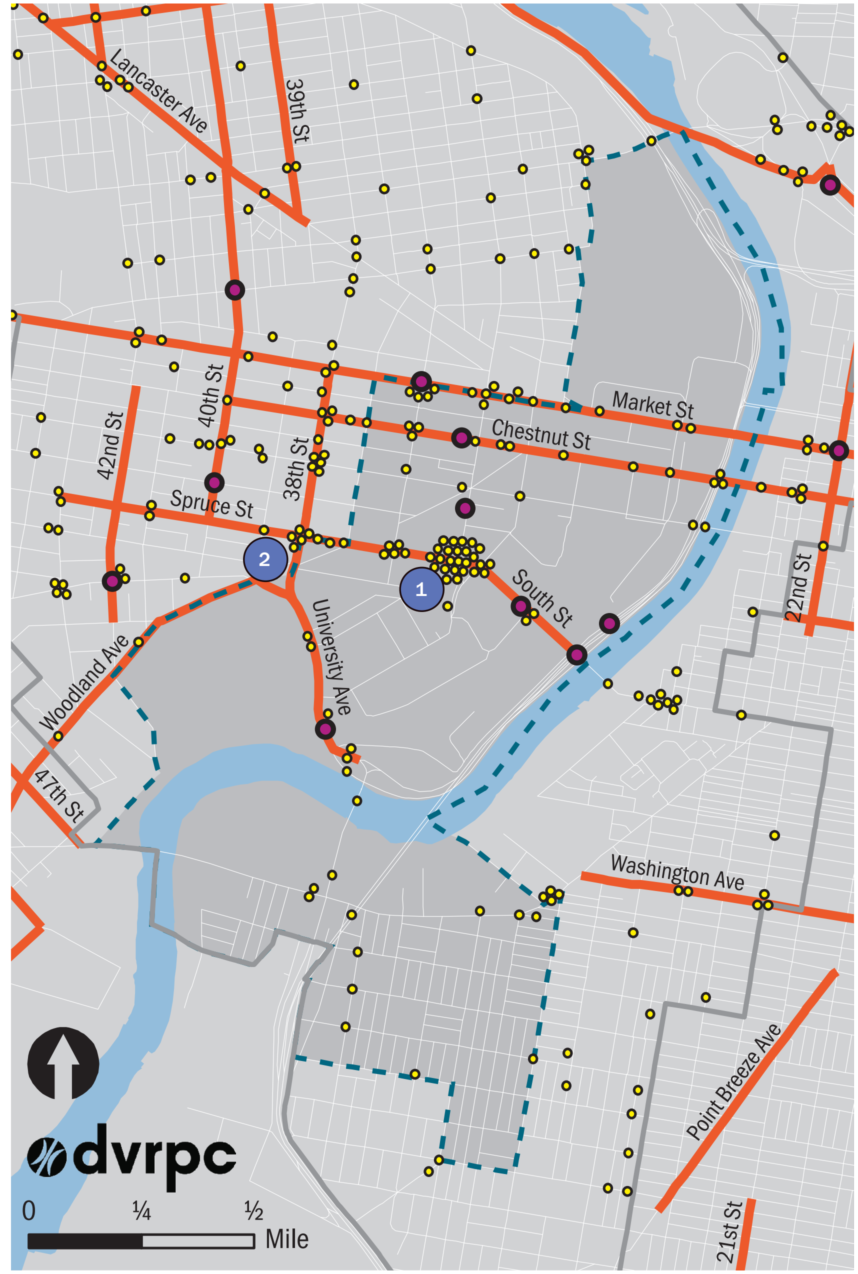
In addition, Chestnut Street, Market Street, and 38th Street tend to have at least a few bicyclist-involved collisions every block or two.

Figure 20: Primary Study Area Bicycle-Involved Collisions by Year



Data: PennDOT

Figure 21: Bicycle-Involved Crashes



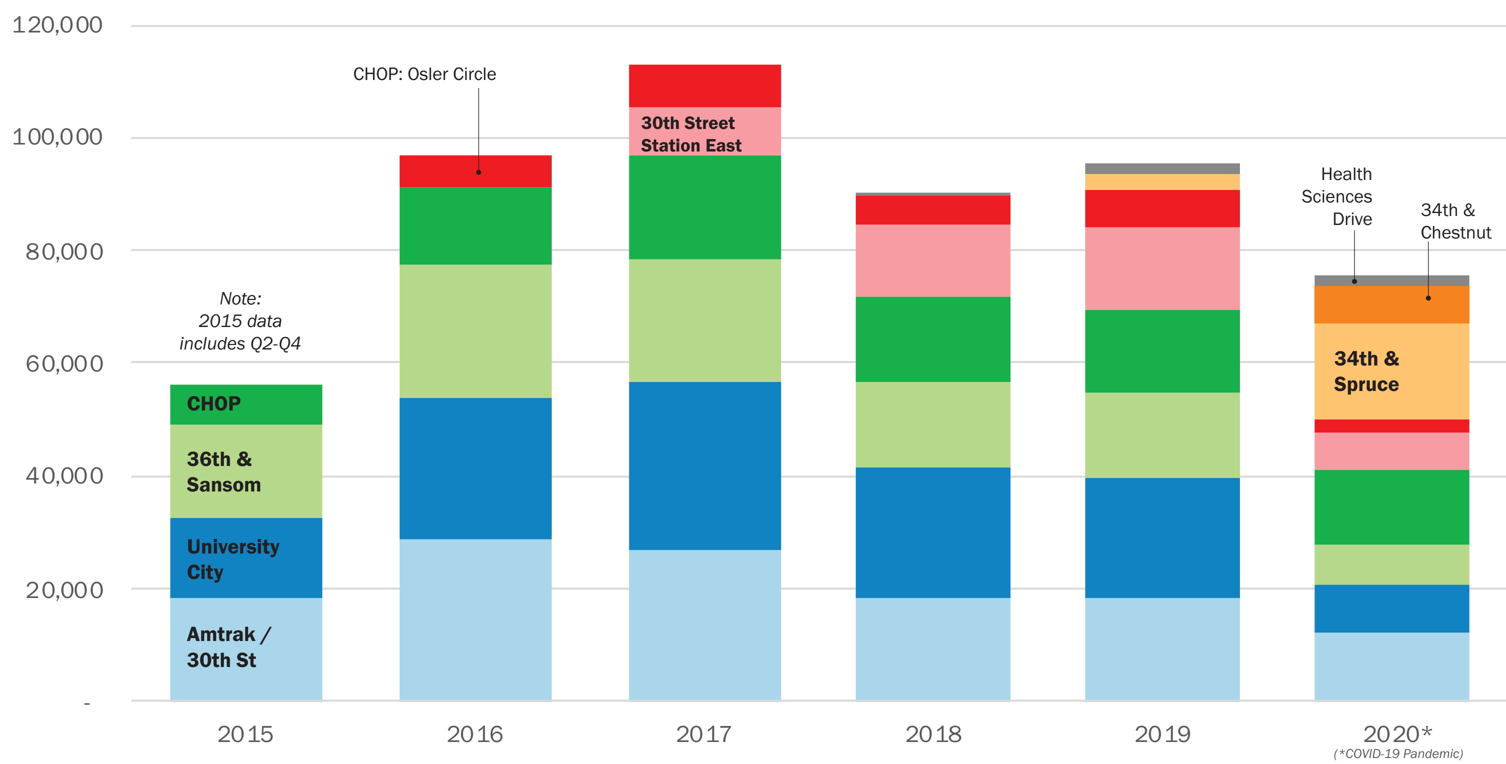
Data: City of Philadelphia, PennDOT

Bikeshare Ridership

Bikeshare travel patterns were analyzed using data provided by Bicycle Transit Systems and the City of Philadelphia. When the system initially launched in 2015 there were four stations within the study area. Over the following years five additional stations were added. One station was closed in 2020 (The Children's Hospital of Philadelphia [CHOP]: Osler Circle) but it was located within a block of another station that remains (CHOP).

Figure 22 below shows annual trips per station, calculated as the sum of inbound, outbound, and internal trips. Outbound and inbound trips are trips that start or end within the study area, respectively. Internal trips are those that start and end within the study area, and these trips were assigned to the destination station. This graph shows that total annual ridership climbed between 2015 and 2017, at which point the annual ridership began shrinking, with a 20 percent drop from 2017 to 2018, and 2020 having 33 percent less ridership than the 2017 peak. Despite the COVID-19 pandemic, bikeshare ridership in 2020 did not drop as significantly as one might expect compared to 2018 and 2019. As shown in a set of detailed station-specific graphs in Appendix A, 2020 ridership dips at many of the older Indego stations were largely offset by ridership surges at some of the newer stations, including Health Science Drive, 34th & Chestnut, and 34th & Spruce.

Figure 22: Annual Bikeshare Trips by Station



Data: Bicycle Transit Systems

Pedestrian Network

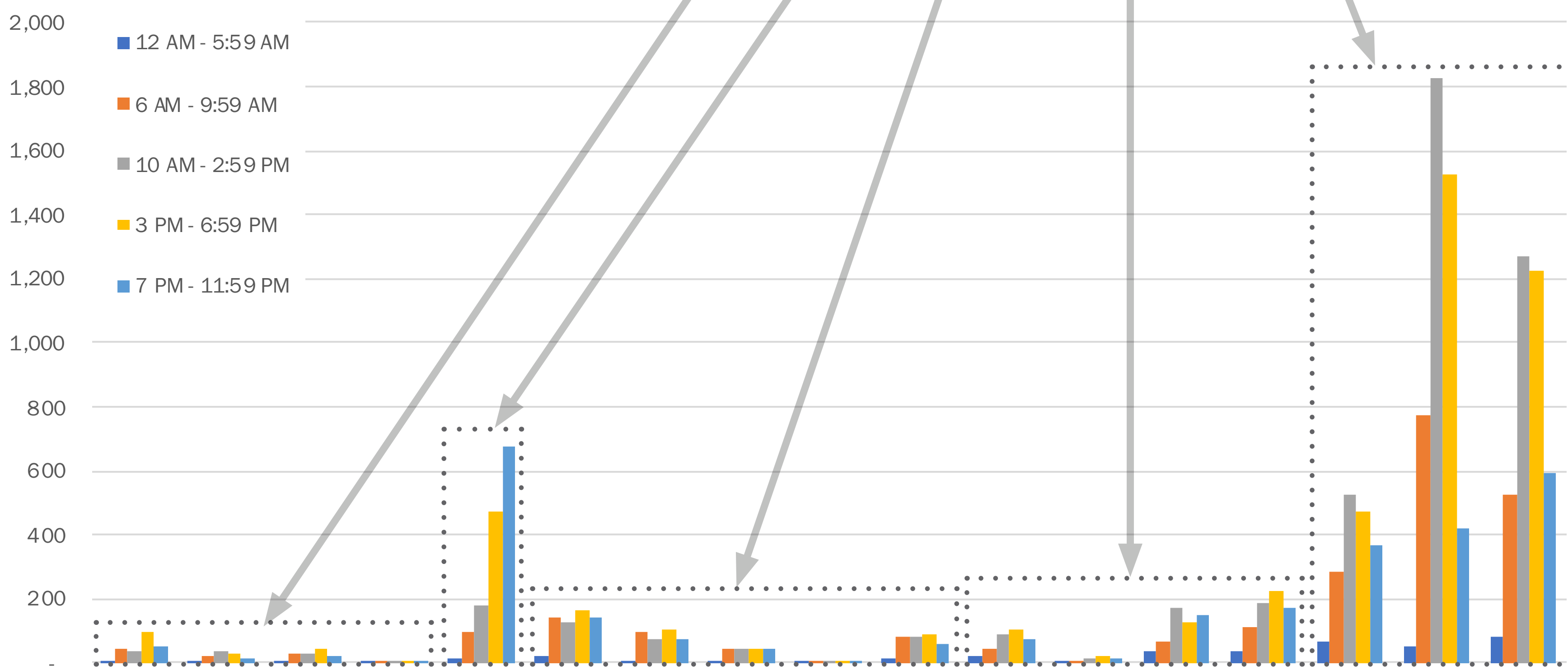
The pedestrian network within the study area is relatively complete, with most streets featuring sidewalks on both sides and crosswalk connections at the intersections.

Figure 23 below shows the pedestrian volumes during different periods for each cluster of counts. Figure 24 at right identifies locations of these recent pre-pandemic pedestrian counts. Note that more than half of these counts were collected adjacent to, but outside, the study area.

Overall the primary study area demonstrates a marked midday peak, dropping off in the evening. Activity in the secondary study area holds into the night, consistent with its mixed residential-commercial character.

Figure 24: Pedestrian Count Locations

Figure 23: Pedestrian Volumes by Time of Day



Data: University City District

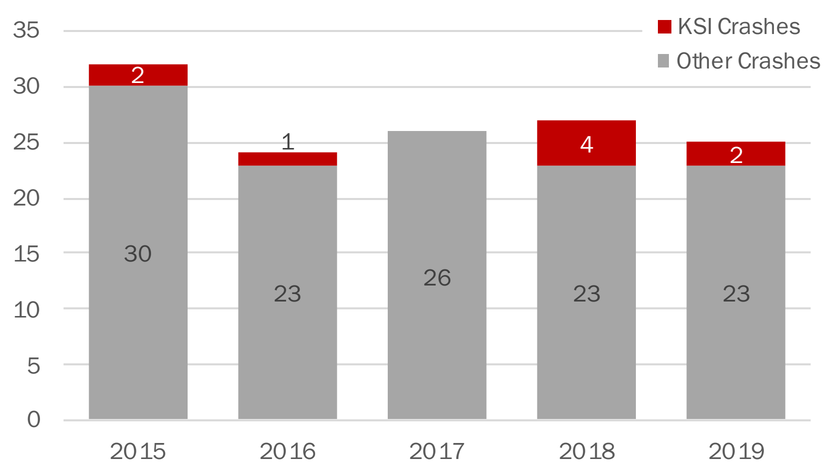
Pedestrian Collisions

KSI crash (2015-19)
Non-KSI crash (2015-19)
High Injury Network (2020)
Primary Study Area
Secondary Study Area

Figure 25 below identifies the number of KSI and non-KSI pedestrian-involved collisions by year, showing a gradual reduction in collisions over the past five years of available data.

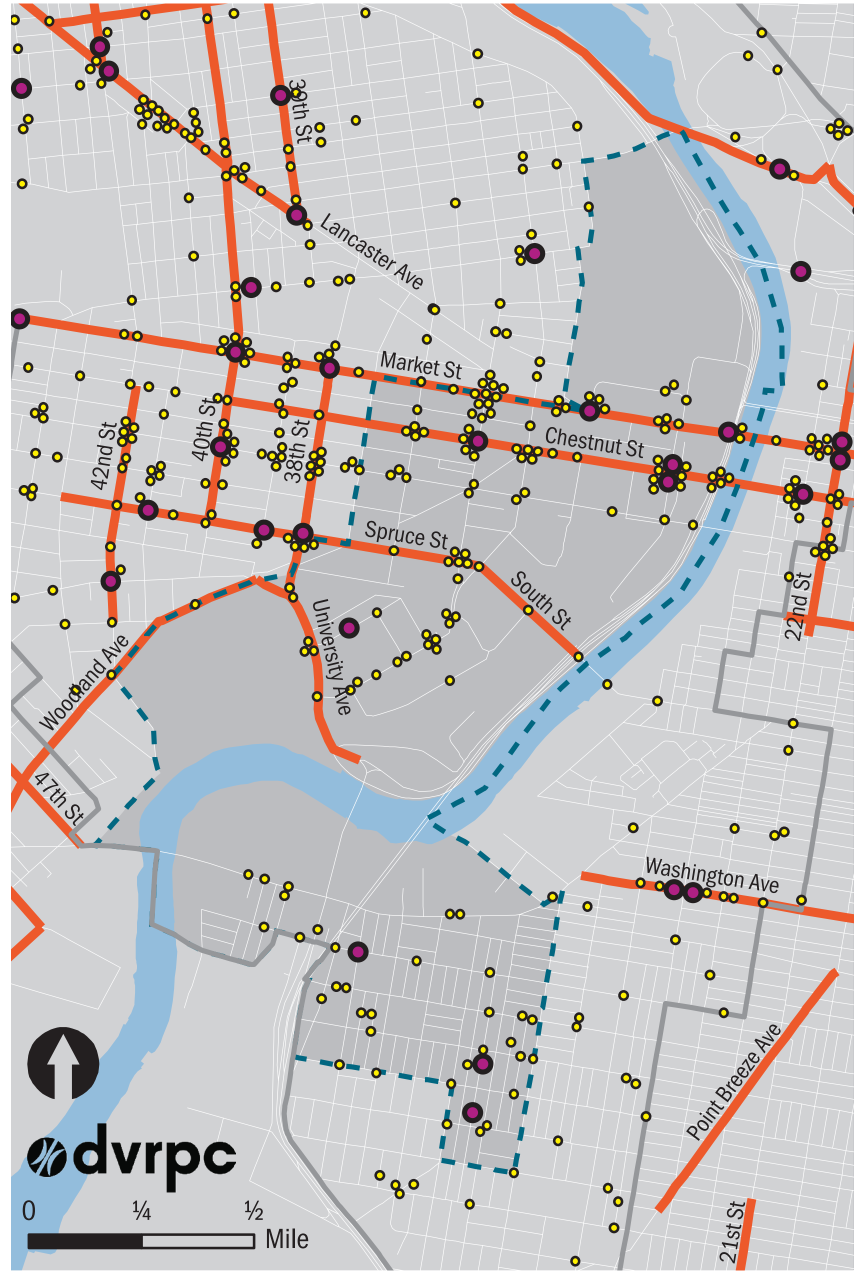
Figure 26 at right illustrates the geographic location of pedestrian-involved collisions (2015–19) within the primary and secondary study areas, highlighting KSI collision locations. Major clusters occurred along the Market Street, Chestnut Street, and the 34th Street corridors.

Figure 25: Primary Study Area Pedestrian-Involved Collisions by Year



Data: PennDOT

Figure 26: Pedestrian-Involved Crashes



Data: City of Philadelphia, PennDOT

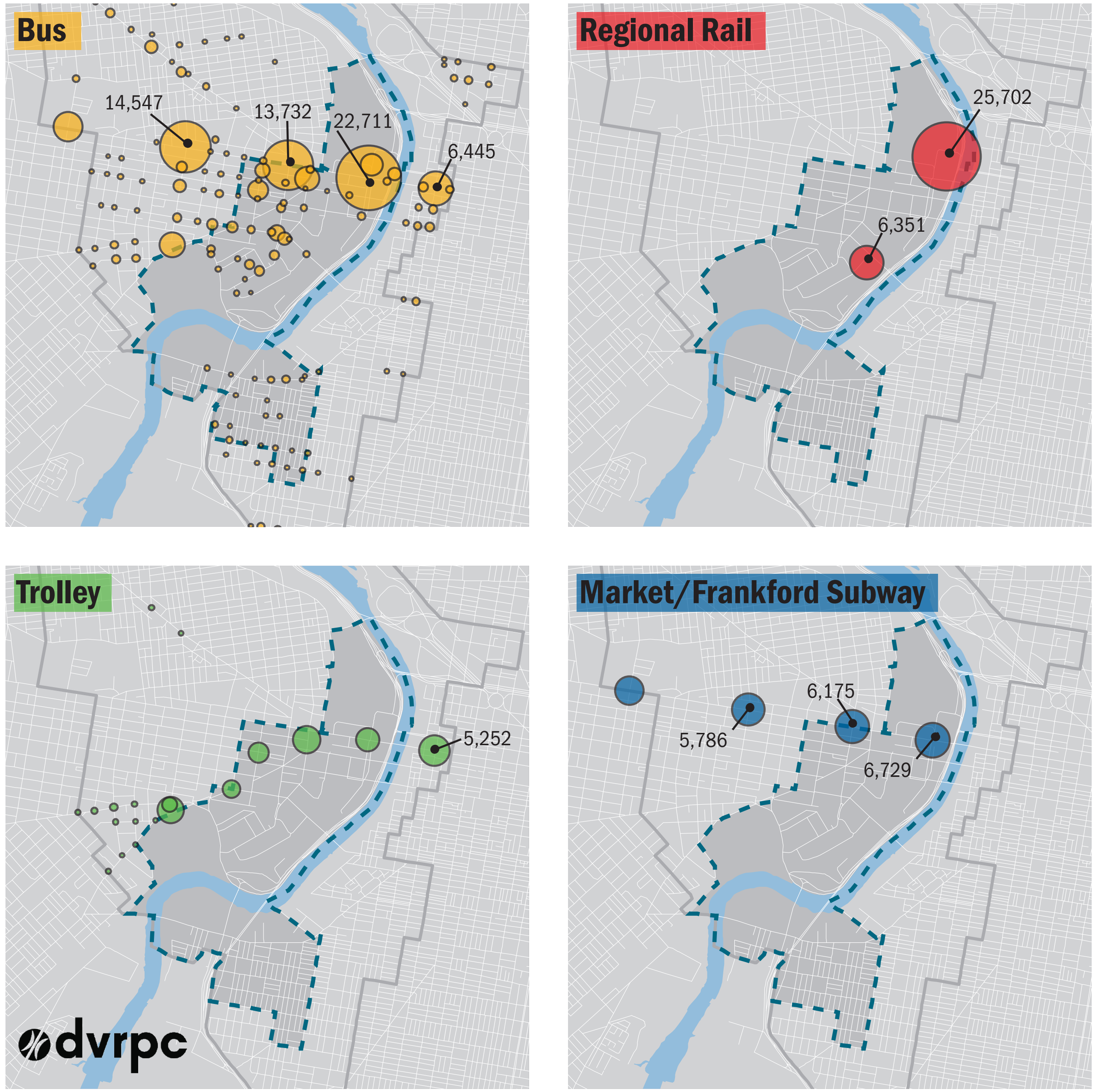
Transit Ridership

Figure 27 at right identifies transit stop ridership by mode within the primary and secondary study areas. For each mode it shows stops with at least 100 boardings and alightings on a typical weekday, and stops with more than 5,000 boardings and alightings are labeled. This analysis used the most recent available dataset for each mode (spring 2018 for all modes except bus, which uses fall 2019 data).

It shows the following modal trends:

- **Bus** boardings and alightings are clustered along Market Street, although at large ridership is more dispersed than the other transit modes due to not requiring rails to operate.
- **Trolley** boardings and alightings are highest within the primary study area.
- **Regional rail** ridership is substantially higher at 30th Street Station than at Penn Medicine station, as 30th Street provides connectivity to all regional rail routes while Penn Medicine only connects to 5 of the 13 routes.
- **Subway** ridership is reasonably consistent for each stop within the study area.

Figure 27: Transit Boardings and Alightings by Mode



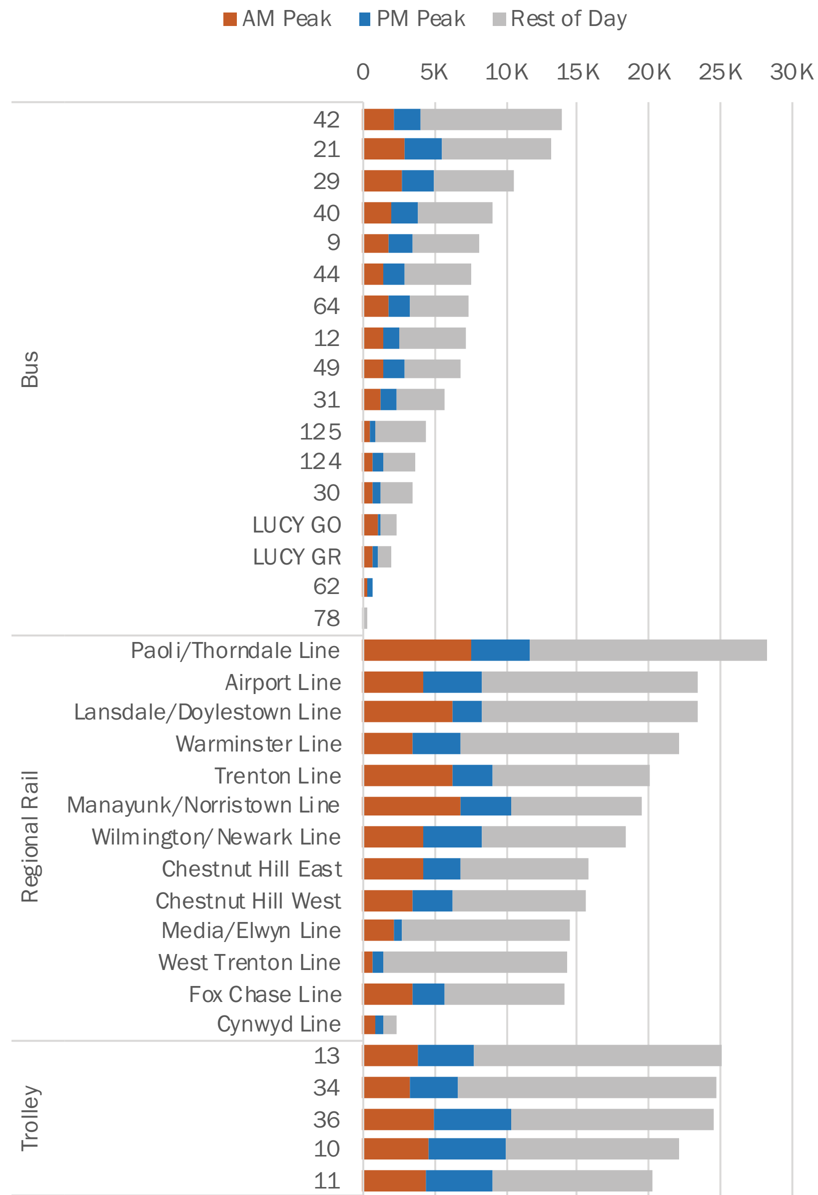
Data: SEPTA, Fall 2019 (Bus) and Spring 2018 (Trolley, Regional Rail, Market/Frankford Subway)

Transit Capacity Analysis

The transit capacity of bus, trolley, and regional rail routes that serve the study area was calculated through an analysis that accounted for scheduled vehicle trips and the number of seats available per vehicle. Trips starting between 6:00 and 9:00 AM were counted as "AM Peak," trips starting between 3:00 and 6:00 PM were counted as "PM Peak," and trips at any other time of day were counted as "Rest of Day." The output of this analysis is the number of people that can be moved by each transit service and time of day.

Figure 28 at right shows the result of this analysis for each transit route, grouped by mode. It shows that regional rail and trolley service tend to provide similar levels of transit capacity within the study area on a per-route basis. Buses provide far less capacity, despite having many more trips due to the discrepancy in capacity on a single vehicle: 59 people per 40-foot bus versus 690 people per six-vehicle set of regional rail cars. Additionally, this graph illustrates that AM and PM peak capacity typically account for less than half of all capacity in a given day.

Figure 28: Capacity of Transit Routes Serving the Study Area

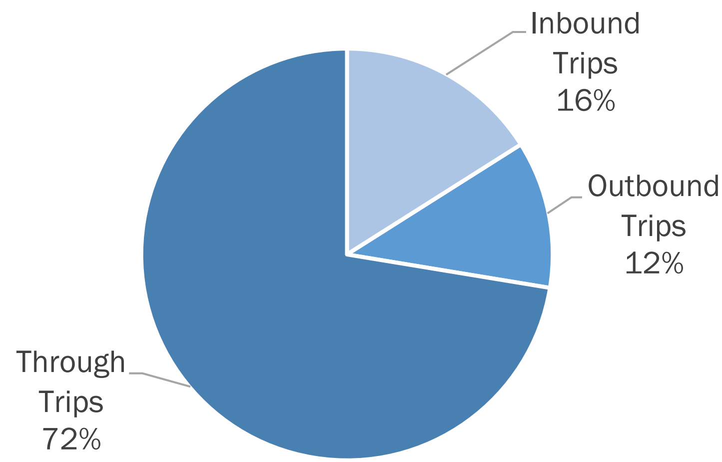


Data: SEPTA 2019 GTFS & Route Statistics Report

Freight

Heavy truck trips serving the study area (those that had a trip start or end) are shown in Figure 29 below. These trips were fairly evenly distributed across major east-west facilities with heavier north-south distribution on 38th and 34th/33rd streets, as seen in the path traces on the street network. Figure 30, at right, shows that these trips accounted for just under 30 percent of all heavy truck trips that passed through gates in and out of the study area, indicating a much higher proportion of through trips than locally serving trips. The primary gates (shown in Figure 29 as scaled point locations) of entry for local outbound heavy trucks were the 34th Street ramp to I-76 and the I-676/I-76 ramp at Arch Street. Inbound heavy trucks utilized the University Avenue and 34th Street ramps from I-76, as well as Grays Ferry Avenue.

Figure 30: Heavy Vehicle Trips within Study Area by Type



Data: INRIX

Figure 29: Inbound and Outbound Heavy Truck Movements

Data: INRIX trace trip tour data, collected over four one-week periods in 2018 that represent each season. These weeks include January 21–27, April 22–28, July 15–21, and October 14–20

Local Projects and Developments

Zoning

As shown in Figure 31, most of the study area is either the University of Pennsylvania or the Drexel University campus and is zoned "Special Purpose," which includes educational uses. There are clusters of commercially-zoned parcels surrounding 30th Street Station and in the medical cluster at the south end of the study area.

There are multiple zoning overlays within the study area, including a flood protection overlay around the Schuylkill River, as well as a Center City/University City commercial district overlay that includes 30th Street Station and a few surrounding blocks within the study area.

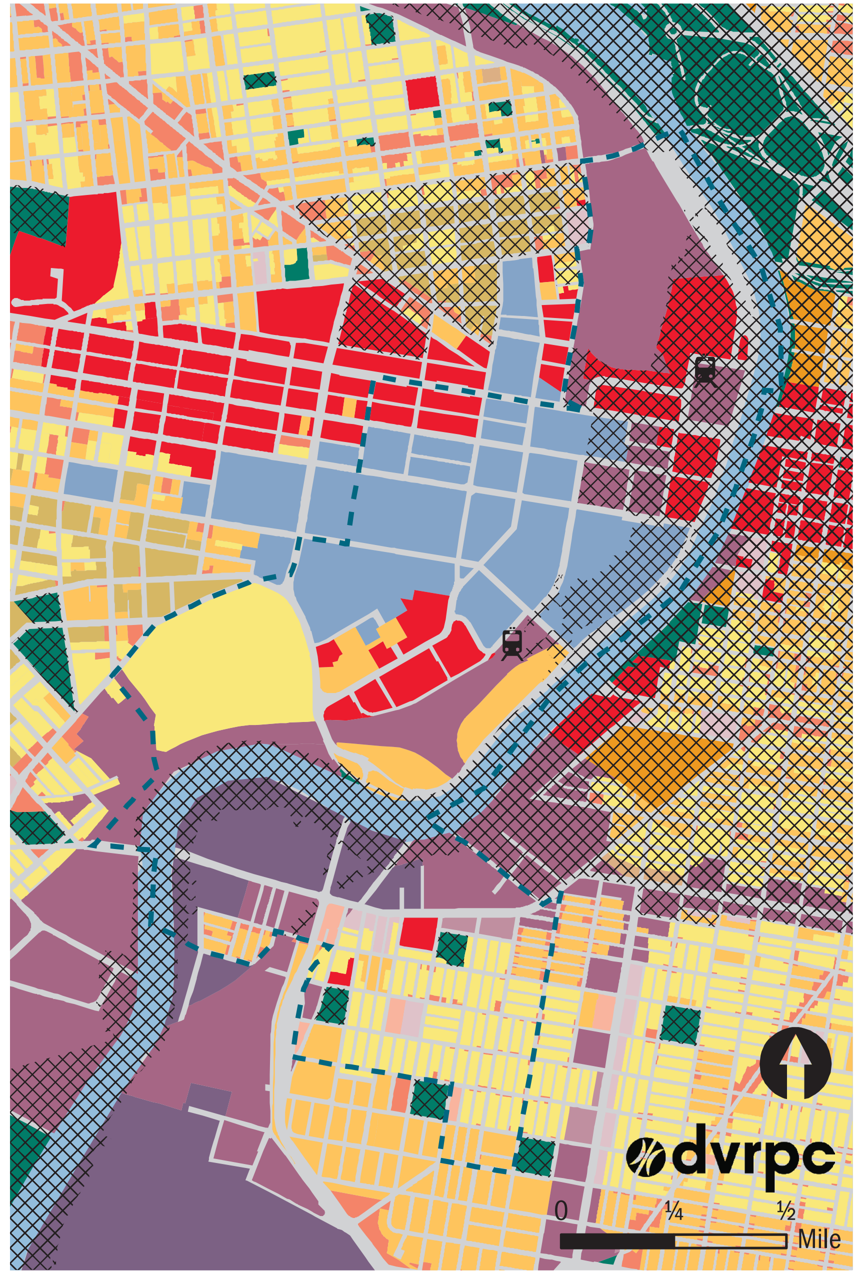
Zoning District

- Single-Family Attached Residential
- Two-Family Attached Residential
- Multi-Family Residential
- Residential Mixed-Use
- Neighborhood Commercial Mixed-Use
- Community & City Center Commericial Mixed-Use
- Auto-Oriented Commercial
- Industrial Residential Mixed-Use
- Industrial Commercial Mixed-Use
- Light Industrial
- Medium Industrial
- Heavy Industrial
- Special Purpose: Institutional
- Special Purpose: Parks & Open Space

Other Layers

- Primary Study Area
- Zoning Overlay

Figure 31: Zoning Classifications



Data: City of Philadelphia, 2020

Land Use

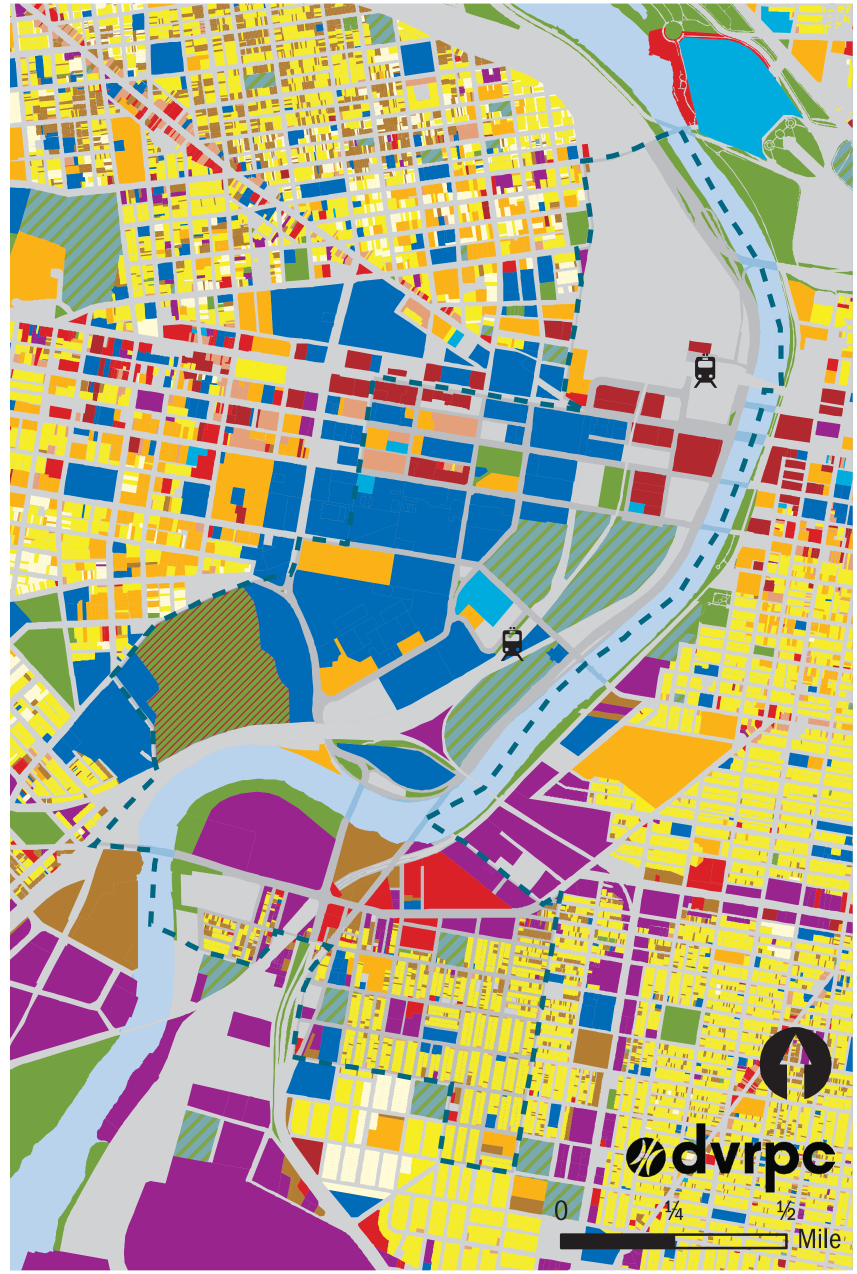
Figure 32 at right identifies land use within the study area. Large amounts of space are used for educational purposes, which are categorized as "Civic/Institution."

Consistent with the zoning shown in Figure 31, uses include sports fields along the western bank of the Schuylkill River ("Active Recreation"), transportation uses around 30th Street Stations, and high-density student housing.

Land Use

- Residential Low
- Residential Medium
- Residential High
- Commercial Consumer
- Commerical Business/Professional
- Commerical Mixed Residential
- Industrial
- Civic/Institution
- Transportation
- Culture/Amusement
- Active Recreation
- Park/Open Space
- Cemetery
- Water
- Vacant
- Other/Unknown
- No Data
- Primary Study Area

Figure 32: Land Use



Data: City of Philadelphia, 2016

Local Planning Projects

Recent planning projects within the study area were reviewed, and any transportation-related recommendations or planned developments were added to the model. These plans included:

- *Lower Schuylkill Master Plan* (2013).
- *University Southwest District Plan* (2013).
- *30th Street Station District Plan* (2016).
- *University City Parking Inventory* (2017).
- *UPenn Traffic, Parking & Circulation Study* (2019).
- *Market Assessment of Life Science Laboratory Space in Philadelphia* (2019).

Projects

Projects within the study area from DVRPC's TIP are shown in Figure 33 at right. A comprehensive table identifying each project by its ID label can be found in Appendix B.

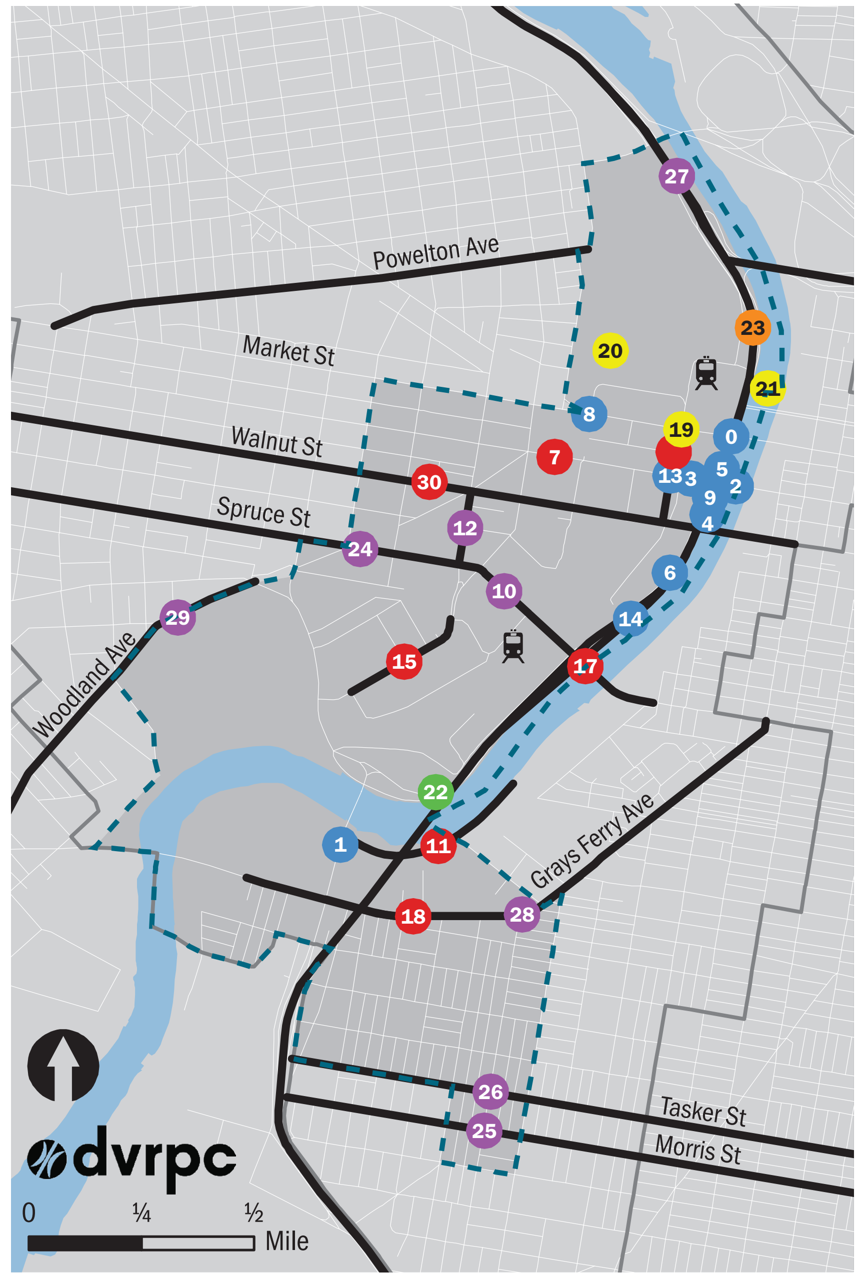
Project Type

- Bicycle / Pedestrian Improvement
- Bridge Repair / Replacement
- Intersecction / Interchange Improvement
- Roadway Rehabilitation
- Signal / ITS Improvement
- Transit Improvement
- Corridor Improvement

Other Layers

- Primary Study Area
- Secondary Study Area

Figure 33: Local TIP Projects



Data: DVRPC

CHAPTER 2

Development Scenarios

Scenarios

Projects Included in Development Scenarios

Recent planning projects within the study area were reviewed, and any transportation-related recommendations or planned developments were identified for inclusion in scenarios of potential futures. The potential futures were translated into modeling inputs and analyzed to evaluate the likely impacts of continued development on the function of (the) University City transport system(s). These inputs were used to inform DVRPC forecasting Travel Improvement Model version 2.3 (TIM 2.3) which combines statistical models of traveler behavior with a network model to estimate future travel patterns.

On the transportation side, projects include those from the TIP and Long-Range Plan (LRP), as well as third-party initiatives to the extent they can be translated into model inputs. Programs or projects not amenable to direct modeling were evaluated off-model (i.e. - using analytical tools and methods separate from TIM to estimate future impacts) to the extent that available data and project capacity allowed.

Figure 34 (page 24) identifies the location, type, and intensity of development projects currently slated for inclusion in the modeling scenarios. Table 3 (page 25) shows details of the developments by name or location, including type of use and square footage, or, in the case of residential development, number of proposed dwelling units. Please note that large developments with multiple specified uses will have separate entries for each proposed use.

Project Selection and Scenario Method

For the development scenarios three potential futures for the horizon year of 2045 have been posited:

1. Aspirational/High Growth:
   This scenario assumes that all projects, will be built as specified in permitting applications, plans, or proposals. Two straight-line trend projections were developed for the zones (Traffic Analysis Zone [TAZ]: a census geography used specifically for transport modeling, see Figure 35 on page 26) in the medical campus and the remainder of the primary study area, respectively. The former used development occuring from 2005 to 2020 to derive annual rates of growth, which were then extended out to 2045. The same method was used for the remainder of the primary study area with the rate being derived from the trend of development from 2005 through 2027 based on the current development pipeline. This scenario also assumes that the 30th Street Master Plan comes to full fruition ahead of schedule and is completed by 2045.

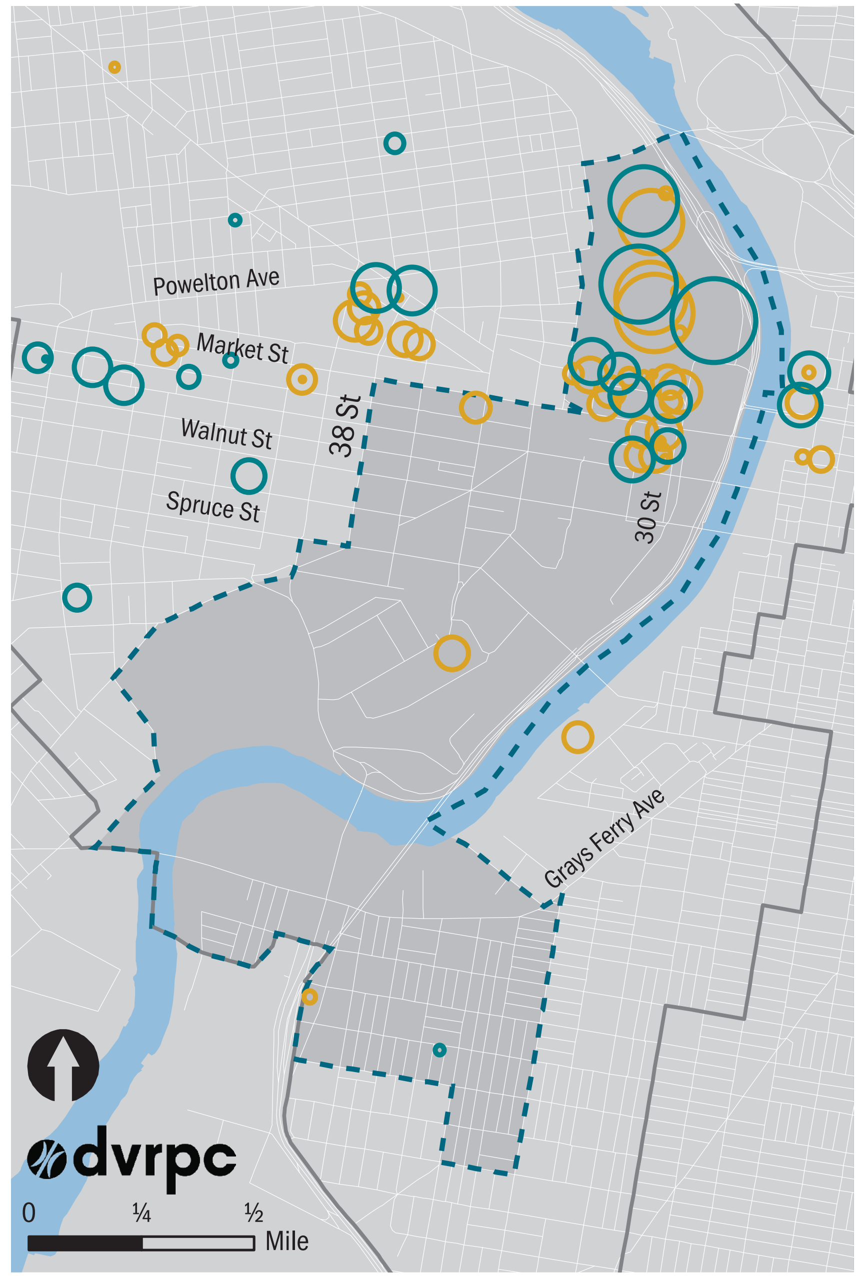
2. Moderate Growth:
   In this scenario a global factor of 0.7 is applied to the high-growth trend lines for the study area. This scenario assumes that some combination of forces depresses demand for new development in the mid to long term. It is assumed that the 30th Street Master Plan is built according to its current proposed timeline.

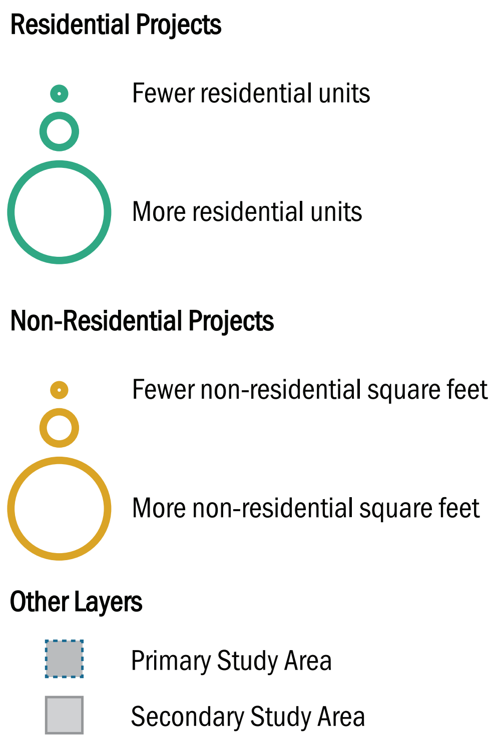
3. Baseline:
   This scenario includes only the developments listed in Table 3 and assumes no further development thereafter. The values used in this scenario are consistent with the DVRPC board-adopted forecasts for the area.

The horizon year for scenarios was set at 2045 to maintain consistency with the current DVRPC LRP demographic and employment forecasts and the upper bound forecasting year of TIM 2.3. For scenario evaluation purposes the regional demographic and employment forecasts remain constant for the rest of the region, while development-specific values replace regional forecast values in the study area.

The two non-baseline scenarios to be evaluated are intended as upper- and lower-bound potential futures in terms of development intensity and resulting transportation demand. The factor of 0.7 applied to overall development in the "Moderate Growth" scenario is intended to reflect a reasonable least-growth case given a high degree of uncertainty as to the downstream effects of current global, national, and local trends and forces. Barring radical change or system collapse we assume that the reality of 2045 will fall somewhere in the range created by these two alternative futures.

Figure 34: Projects Included In Development Scenarios





Data: CoStar, DVRPC, Philadelphia City Planning Commission

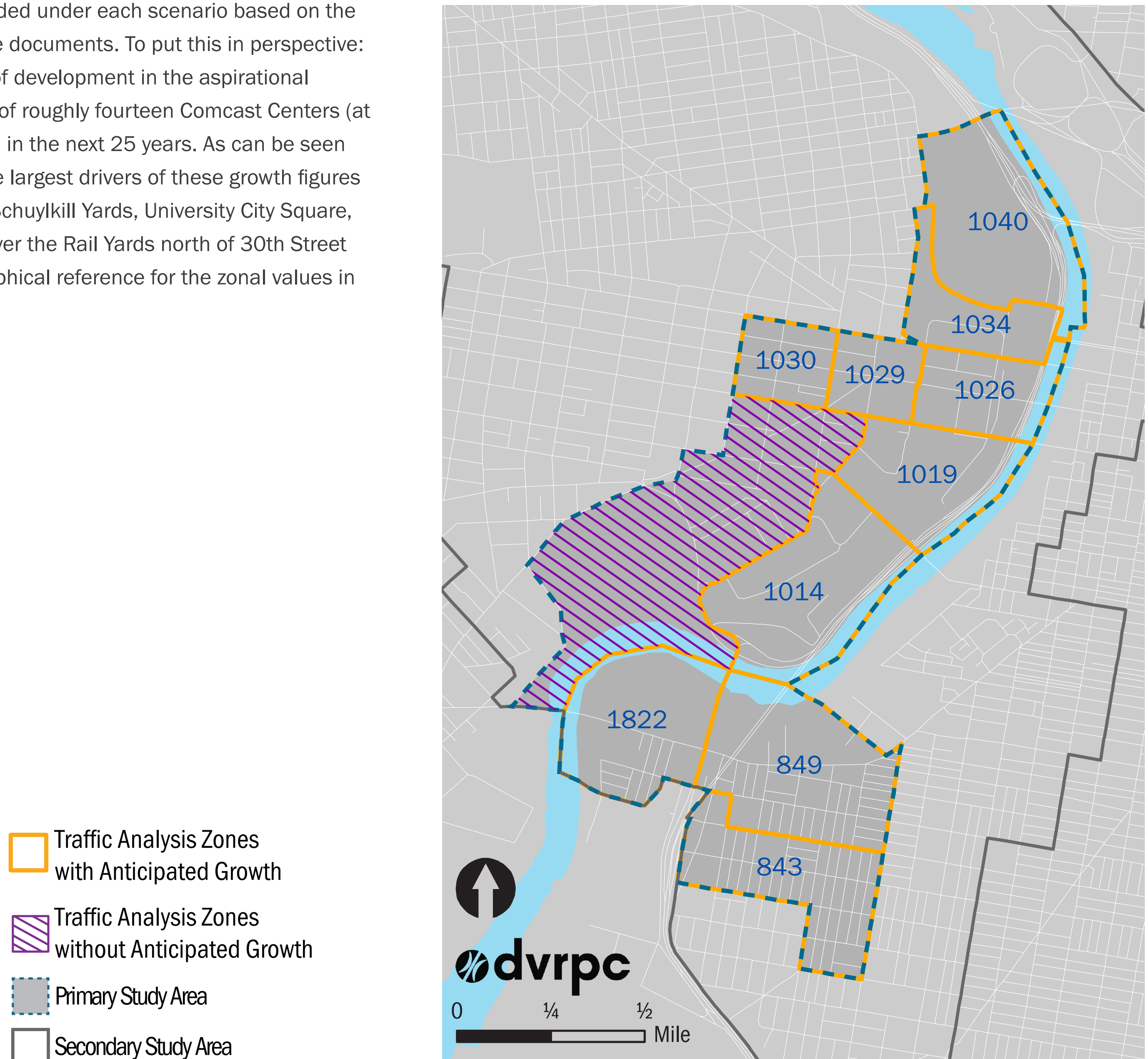
Table 3: Projects Included in Development Scenarios

Development	Use	Dwelling Units	Sq Ft
1400-1450 S 33rd St	Retail		81,288
225 N 38th St	Research		482,085
2300 Market St	Commercial		80,000
2301 John F Kennedy Blvd	Residential	380	
2301 John F Kennedy Blvd	Commercial		500,000
23rd and Market	Commercial		308,000
2413-27 Federal St	Residential	23	
2501 Oakford St	Residential	54	
275 N 38th St - UCity Square	Commercial		230,000
2922 Dickinson St	Residential	20	
3.0 University Place	Commercial		250,000
3000 Market - Schuylkill Yards	Medical		600,000
3000 Market - Schuylkill Yards	Residential	225	
3000 Market - Schuylkill Yards	Retail		35,000
3001 Chestnut St - Schuylkill Yards	Medical		503,000
3001 Chestnut St - Schuylkill Yards	Residential	390	
3001 Chestnut St - Schuylkill Yards	Commercial		500,000
3001 Chestnut St - Schuylkill Yards	Retail		26,000
3001,3003 JFK Boulevard	Mixed Use		936,000
3020 Market - Schuylkill Yards	Commercial		500,000
3025 JFK - Schuylkill Yards	Medical		200,000
3025 JFK - Schuylkill Yards	Residential	326	
3025 JFK - Schuylkill Yards	Retail		38,000
3051 JFK - Schuylkill Yards	Commercial		612,000
3051 JFK - Schuylkill Yards	Residential	424	
3101 Market St - Schuylkill Yards	Residential	350	
3101 Market St - Schuylkill Yards	Commercial		500,000
3400 Market - UCity Square	Commercial		450,000
3500 Civic Center Boulevard	Institutional		564,500
3700 Lancaster - UCity Square	Residential	463	
3700 Lancaster - UCity Square	Retail		16,000
37th and Filbert - UCity Square	Commercial		350,000
3800 Market St - UCity Square	Commercial		400,000
3800 Market St - UCity Square	Retail		15,000
3948 Locust Walk	Residential	225	
4.0 University Place	Commercial		310,000
4000 Market St	Residential	32	
4050 Ludlow St	Residential	96	
4101 Market St	Office		191,000
42 S 44th St	Residential	6	
4224 Baltimore	Residential	132	
4233 Chestnut St	Residential	278	
437 N 40th St	Residential	19	
4701-29 Pine St	Mixed-Use	220	
4900-34 Spruce St	Residential	150	
60 N 23rd St	Retail		65,000
60 N 23rd St	Residential	331	
60 N 36th Street	Mixed-Use		450,000
Additional CHOP tower	Medical		466,000
Drexel Nursing & Pub Health	Commercial		554,000
Ludlow Complex	Residential	165	
One UCity Square	Commercial		798,000
Quality Hotel Philadelphia	Commercial		44,687
Rail Yards - 2041-2045	Residential	1,250	
Rail Yards - 2041-2045	Commercial		2,650,000
Rail Yards - 2041-2045	Retail		75,000
The Next LVL	Residential	278	
The Village Square on Haverford	Residential	75	
Ultra Labs	Commercial		185,000

Source: DVRPC

Tables 4 through 6 on the next page show the number of dwelling units and square footage by use type added under each scenario based on the classifications provided in available documents. To put this in perspective: the almost 20 million square feet of development in the aspirational scenario would see the equivalent of roughly fourteen Comcast Centers (at 17th & Arch) built in the study area in the next 25 years. As can be seen in Table 3 and Figure 34 above, the largest drivers of these growth figures are the planned developments at Schuylkill Yards, University City Square, and the proposed developments over the Rail Yards north of 30th Street Station. Figure 35 provides geographical reference for the zonal values in Tables 4 through 6.

Figure 35: TAZs



Data: U.S. Census Bureau 2010

Table 4: Base Scenario Dwelling Units and Thousands of Square Feet by Use

Zone	843	849	1014	1019	1026	1029	1030	1034	1040	1822	Total
Multifamily Dwelling Units	20	-	-	-	615	-	-	1,100	1,750	-	3,485
Industrial/Warehouse	-	-	-	-	-	-	-	-	-	-	-
Medical	-	-	-	-	1,103	-	-	864	-	-	1,967
Lodging	-	-	-	-	-	-	-	-	-	-	-
Office	-	-	-	-	1,000	-	450	1,676	2,120	-	5,246
Retail/Commercial	81	-	-	3	61	-	-	100	75	-	320
Other Miscelaneous	-	-	-	-	-	-	-	-	-	-	-
Sum of Square Feet	81	-	-	3	2,164	-	450	2,640	2,195	-	7,533

Table 5: Moderate Scenario Dwelling Units and Thousands of Square Feet by Use

Zone	843	849	1014	1019	1026	1029	1030	1034	1040	1822	Total
Multifamily Dwelling Units	58	-	-	-	932	56	166	1,730	1,750	3	4,695
Industrial/Warehouse	-	-	-	-	-	-	-	-	-	35	35
Medical	-	-	1,400	-	1,103	-	-	1,359	-	-	3,862
Lodging	-	-	-	-	30	52	-	-	-	-	82
Office	-	-	467	-	1,358	-	450	2,285	2,540	-	7,100
Retail/Commercial	128	12	-	2	61	-	5	158	75	-	442
Other Miscelaneous	-	-	-	-	340	128	-	-	-	-	469
Sum of Square Feet	128	12	1,867	2	2,893	180	455	3,802	2,615	35	11,990

Table 6: High Scenario Dwelling Units and Tousands of Square Feet by Use

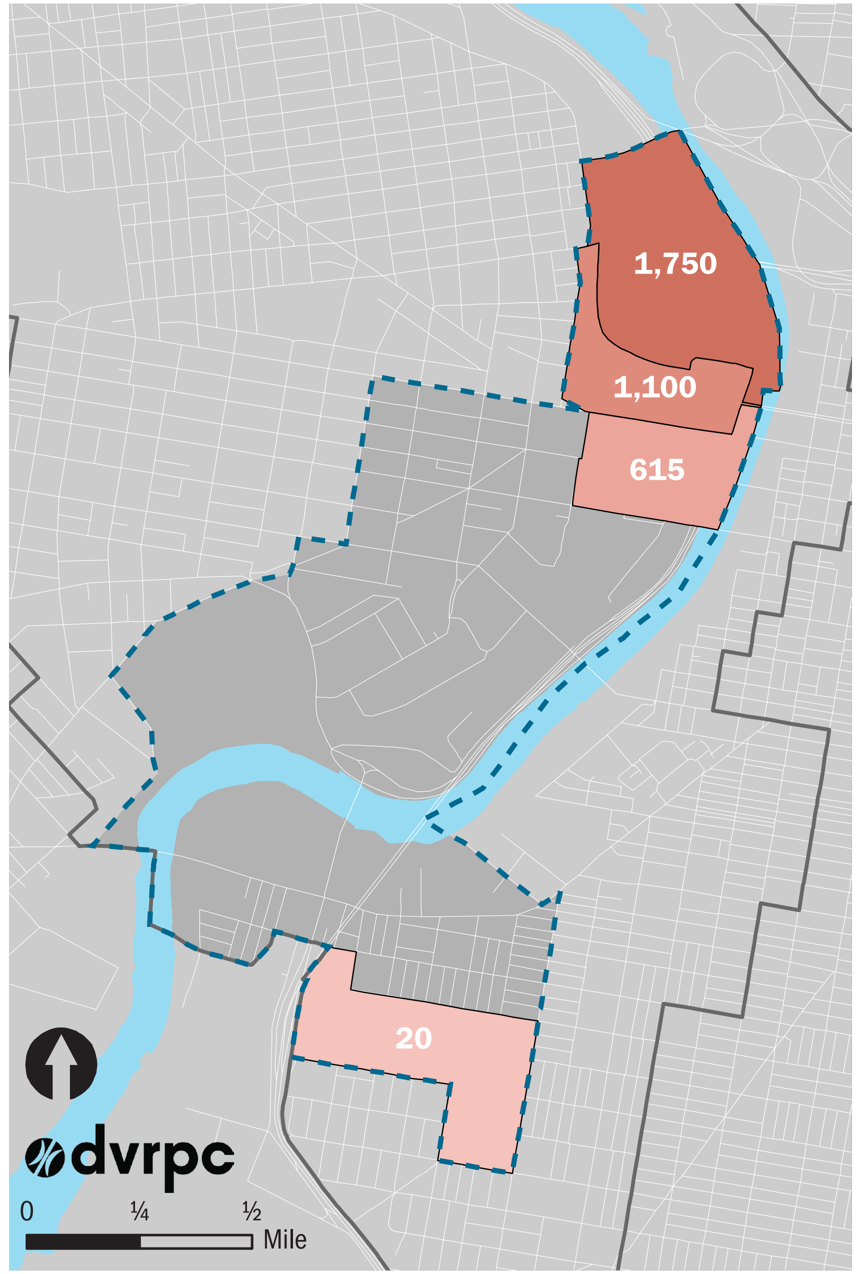
Zone	843	849	1014	1019	1026	1029	1030	1034	1040	1822	Total
Multifamily Dwelling Units	74	-	-	-	1,067	80	237	2,000	3,750	4	7,213
Industrial/Warehouse	-	-	-	-	-	-	-	-	-	49	50
Medical	-	-	2,000	-	1,103	-	-	1,571	-	-	4,674
Lodging	-	-	-	-	43	74	-	-	-	-	117
Office	-	-	667	-	1,512	-	450	2,547	8,550	-	13,725
Retail/Commercial	148	17	-	3	61	-	7	182	225	-	642
Other Miscelaneous	-	-	-	-	487	184	-	-	-	-	670
Sum of Square Feet	148	17	2,667	3	3,205	258	457	4,299	8,775.	49	19,877

Source: DVRPC 2021

Dwelling Units

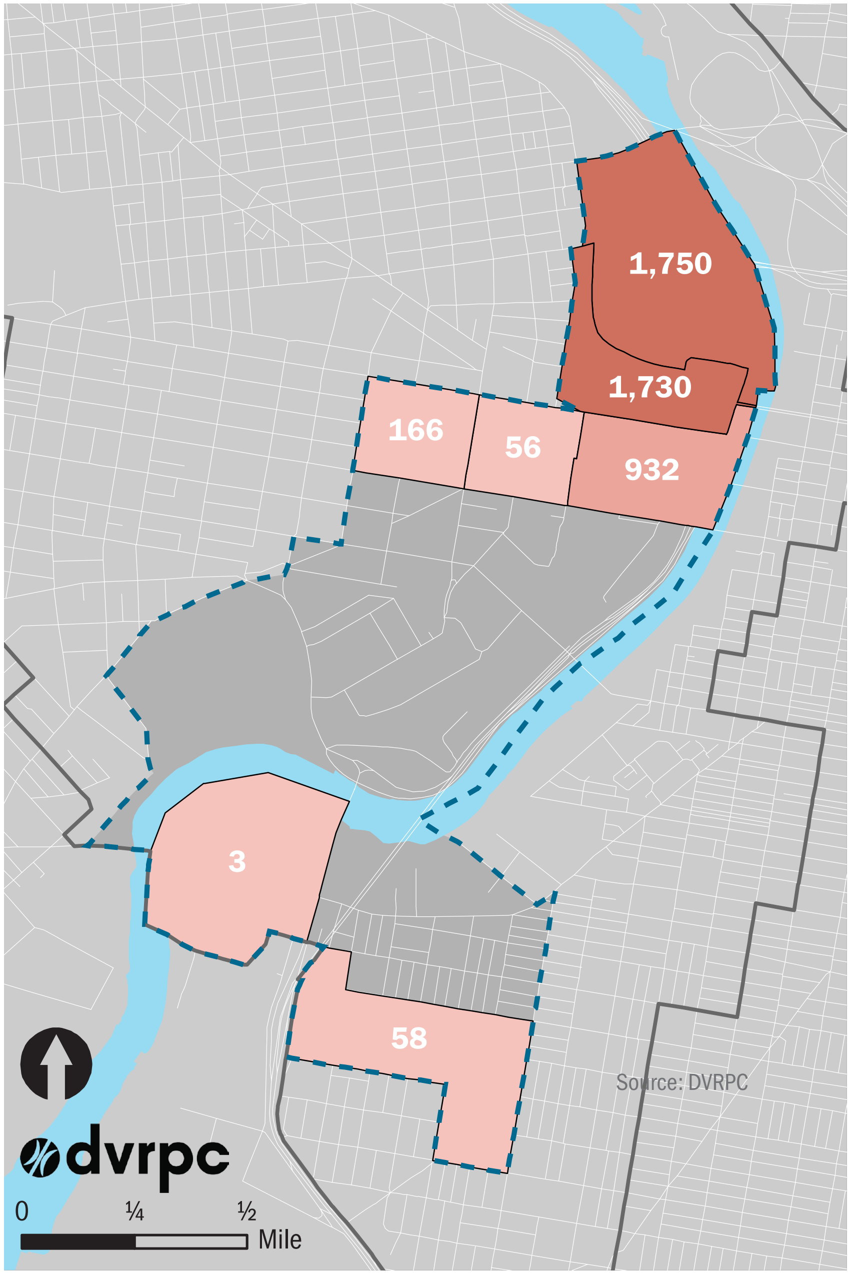
Figures 36 through 38 show the number of new dwelling units assumed at the zonal level for each of the scenarios. Under all scenarios the lion's share of new housing is produced in the area encompassed by University City Square, Schuylkill Yards, and the Rail Yards, while the moderate and high scenarios assume some degree of additional housing built farther west and in the area adjacent to the Pennovation Center.

Figure 36: Dwelling Units in Base Scenario



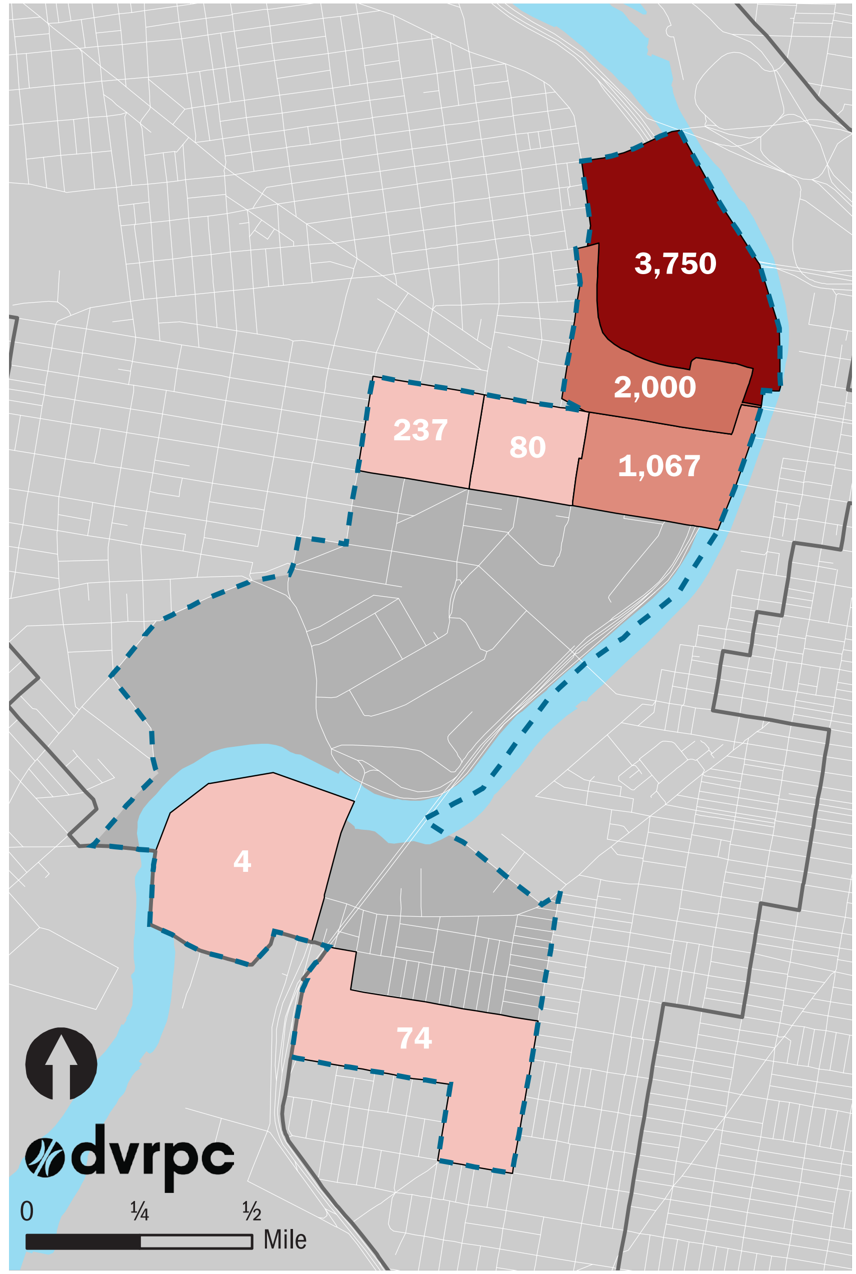
Source: DVRPC 2021

Figure 37: Dwelling Units in Moderate Scenario



Source: DVRPC 2021

Figure 38: Dwelling Units in High Scenario

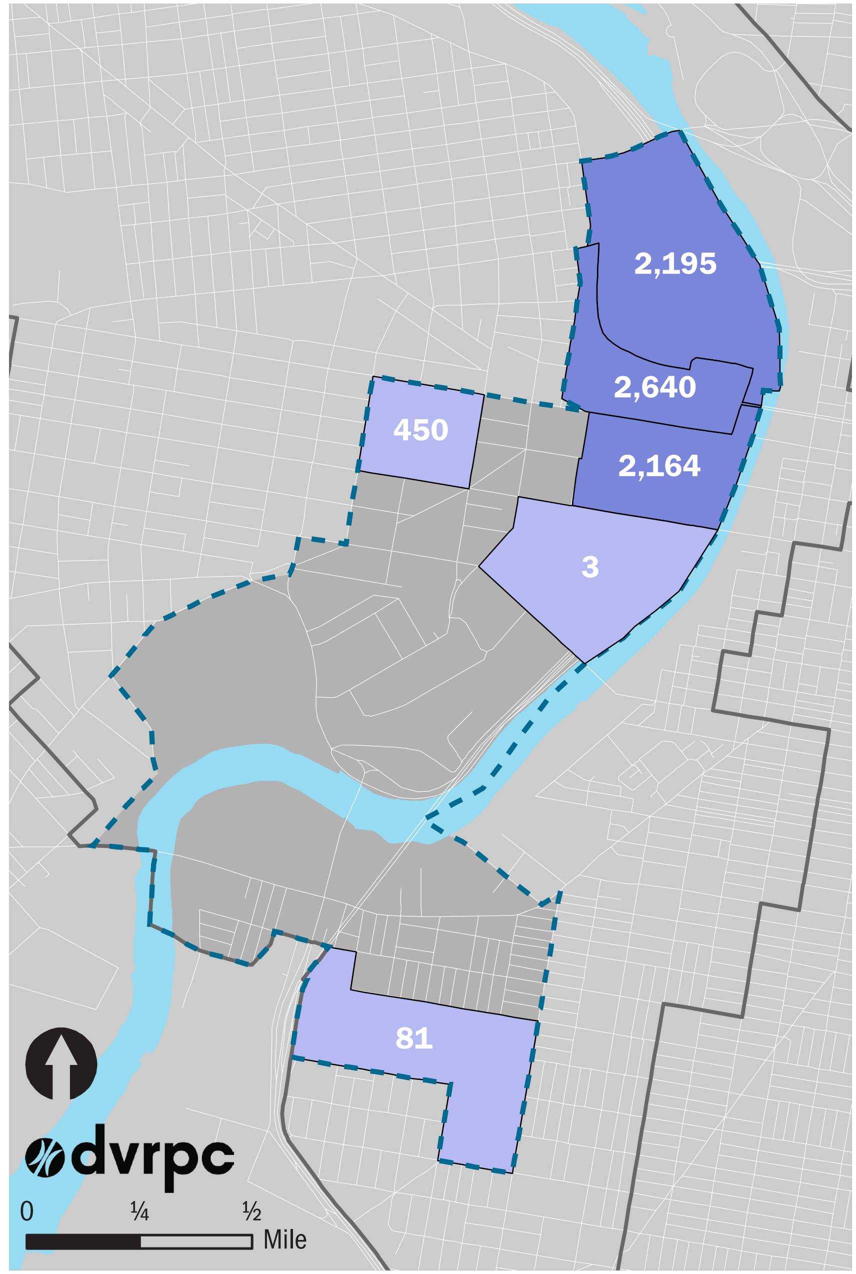


Source: DVRPC 2021

Non-Residential Square Feet

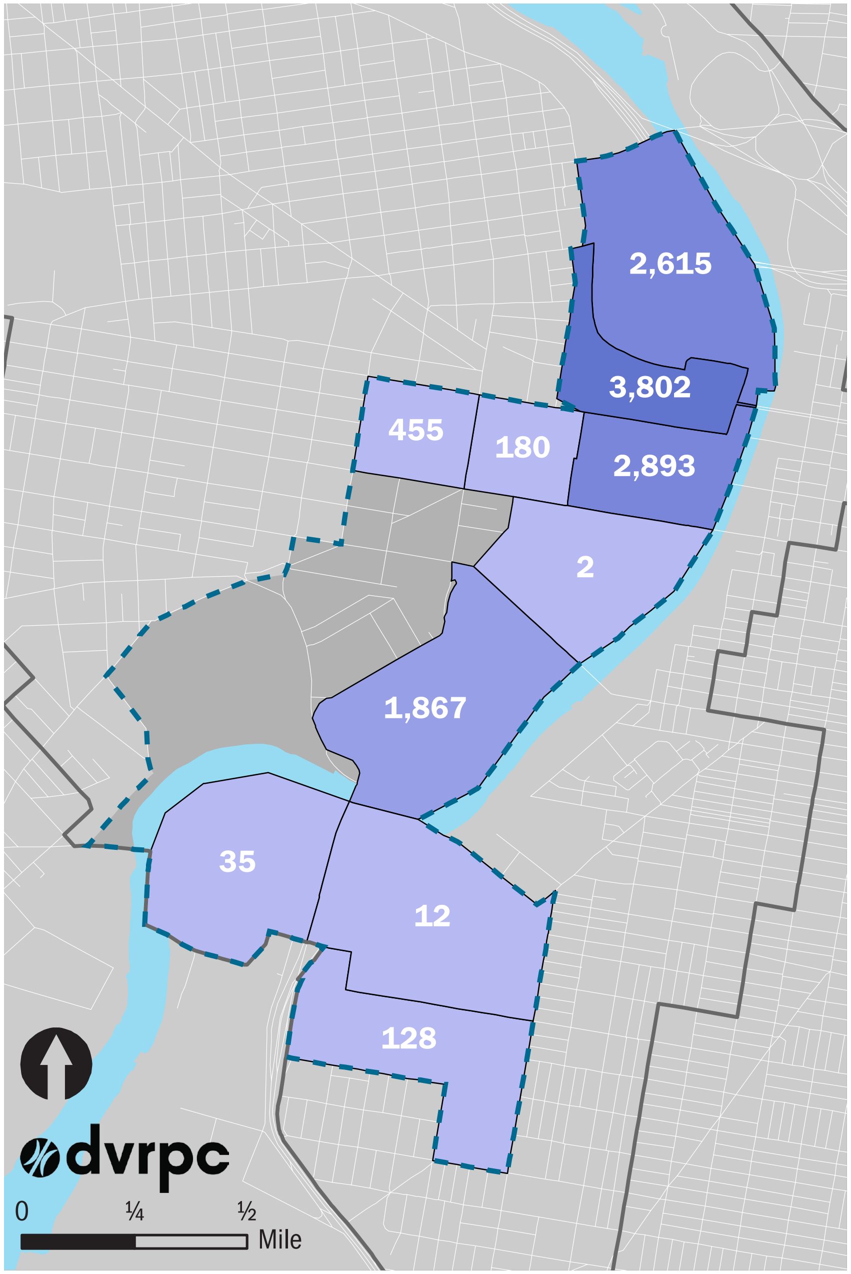
Figures 39 through 41 show the sum of non-residential square footage assumed by zone under each of the development scenarios. The most notable difference between scenarios, aside from the changing intensity within zones, is the new development in the medical campus assumed in the moderate and high-growth scenarios. In these two scenarios the extension of prior trends leads to continued expansion of the CHOP/ Hospital of the University of Pennsylvania (HUP) hospital cluster and significant new development.

Figure 39: Non-Residential Square Feet (Thousands) in Base Scenario



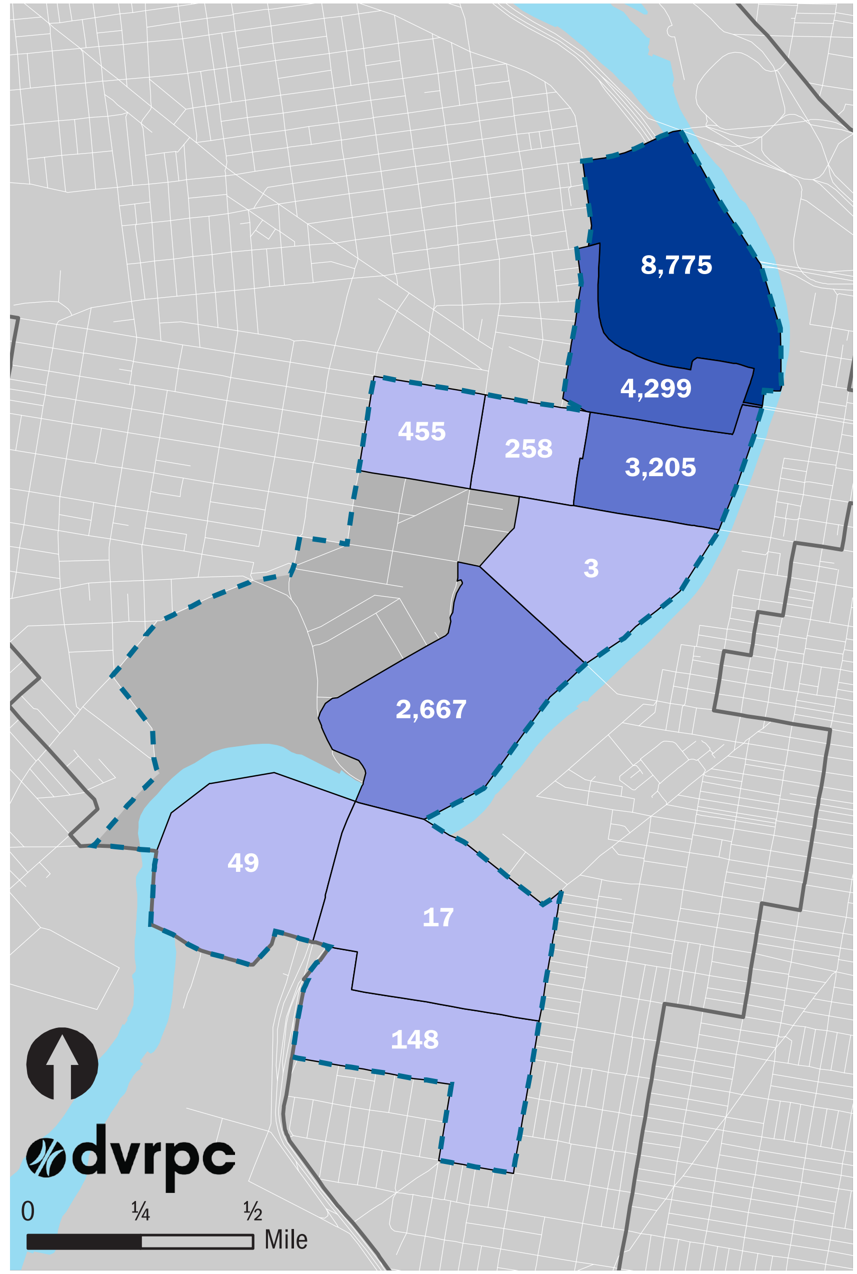
Source: DVRPC 2021

Figure 40: Non-Residential Square Feet (Thousands) in Moderate Scenario



Source: DVRPC 2021

Figure 41: Non-Residential Square (Thousands) Feet in High Scenario



Source: DVRPC 2021

CHAPTER 3

Modeling Results

Summary of Findings

Roadway Impacts

Under all scenarios capacity constraints, many of them ultimately caused by the Schuylkill River, lead to significant congestion and potential gridlock when trying to provide access to substantial new develpment in the area. The degree of impacts tracks with the intensity of development proposed. The immediate conclusion to be drawn from this is that significant new development in University City will require either significant upgrades to infrastructure or significant changes to traveller behavior, and likely both. In the absence of a substantial modal shift by travellers entering and leaving University City, these results indicate that all ramps serving University City from I-76 would merit re-evaluation and possible redesign. This is most clearly the case at University Avenue, South Street, I-676 to 30th Street Station, and Spring Garden Bridge (which would require widening and redesign under any scenario). In the high scenario traffic impacts start to be seen in new congestion on neighborhood grids to the west of the study area.

These findings beg the question of interventions that can be undertaken to induce travellers to use non-automobile, modes including limiting parking, parking pricing, increasing transit service (either coverage or frequency or both), and institutional policies (eliminating parking benefits, providing a transit benefit, remote work and flexible arrival/departure for staff whose responsibilities allow it, etc.).

Transit Impacts

The transit capacity serving University City is capable of serving the amount of demand forecasted under all scenarios. No time period expresses demand in excess of capacity for the period as a whole. What will remain to be seen is how transit demand rebounds from the COVID pandemic and whether the oil-price impacts of the invasion of Ukraine prompt a modal shift away from driving as household budgets reckon with the effects of expensive energy.

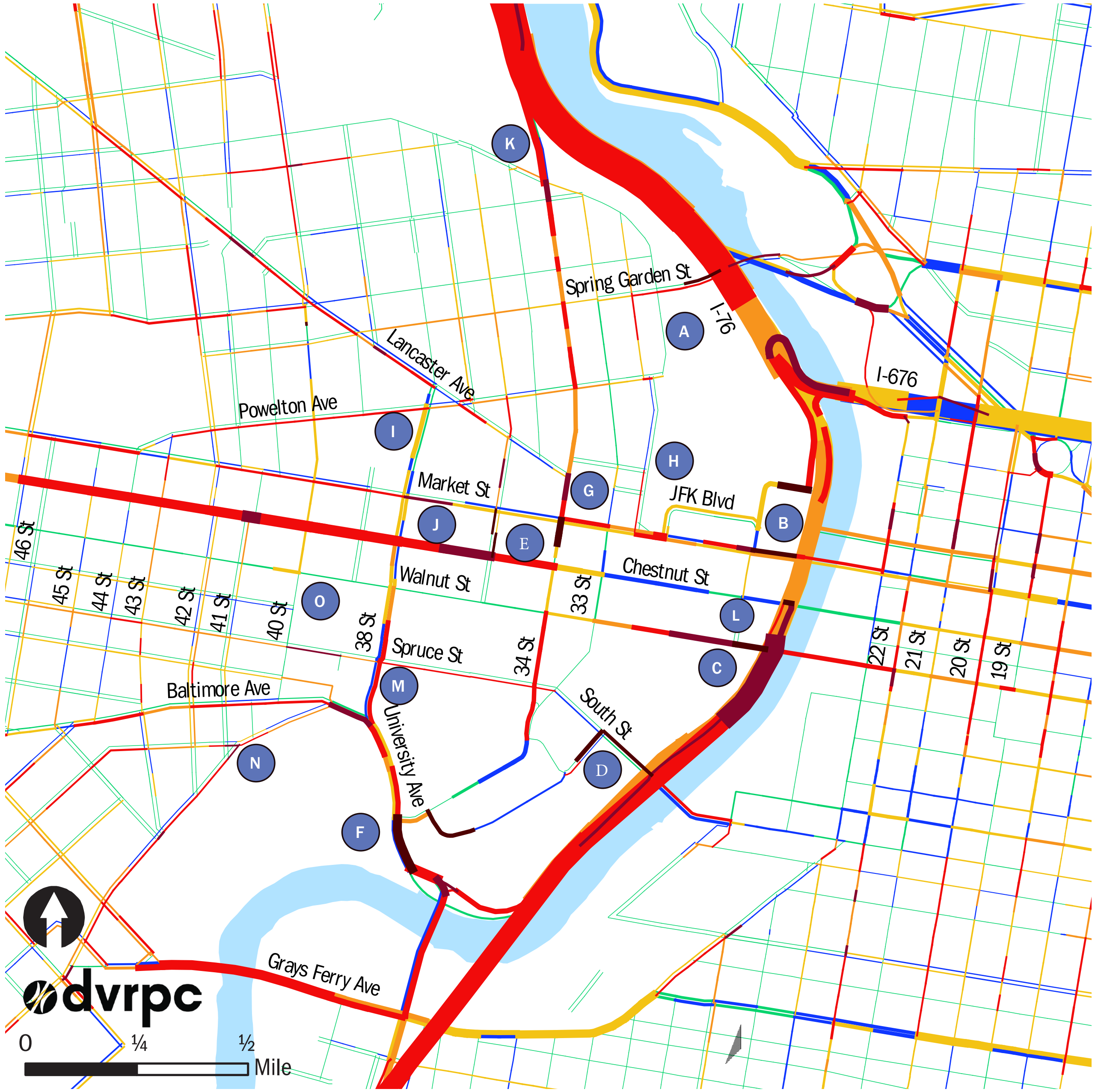
Increases in demand follow the pattern one would predict based on locations and intensities of development, with the Market/Frankford Line (MFL) seeing far and away the largest increases in demand. For all scenarios and all time periods that increase is driven by development around 30th Street Station and development immediately west of 34th Street Station. Although increases on the Loop through University City (LUCY) routes and University City Station serving the medical campus are present, they are of a lesser magnitude in keeping with the more modest estimate of additional development associated with that area.

In the interest of achieving a greater transit share of trips to the area, the proposed increase in regional rail frequency and fare parity with other modes in Zone 1 merits further investigation. As does the markedly more ambitious possibility of extending the PATCO tunnel to, or even through, University City. Both of the concepts can be found in *The Philadelphia Transit Plan* (City of Philadelphia, 2021).

AM Peak: Traffic Volumes and Volume-to-Capacity (V/C) Ratios

AM peak-period results for all scenarios indicate congestion on roadways inbound to University City. Seen in FIgure 42, in all cases the ramps and/or approaches serving I-76 have V/C ratios in excess of 100 percent indicating substantial congestion and delay. The potential for congestion resulting in significant spillback and increased likelihood of gridlock is indicated by V/C ratios in excess of 150 percent which can be seen in all scenarios at the Spring Garden Bridge (A), 30th Street Station (B), Walnut Street at I-76 (C), South Street at I-76 (D), 34th at Lancaster (G), Market (E), University Avenue inbound from I-76 (F), Chestnut at 36th (J), University Avenue at Woodland/Baltimore (N), and upper 34th serving I-76 (K).

Figure 42: 2045 Base Scenario: AM Peak Volumes and V/C Ratios



V/C Ratio

- <=50%
- 51–75%
- 76–100%
- 101–125%
- 126–150%
- >150%

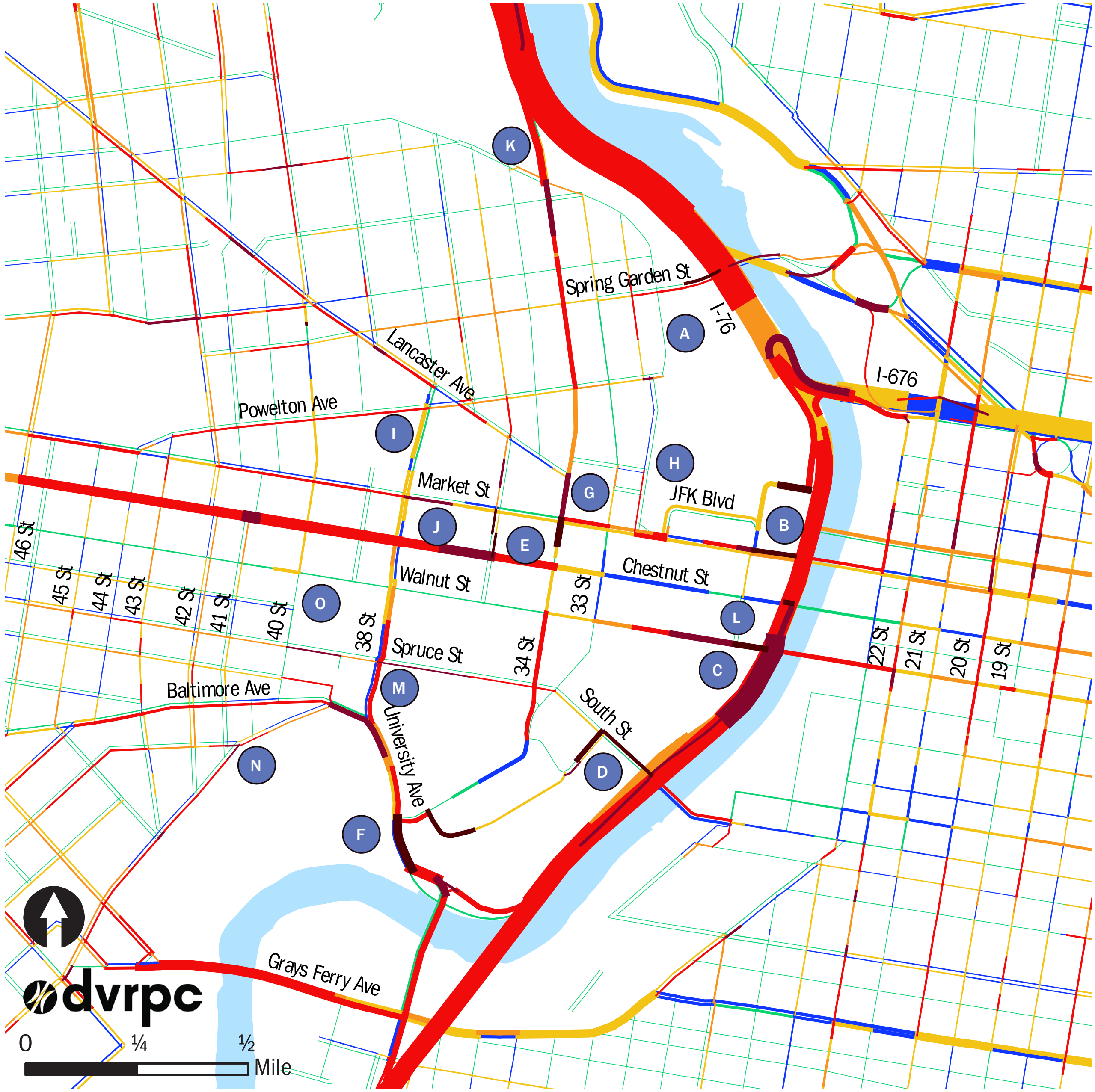
Traffic Volume

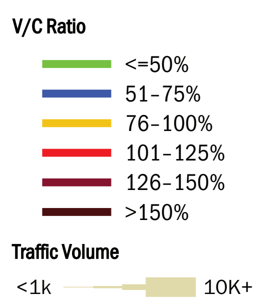
<1k 10K+

Data: DVRPC 2021

Escalating from the base to moderate scenarios, Figure 43 shows increasing congestion inbound on 34th at Lancaster (G). Demand resulting from increased development is also reflected in increasing volumes along Convention Avenue at South Street (D), with traffic seeking parking access. Upper 34th (K, G) and Spruce Street (M), although congested in the 2045 base scenario, degrade and are squarely in failing territory under this scenario.

Figure 43: 2045 Moderate Scenario: AM Peak Volumes and V/C Ratios



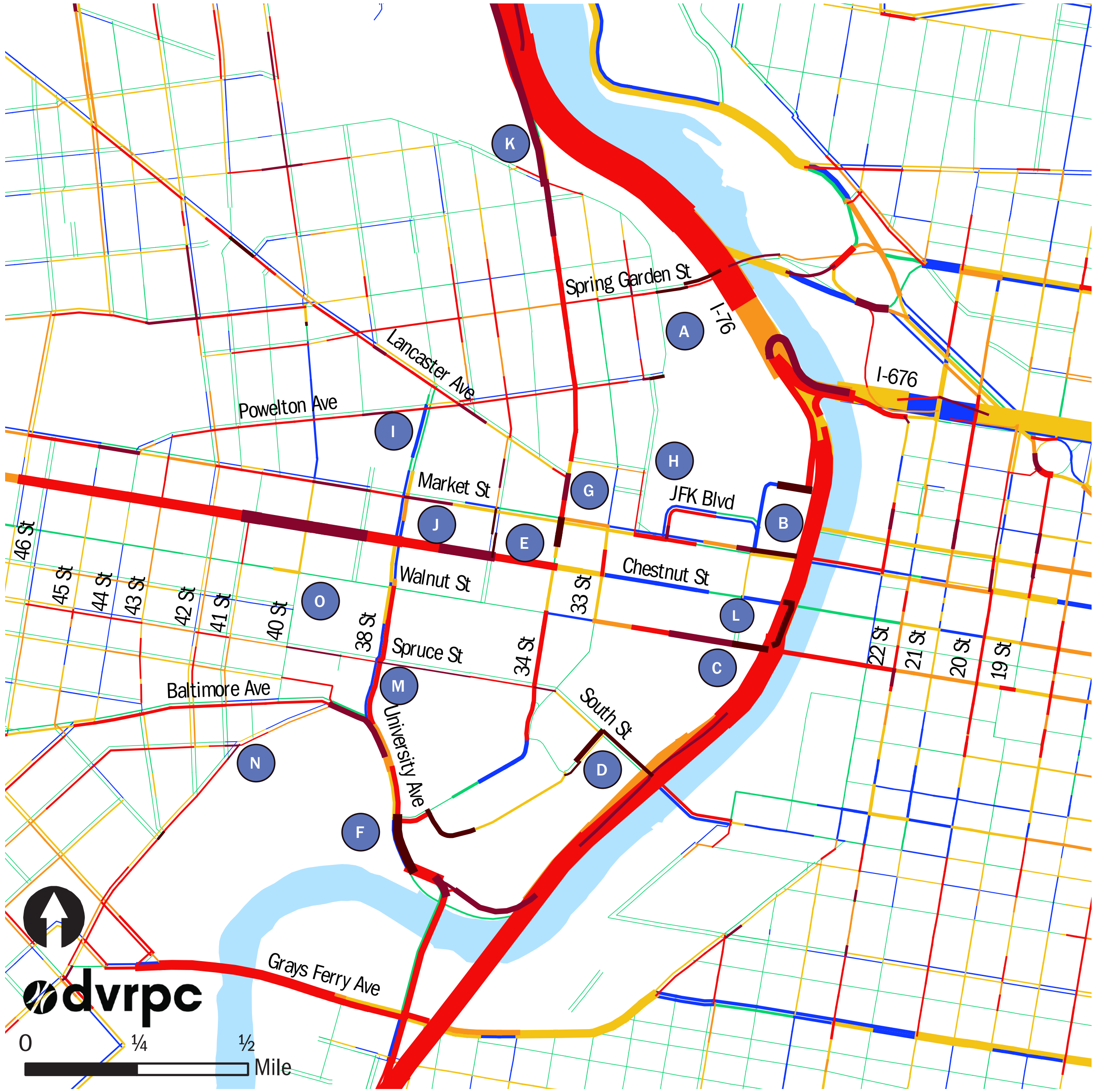


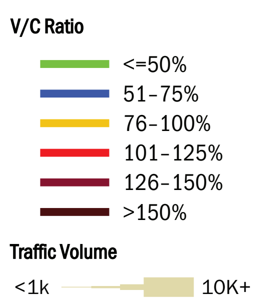
Data: DVRPC 2021

In the high scenario (Figure 44) the increased inbound demand results in Powelton at 38th Street (I) becoming overloaded as inbound traffic seeks a parallel route to I-76 and access to the 30th Street Station District, while upper 34th (K) further degrades serving additional inbound demand, and congestion on JFK at Market (H) overwhelms capacity.

Figures 45 and 46 show detailed V/C ratios and modeled speeds on selected links. Figure 46 in particular highlights the predicted gridlock resulting from demand well in excess of capacity, with multiple road segments suffering expected average speeds well below five miles per hour (mph) and a second set hovering around five mph depending on scenario.

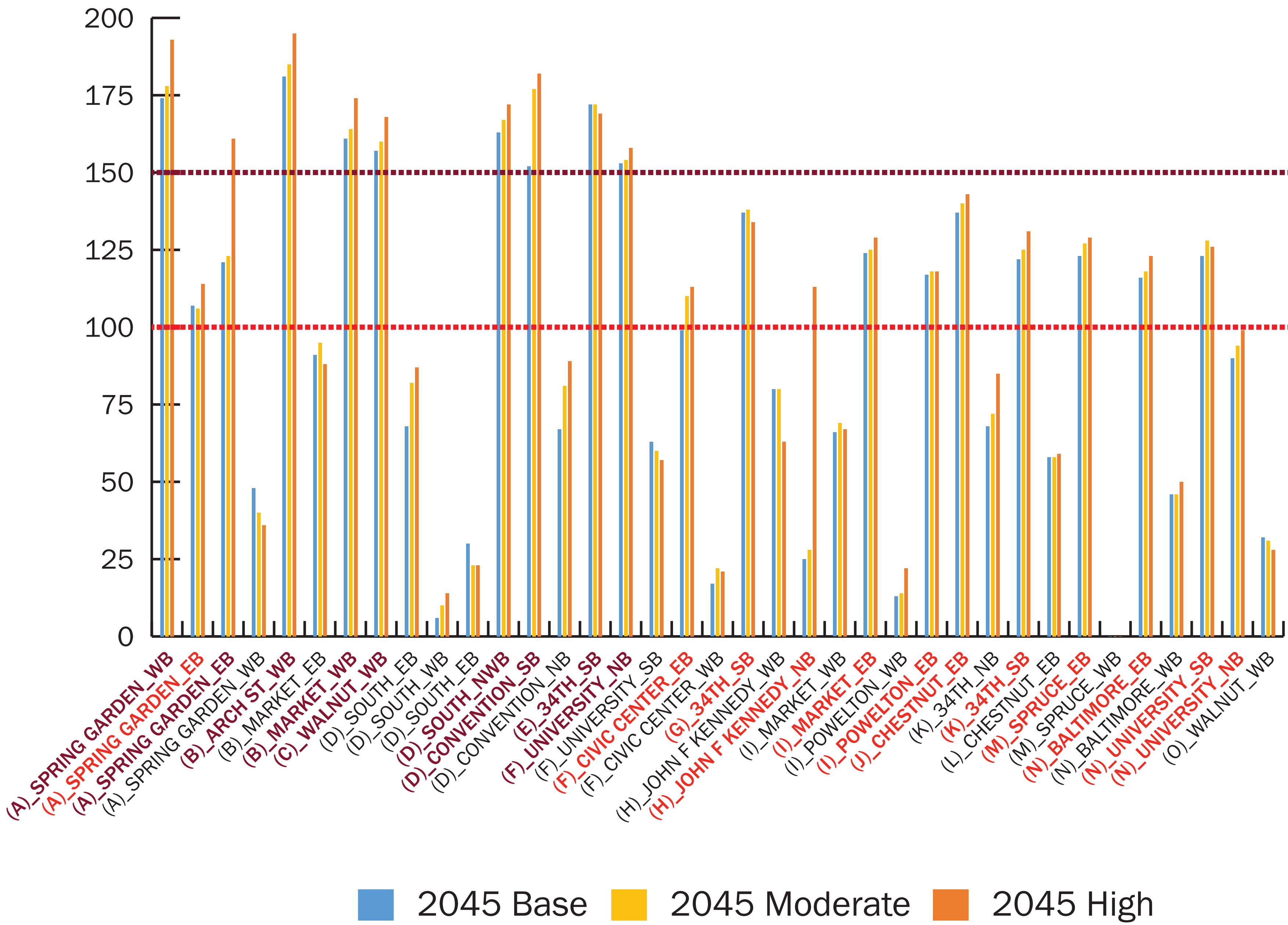
Figure 44: 2045 High Scenario: AM Peak Volumes and V/C Ratios





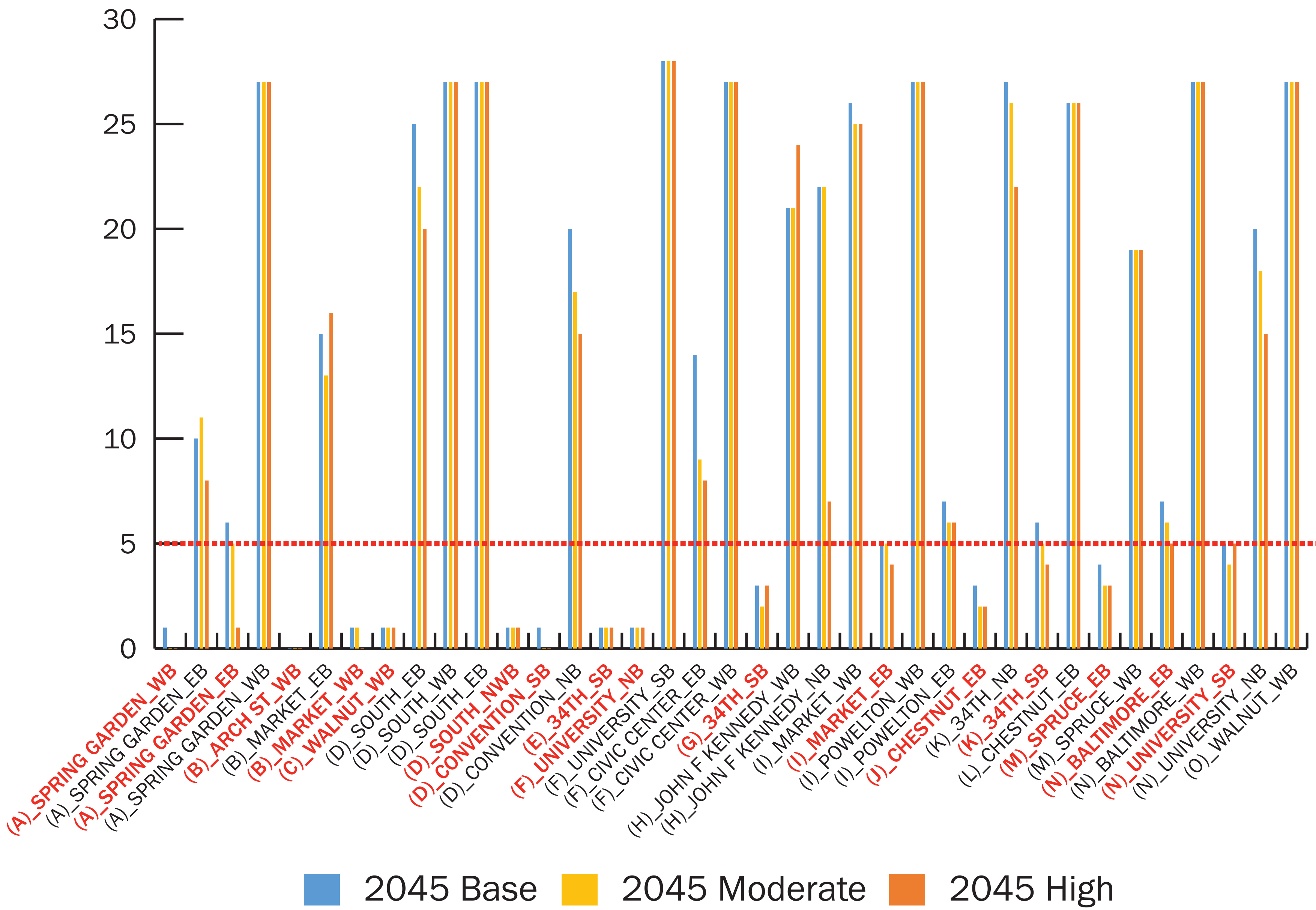
Data: DVRPC 2021

Figure 45: AM V/C Ratio



Source: DVRPC 2021

Figure 46: AM Speeds (mi/h) on Select Links

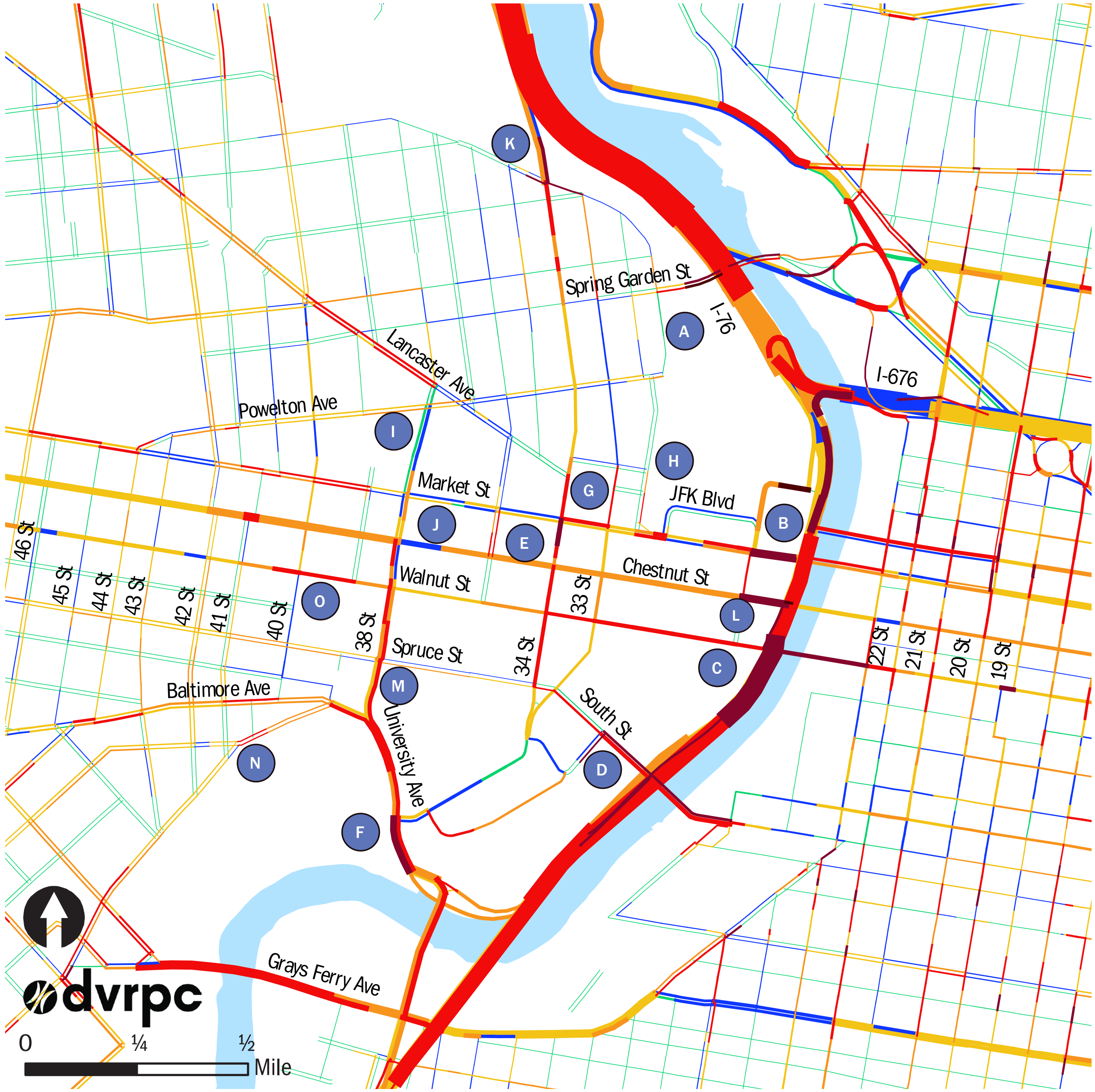


Source: DVRPC 2021

Midday Period: Traffic Volumes and Volume-to-Capacity (V/C) Ratios

Figure 47 shows Spring Garden Bridge (A), Upper 34th (K), 34th at Market (E), 30th Street Station (B), Chestnut at I-76 (L), South and Convention (B), and University Avenue (F) between Civic Center Blvd and I-76 all failing in the midday under the 2045 base scenario. Overall the operation of the street grid in and adjacent to University City is better than in the peaks, but bottlenecks remain on bridges and ramps crossing or adjacent to the Schuylkill River.

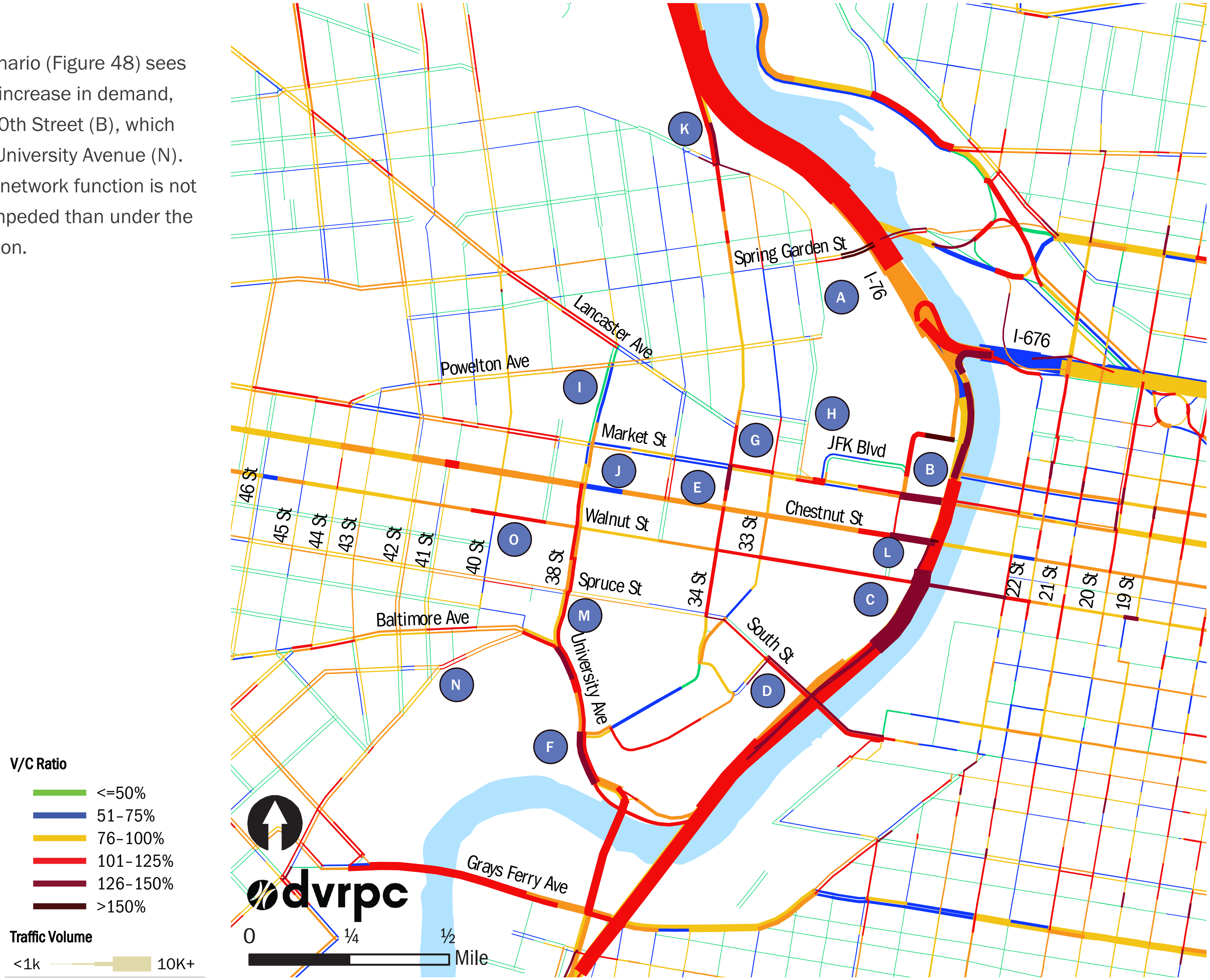
Figure 47: 2045 Base Scenario: Midday Peak Volumes and V/C Ratios



Source: DVRPC 2021

The moderate scenario (Figure 48) sees a modest general increase in demand, most notably on 30th Street (B), which starts to fail, and University Avenue (N). Overall, the street network function is not noticeably more impeded than under the 2045 base condition.

Figure 48: 2045 Moderate Scenario: Midday Peak Volumes and V/C Ratios

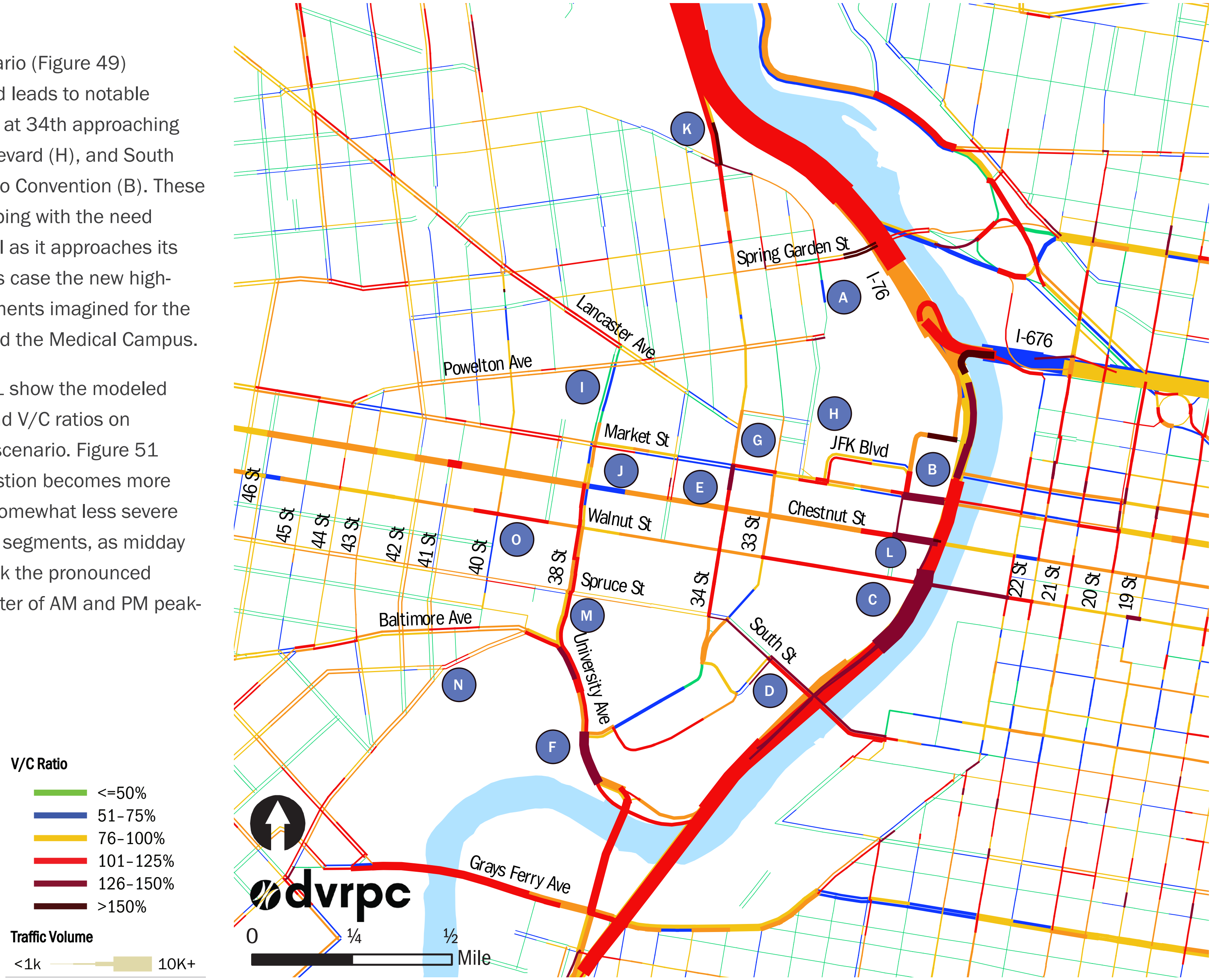


Source: DVRPC 2021

For the high scenario (Figure 49) increased demand leads to notable increased failures at 34th approaching I-76 (K), JFK Boulevard (H), and South Street from 34th to Convention (B). These results are in keeping with the need for traffic to funnel as it approaches its destination: in this case the new high-intensity developments imagined for the Station District and the Medical Campus.

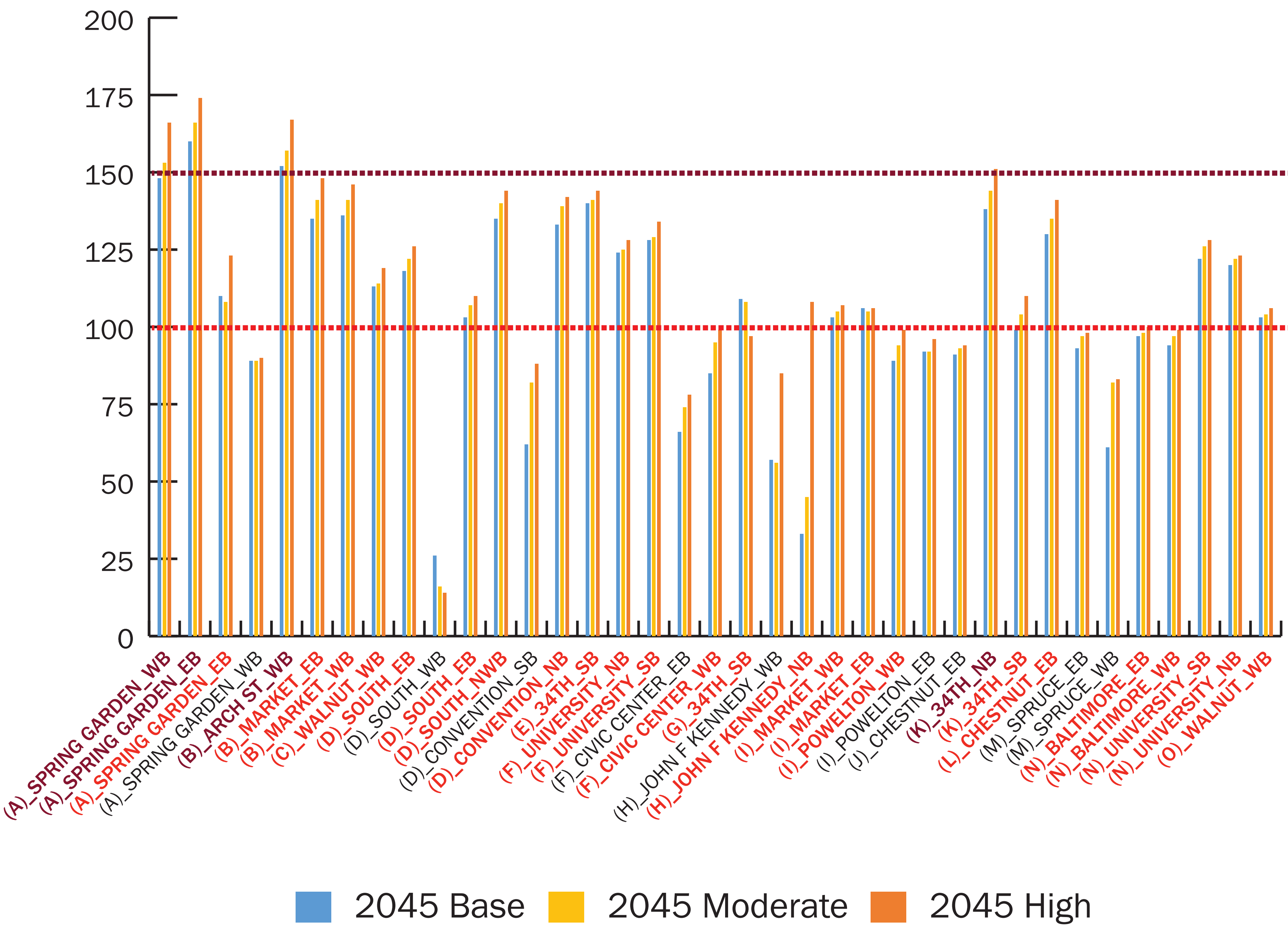
Figures 50 and 51 show the modeled midday speeds and V/C ratios on selected links by scenario. Figure 51 shows that congestion becomes more widespread, but somewhat less severe for impacted road segments, as midday travel patterns lack the pronounced directional character of AM and PM peak-period trips.

Figure 49: 2045 High Scenario: Midday Peak Volumes and V/C Ratios



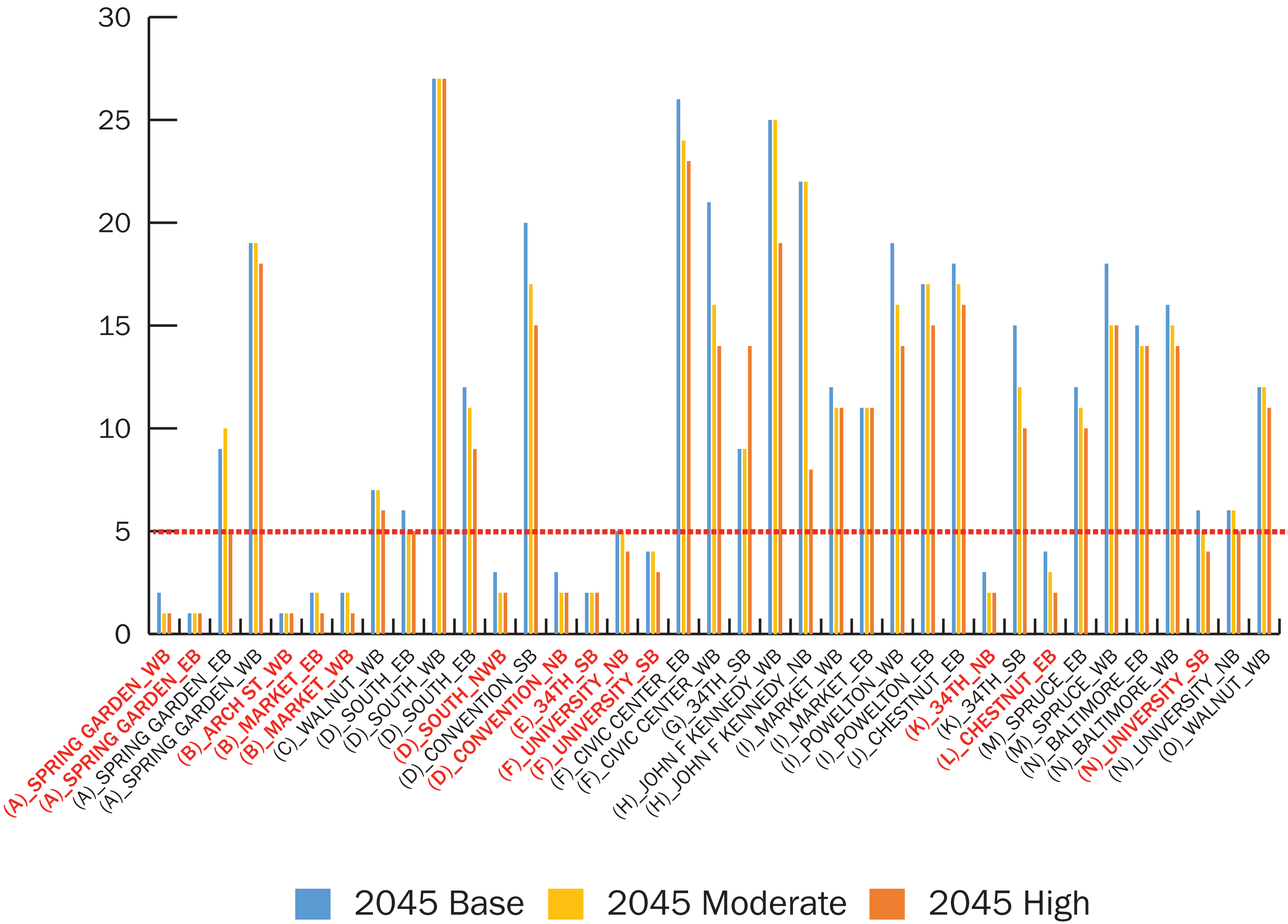
Source: DVRPC 2021

Figure 50: Midday V/C Ratio



Source: DVRPC 2021

Figure 51: Midday Speeds (mi/h) on Select Links

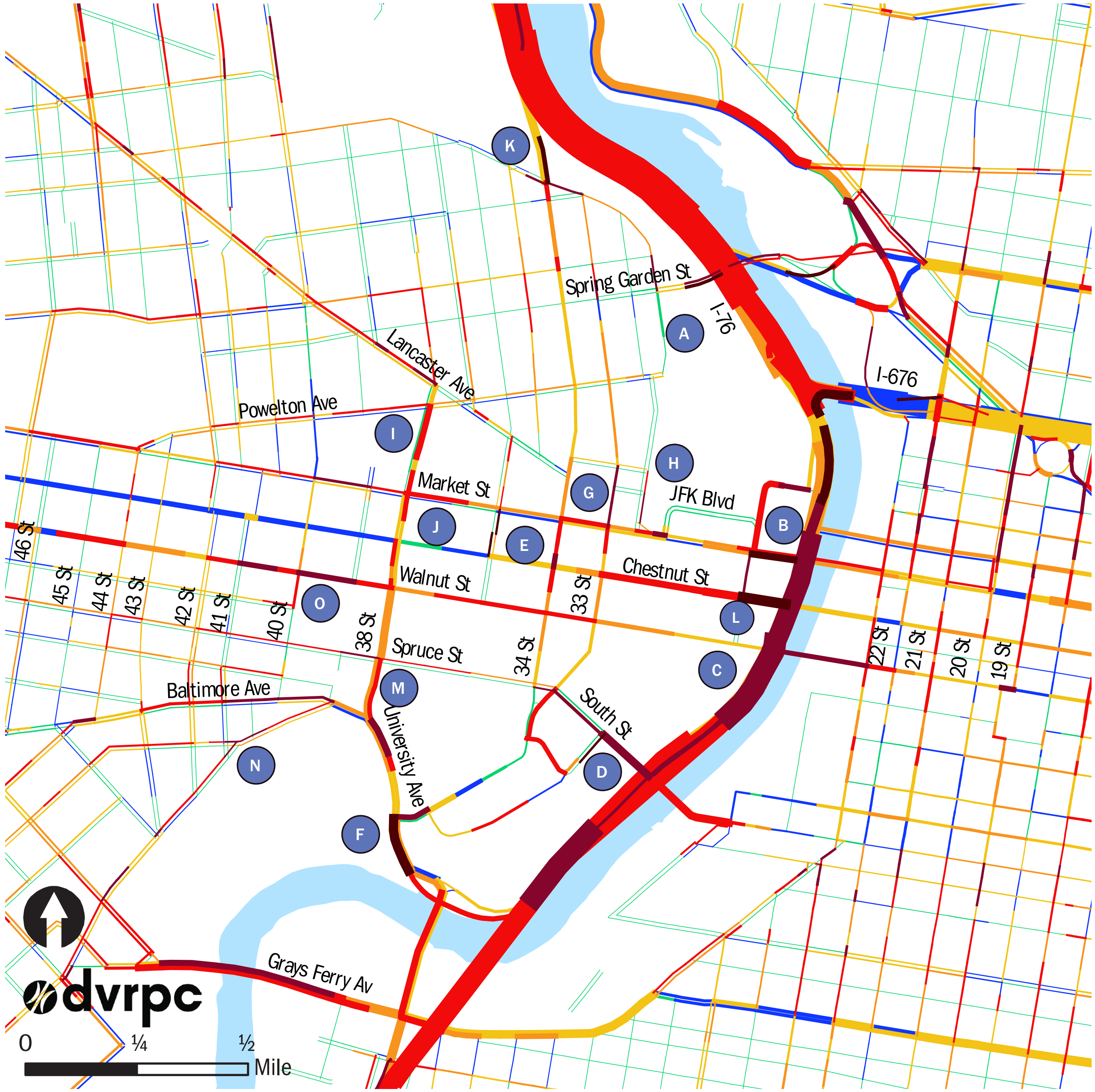


Source: DVRPC 2021

PM Peak: Traffic Volumes and Volume-to-Capacity (V/C) Ratios

In the PM peak roadway volumes and attendant congestion and delay mirror the results seen in the AM. Outbound movements along University Avenue, Convention Avenue, and South Street (D, F) show significantly overloading under all scenarios (Figures 52-54), with noticeable increases for the moderate and high scenarios. Likewise, 34th Street at I-76 (K), Spring Garden Bridge, Market at I-76, and Chestnut at I-76 (L) are all significantly overloaded in all scenarios.

Figure 52: 2045 Base Scenario: PM Peak Volumes and V/C Ratios



V/C Ratio

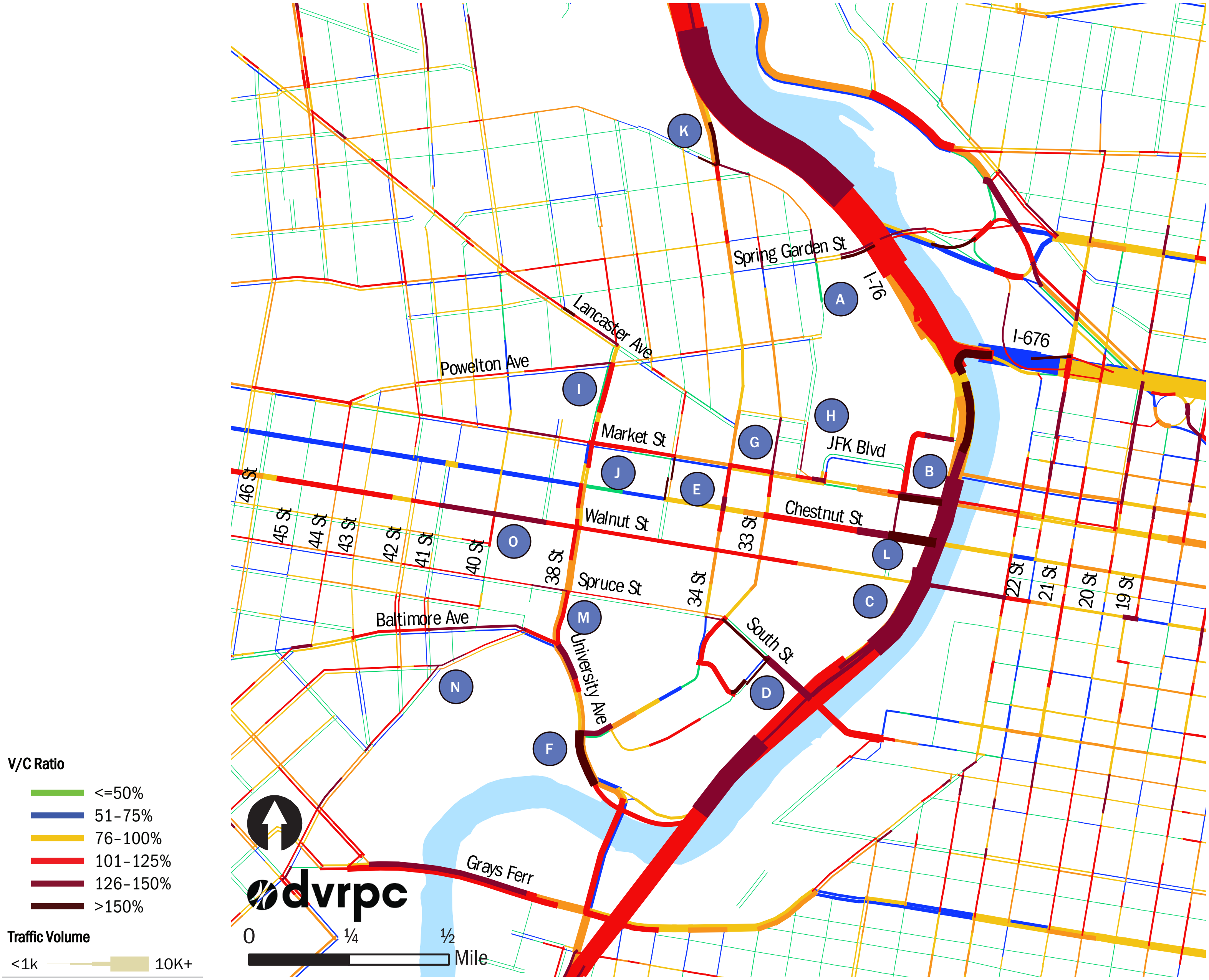
- <=50%
- 51-75%
- 76-100%
- 101-125%
- 126-150%
- >150%

Traffic Volume

<1k 10K+

Source: DVRPC 2021

Figure 53: 2045 Moderate Scenario: PM Peak Volumes and V/C Ratios

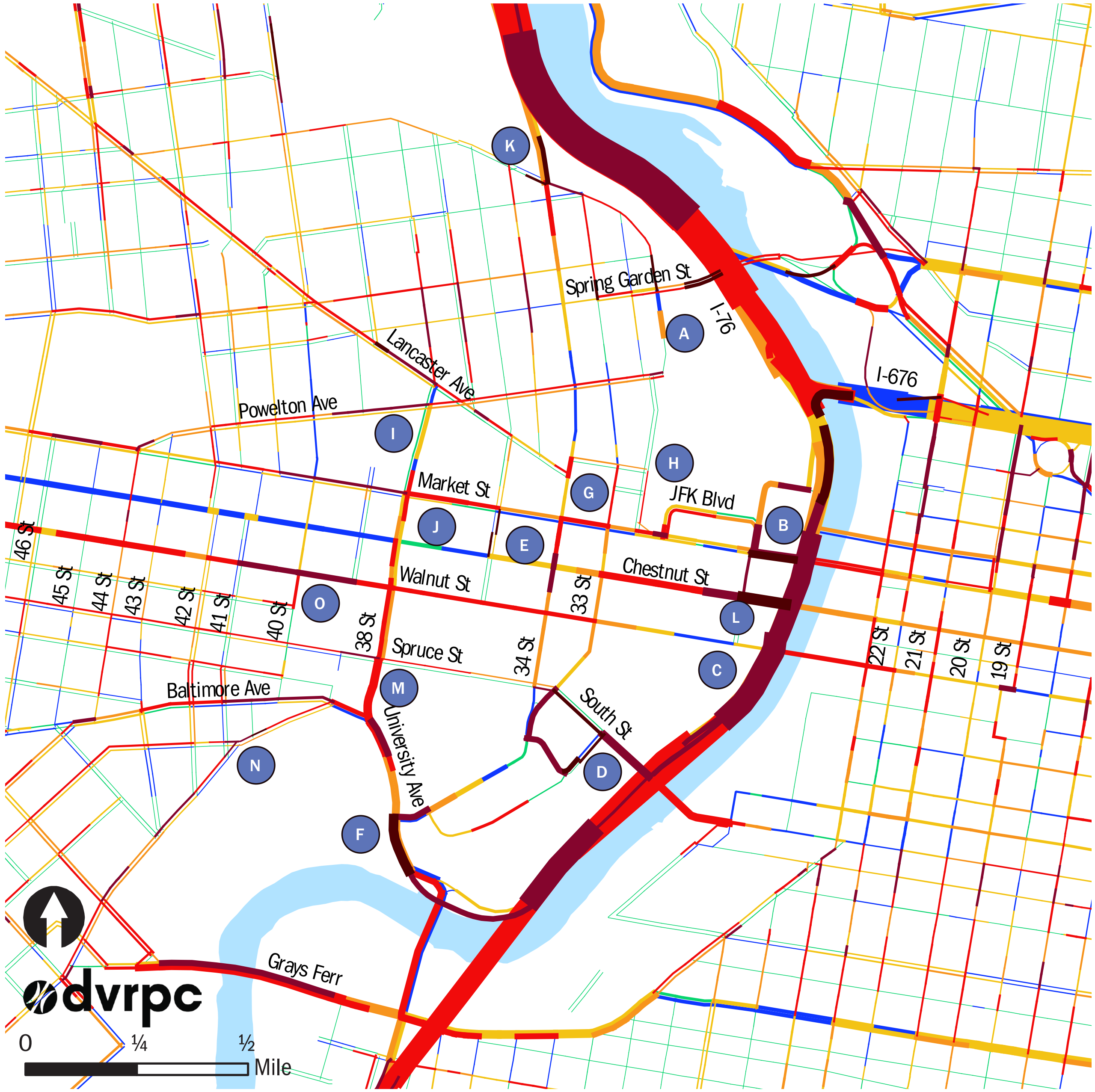


Source: DVRPC 2021

Under the high scenario Arch (H) and N 30th at 30th Street Station (B), both fail under the combined demand of outbound workers and inbound residents associated with the 30th Street Station District. Baltimore Avenue west of University (N) fails in all scenarios, while west of 38th westbound facilities (most noticeably) Walnut (O), Market (I), and Powelton (I), experience escalating degradation of operations positively correlated with higher-intensity development. The high development scenario also sees PM peak demand overloading neighborhood grids in Mantua and Spruce Hill.

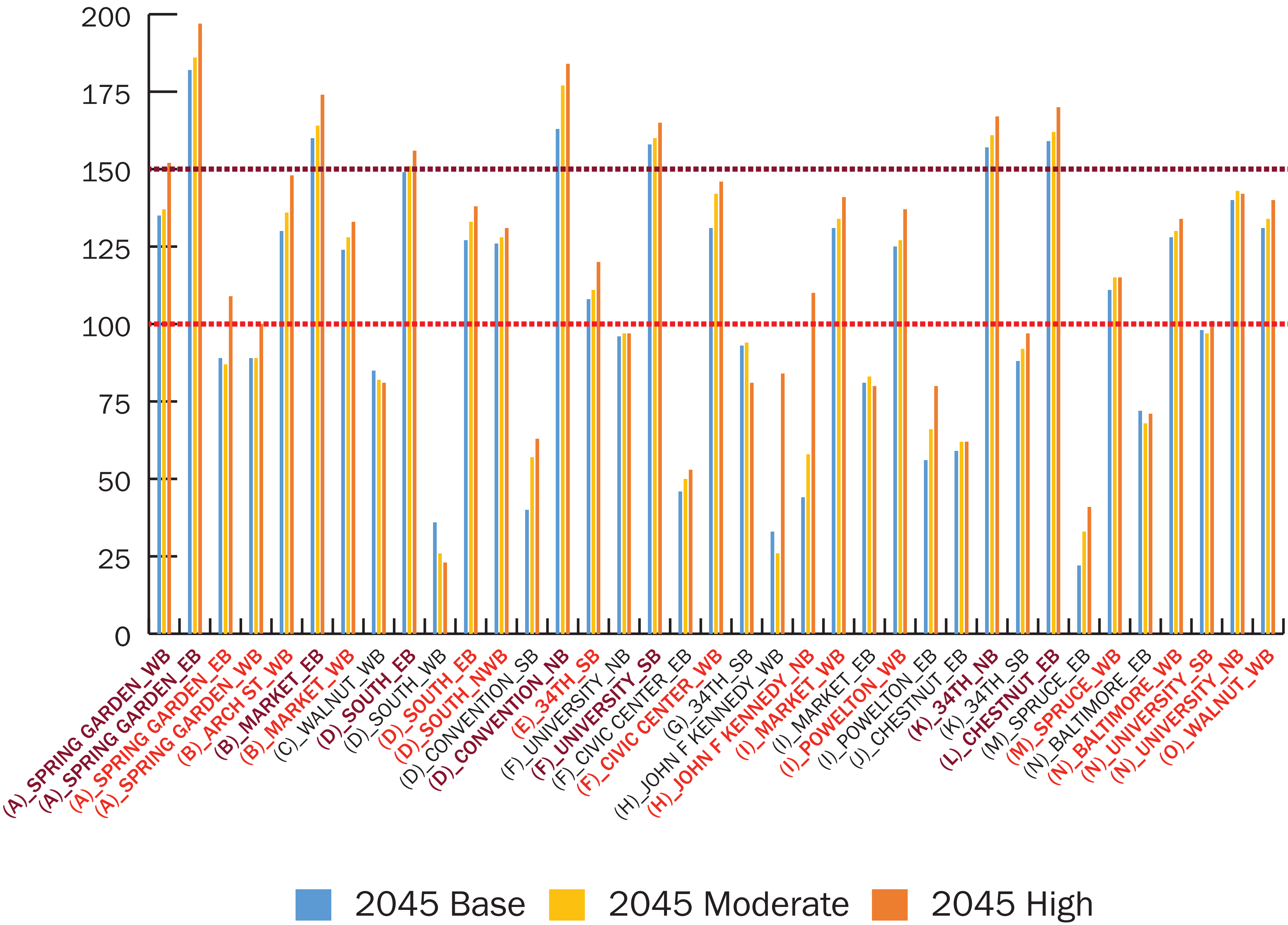
Figures 55 and 56 show that speeds and V/C ratios in the PM mirror those seen in the AM peak, as workers and residents overload complementary (primarily outbound) routes on their work to home trips.

Figure 54: 2045 High Scenario: PM Peak Volumes and V/C Ratios



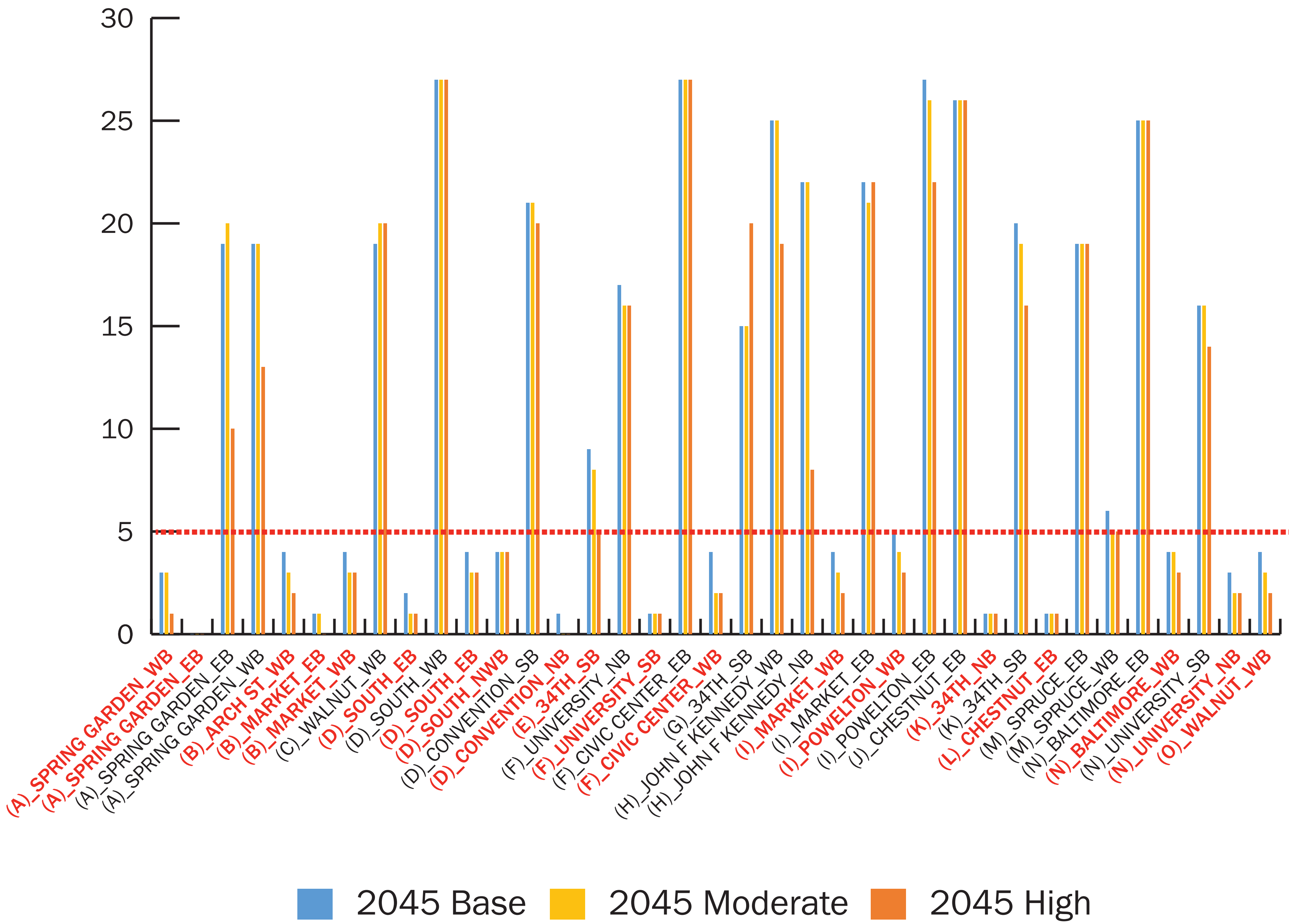
Source: DVRPC 2021

Figure 55: PM V/C Ratio



Source: DVRPC 2021

Figure 56: PM Speeds (mi/h) on Select Links



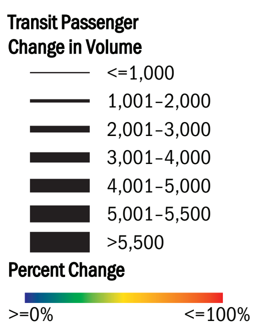
Source: DVRPC 2021

Transit Impacts

AM Peak: Transit Passenger Trips

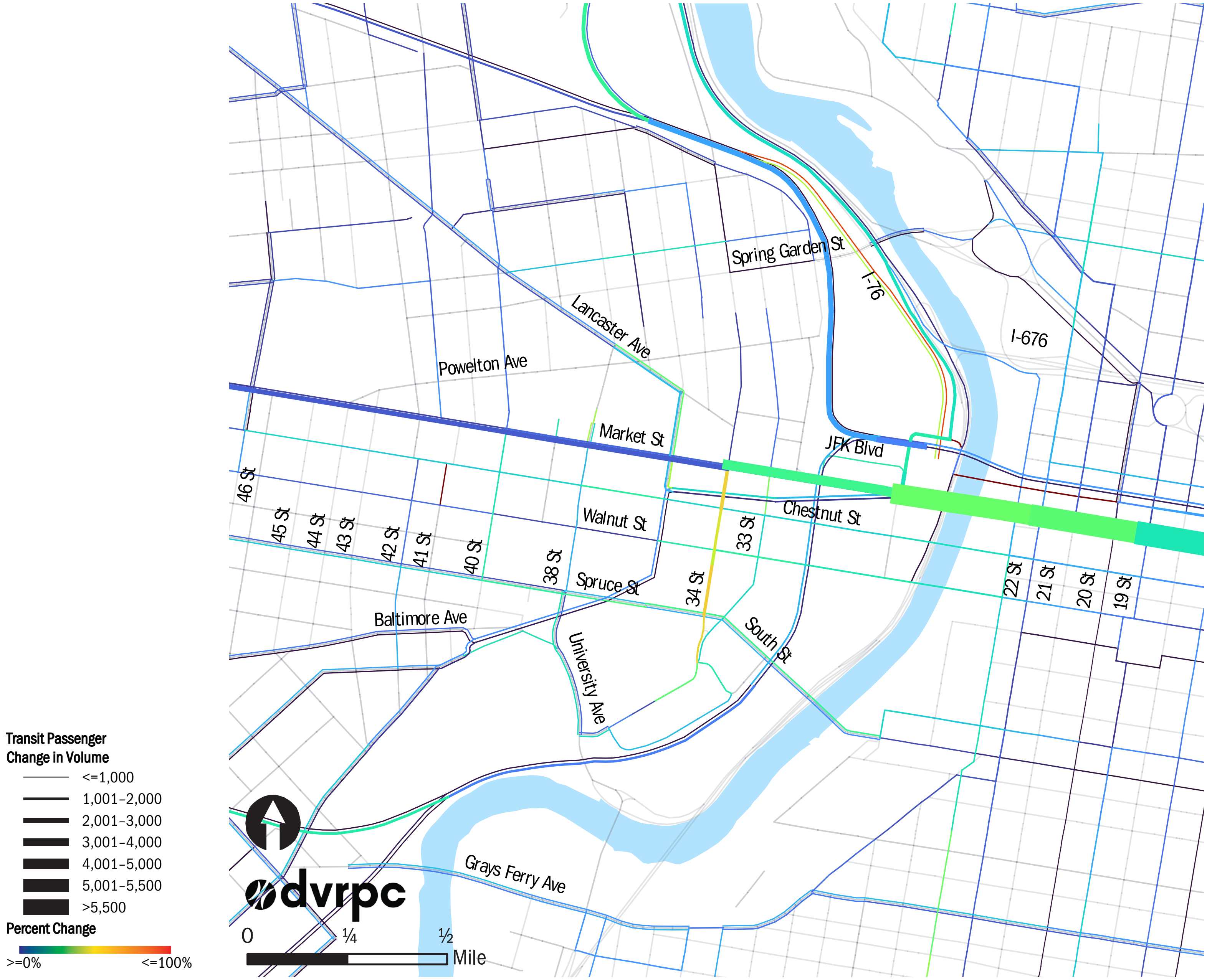
Like roadway volumes, the change in inbound transit volumes in the AM are proportional to the development intensity and locations associated with each scenario with the bulk of any increase being associated with developments adjacent to 30th Street Station (Figures 57-59). While SEPTA's Reimagining Regional Rail, Bus Revolution, and Trolley Modernization initiatives have the potential to mitigate any increased demand on those services, the most significant increase is seen inbound via the combined MFL/Trolley tunnel under Market Street. Tables 7 and 8 show the breakdown in increased demand by scenario for the AM time period. Figures 66 and 67 (page 60) show modeled volumes in the tunnel by direction by time period.

Figure 57: 2045 Base Scenario: AM Peak Transit Passenger Trips



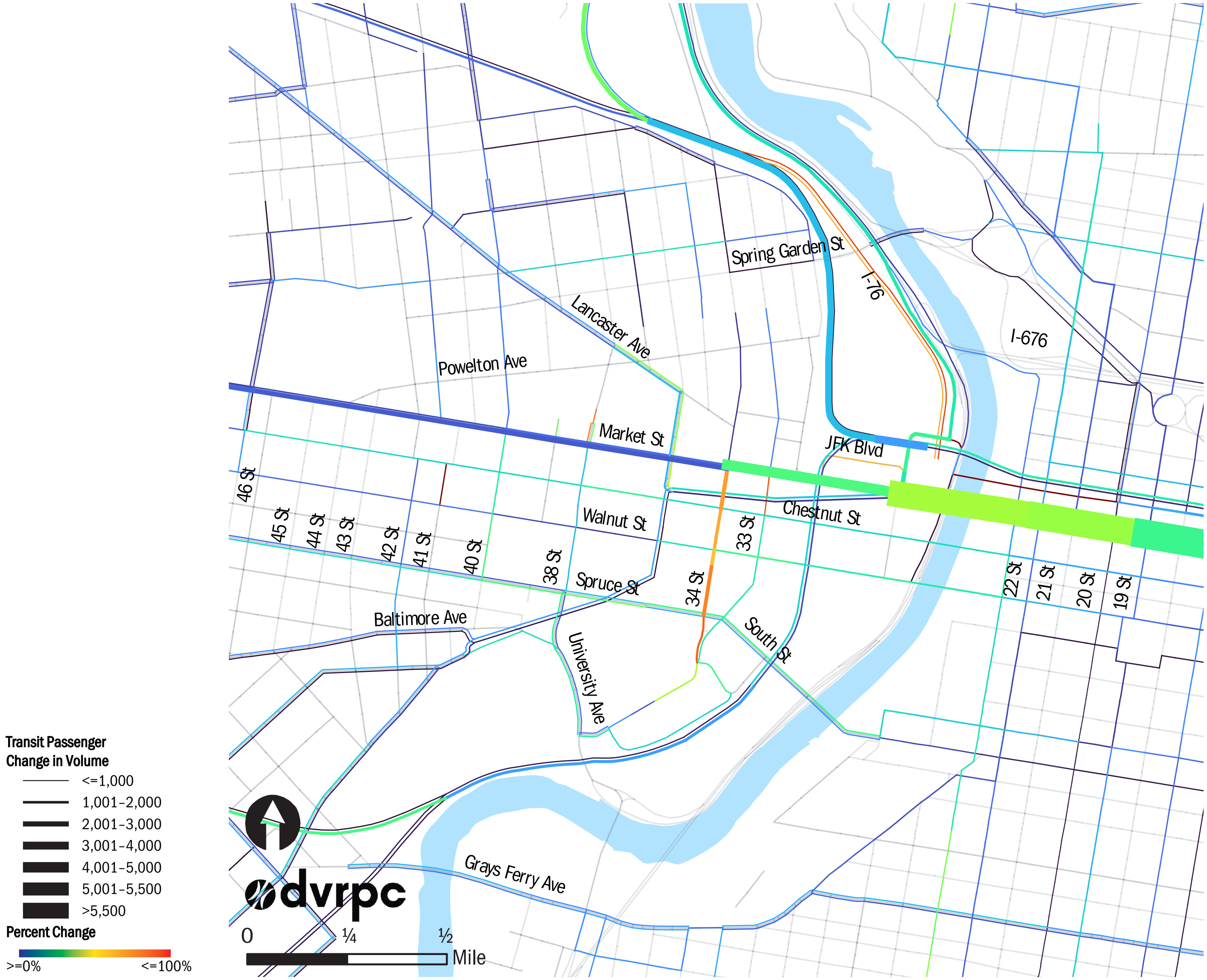
Source: DVRPC 2021

Figure 58: 2045 Moderate Scenario: AM Peak Transit Passenger Trips



Source: DVRPC 2021

Figure 59: 2045 High Scenario: AM Peak Transit Passenger Trips



Source: DVRPC 2021

Table 7: AM Eastbound Demand Change MFL/Trolley Tunnel Schuylkill Section

AM	Base	Moderate	High
MFL	13%	13%	14%
Trolley	9%	8%	8%
Total	12%	12%	13%

Table 8: AM Westbound Demand Change MFL/Trolley Tunnel Schuylkill Section

AM	Base	Moderate	High
MFL	69%	78%	91%
Trolley	30%	33%	37%
Total	62%	70%	81%

Source: DVRPC 2021

Midday Period: Transit Passenger Trips

Midday results (Figures 60-62) show a roughly similar pattern to the AM, although more modest in keeping with reduced overall trip making when compared to peak periods.The largest volume increases are seen on the MFL driven by new developments in and around 30th and 34th Street stations. Tables 9 and 10 show the breakdown in increased demand by scenario for the midday time period.

Figure 60: 2045 Base Scenario: Midday Peak Transit Passenger Trips

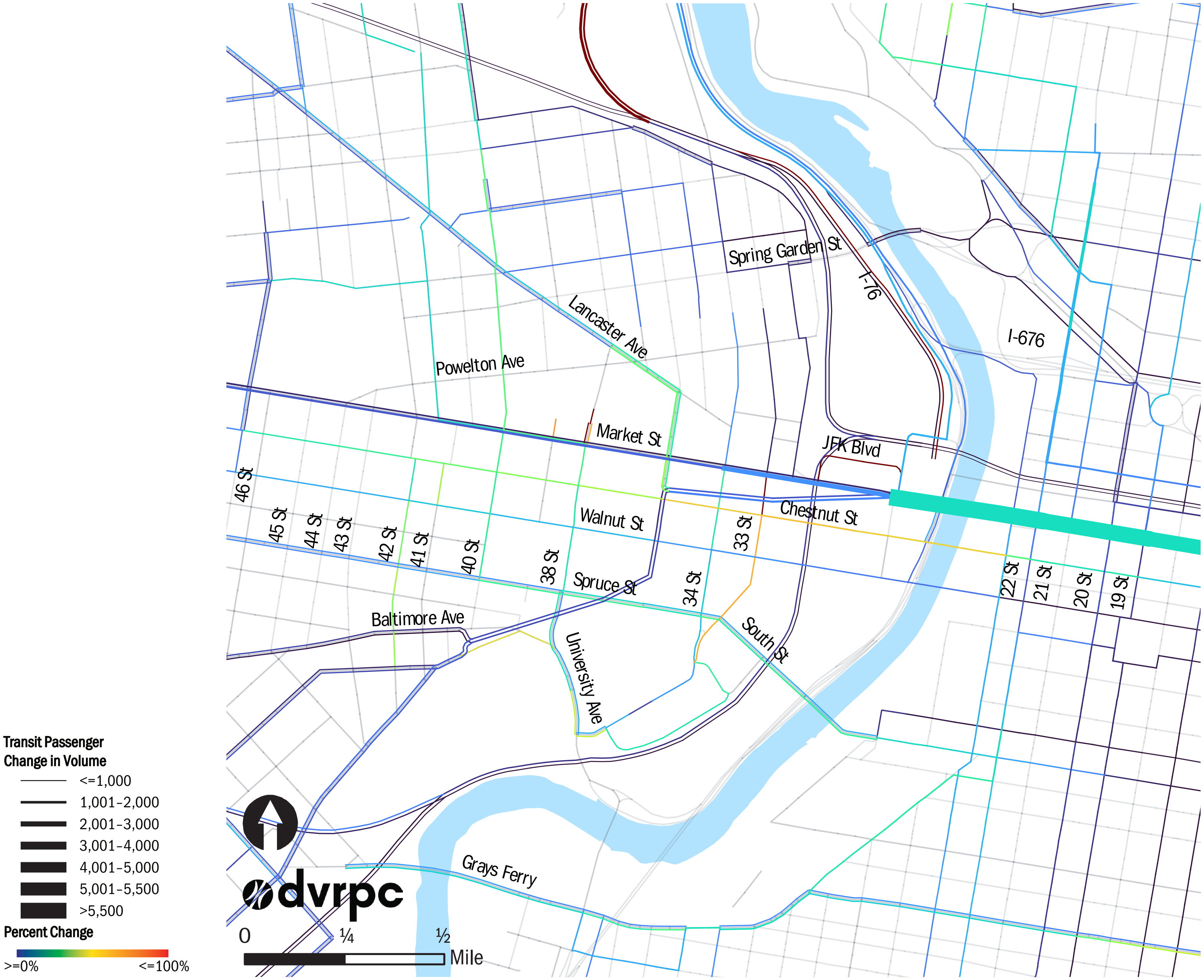
Transit Passenger Change in Volume
- <=1,000
- 1,001-2,000
- 2,001-3,000
- 3,001-4,000
- 4,001-5,000
- 5,001-5,500
- >5,500

Percent Change

>=0% <=100%

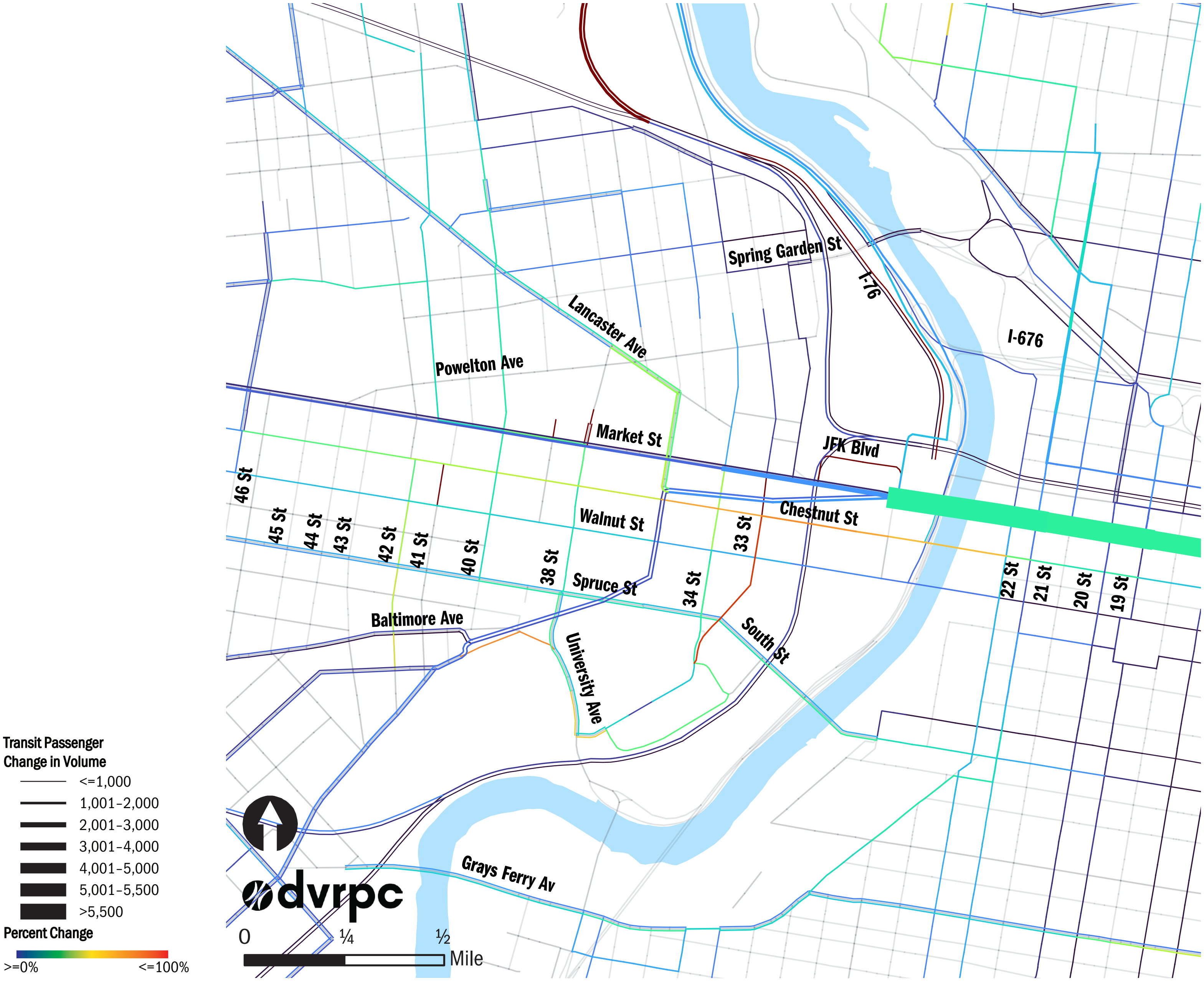
Source: DVRPC 2021

Figure 61: 2045 Moderate Scenario: Midday Peak Transit Passenger Trips



Source: DVRPC 2021

Figure 62: 2045 High Scenario: Midday Peak Transit Passenger Trips



Source: DVRPC 2021

Table 9: Midday Eastbound Demand Change MFL/Trolley Tunnel Schuylkill Section

MD	Base	Moderate	High
MFL	30%	35%	41%
Trolley	19%	21%	24%
Total	27%	31%	36%

Table 10: Midday Westbound Demand Change MFL/Trolley Tunnel Schuylkill Section

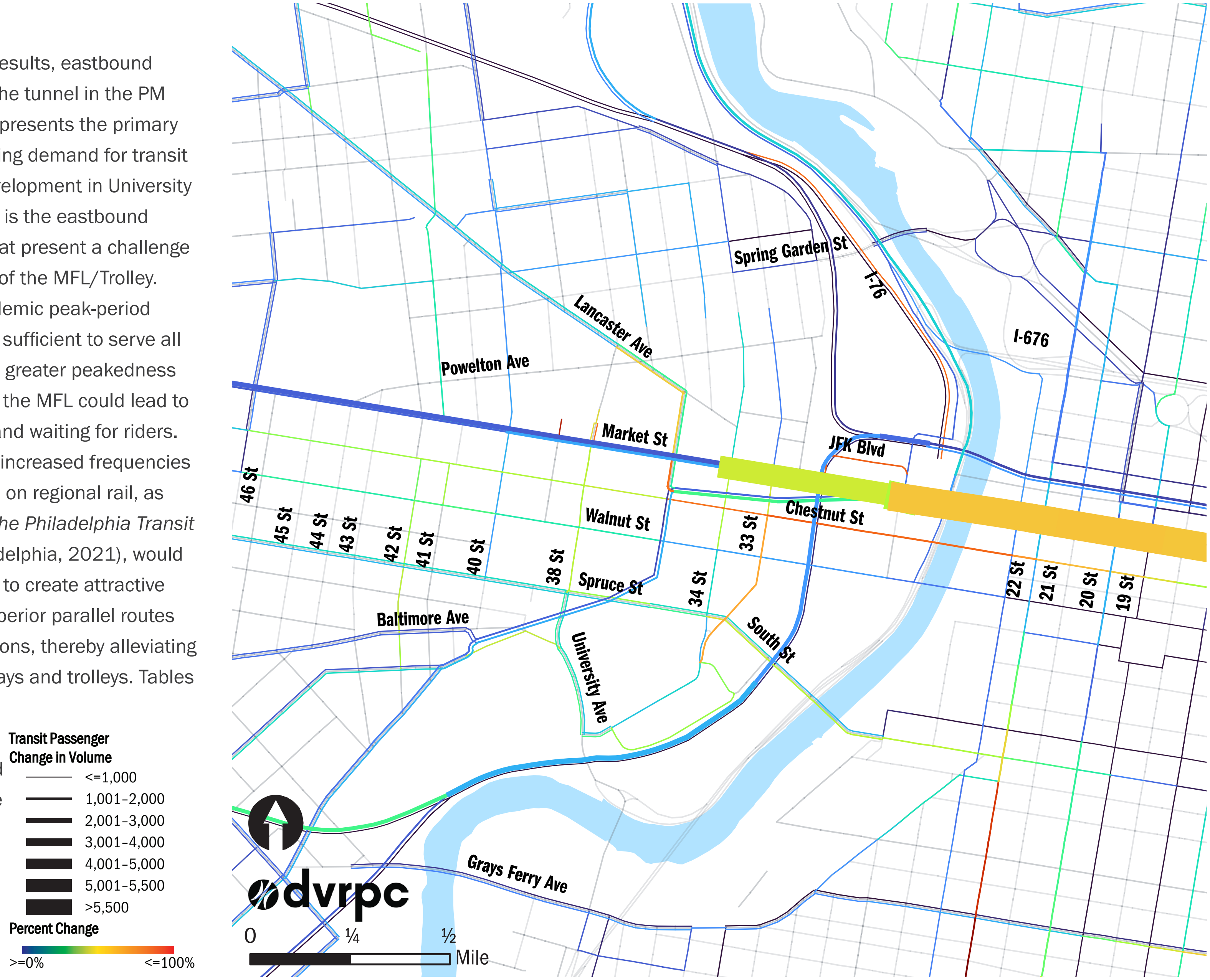
MD	Base	Moderate	High
MFL	7%	9%	10%
Trolley	9%	12%	13%
Total	8%	10%	11%

Source: DVRPC 2021

PM Peak: Transit Passenger Trips

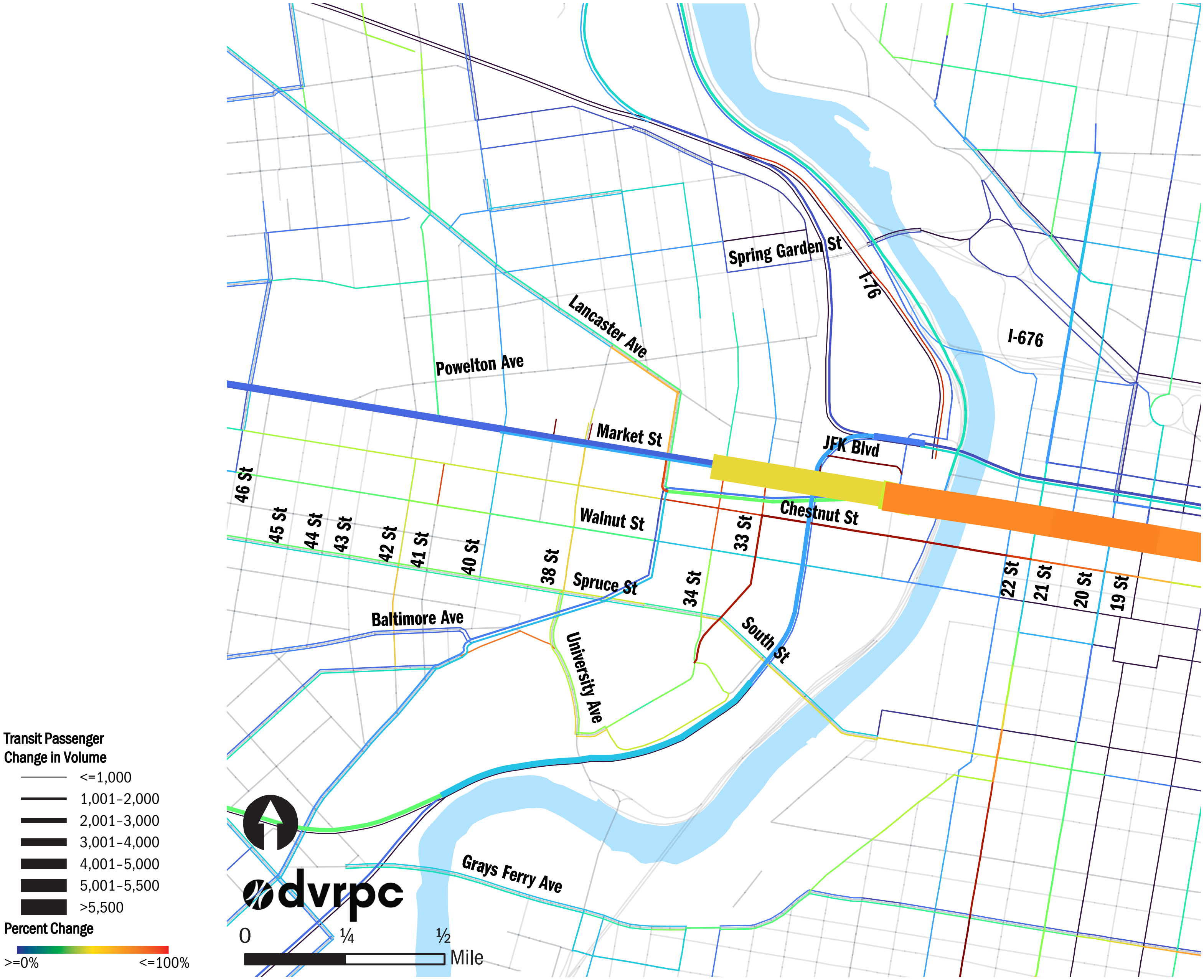
Mirroring the AM results, eastbound demand through the tunnel in the PM (Figures 63-65) represents the primary challenge to meeting demand for transit access to new development in University City. In this case it is the eastbound transit volumes that present a challenge to the throughput of the MFL/Trolley. Although pre-pandemic peak-period capacity would be sufficient to serve all modeled trips, the greater peakedness of PM demand for the MFL could lead to greater crowding and waiting for riders. At the same time, increased frequencies and reduced fares on regional rail, as contemplated in *The Philadelphia Transit Plan* (City of Philadelphia, 2021), would have the potential to create attractive and potentially superior parallel routes for some destinations, thereby alleviating pressure on subways and trolleys. Tables 11 and 12 show the breakdown in increased demand by scenario for the PM time period.

Figure 63: 2045 Base Scenario: PM Peak Transit Trips



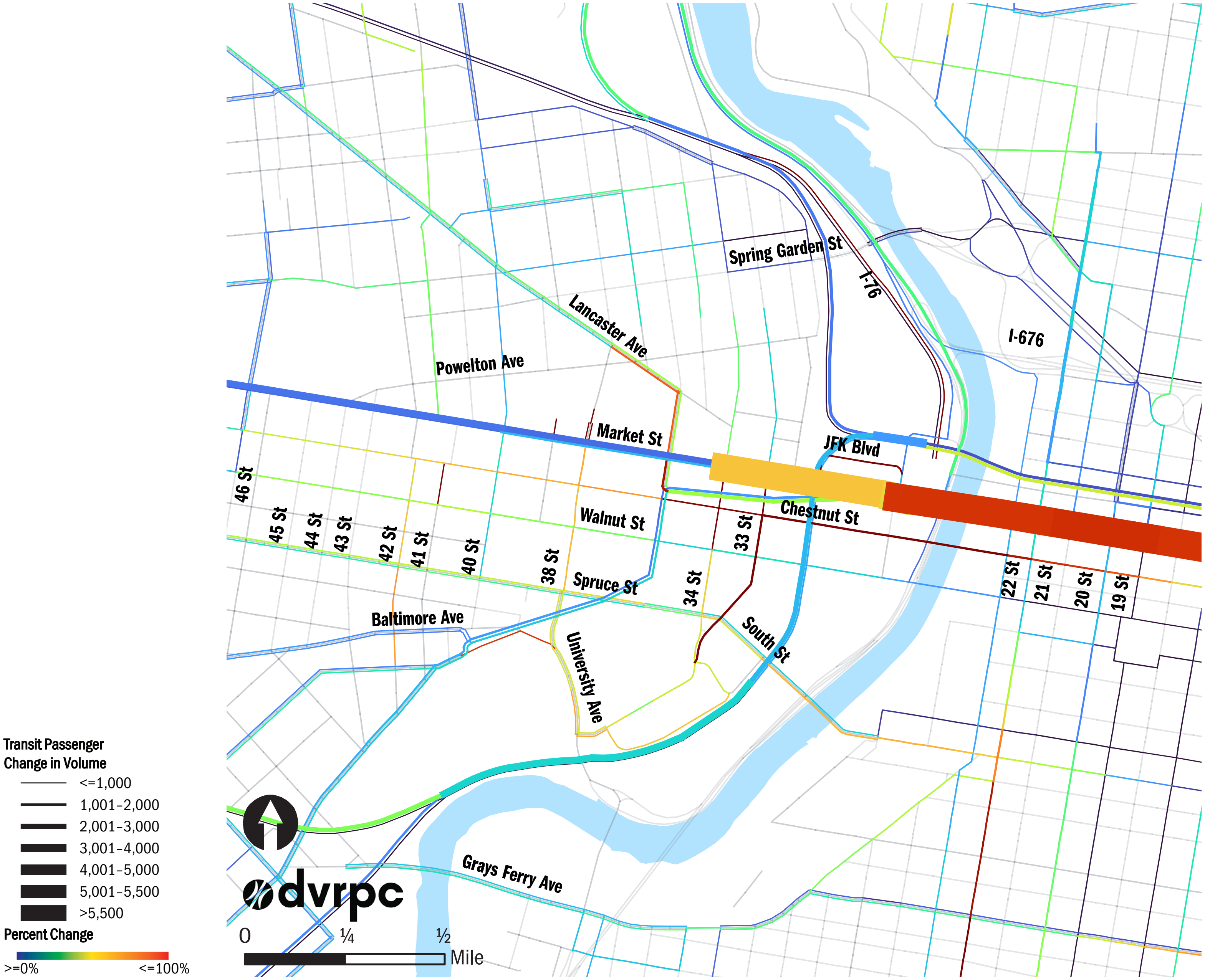
Source: DVRPC 2021

Figure 64: 2045 Moderate Scenario: PM Peak Transit Trips



Source: DVRPC 2021

Figure 65: 2045 High Scenario: PM Peak Transit Trips



Source: DVRPC 2021

Table 11: PM Eastbound Demand Change MFL/Trolley Tunnel Schuylkill Section

PM	Base	Moderate	High
MFL	71%	81%	96%
Trolley	39%	45%	51%
Total	64%	74%	87%

Table 12: PM Westbound Demand Change MFL/Trolley Tunnel Schuylkill Section

PM	Base	Moderate	High
MFL	9%	10%	11%
Trolley	9%	10%	10%
Total	9%	10%	11%

Source: DVRPC 2021

Figure 66: Modeled MFL/Trolley Tunnel Inbound Volumes

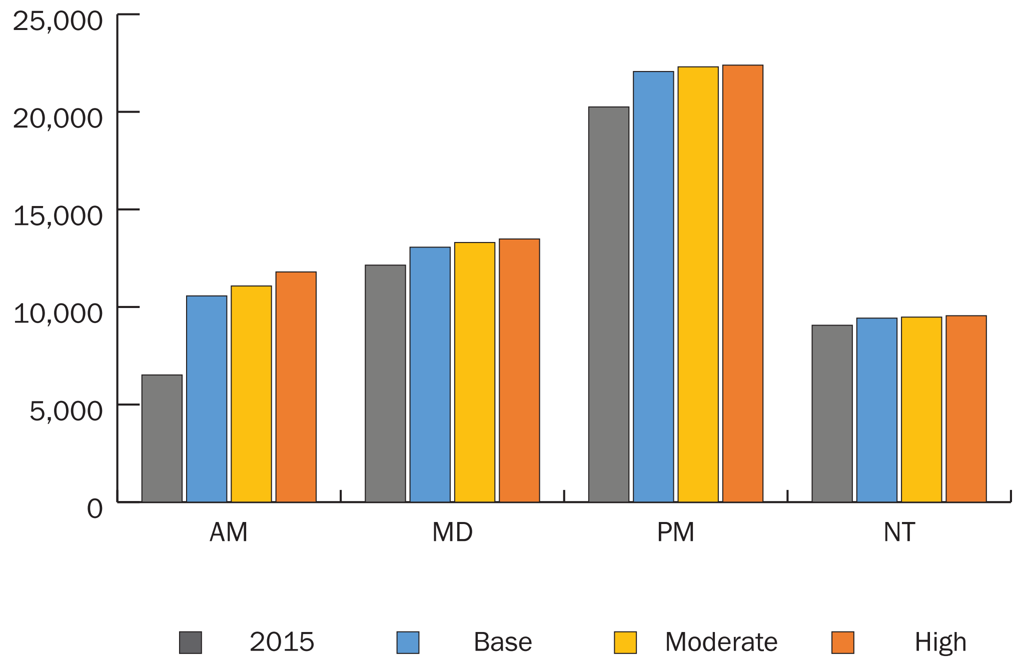
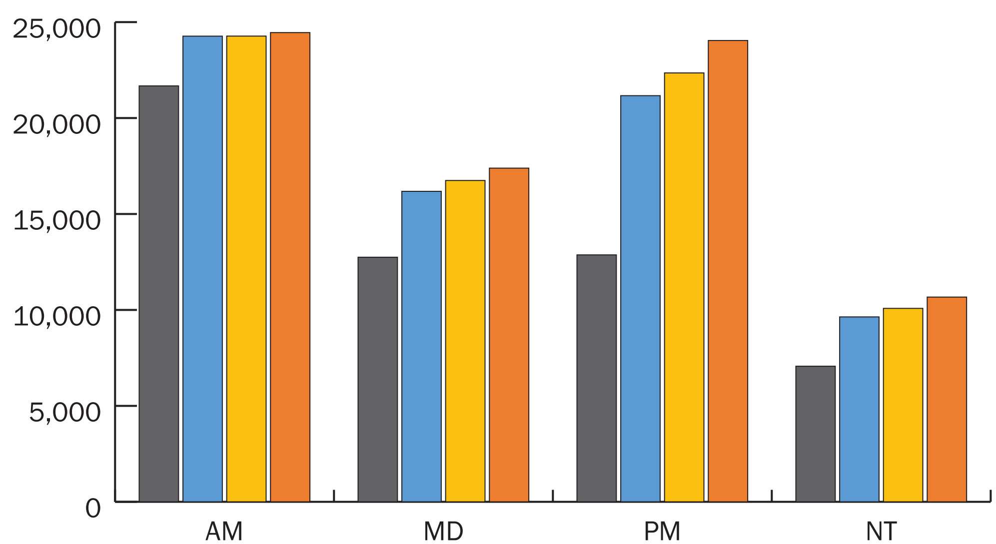


Figure 67: Modeled MFL/Trolley Tunnel Outbound Volumes

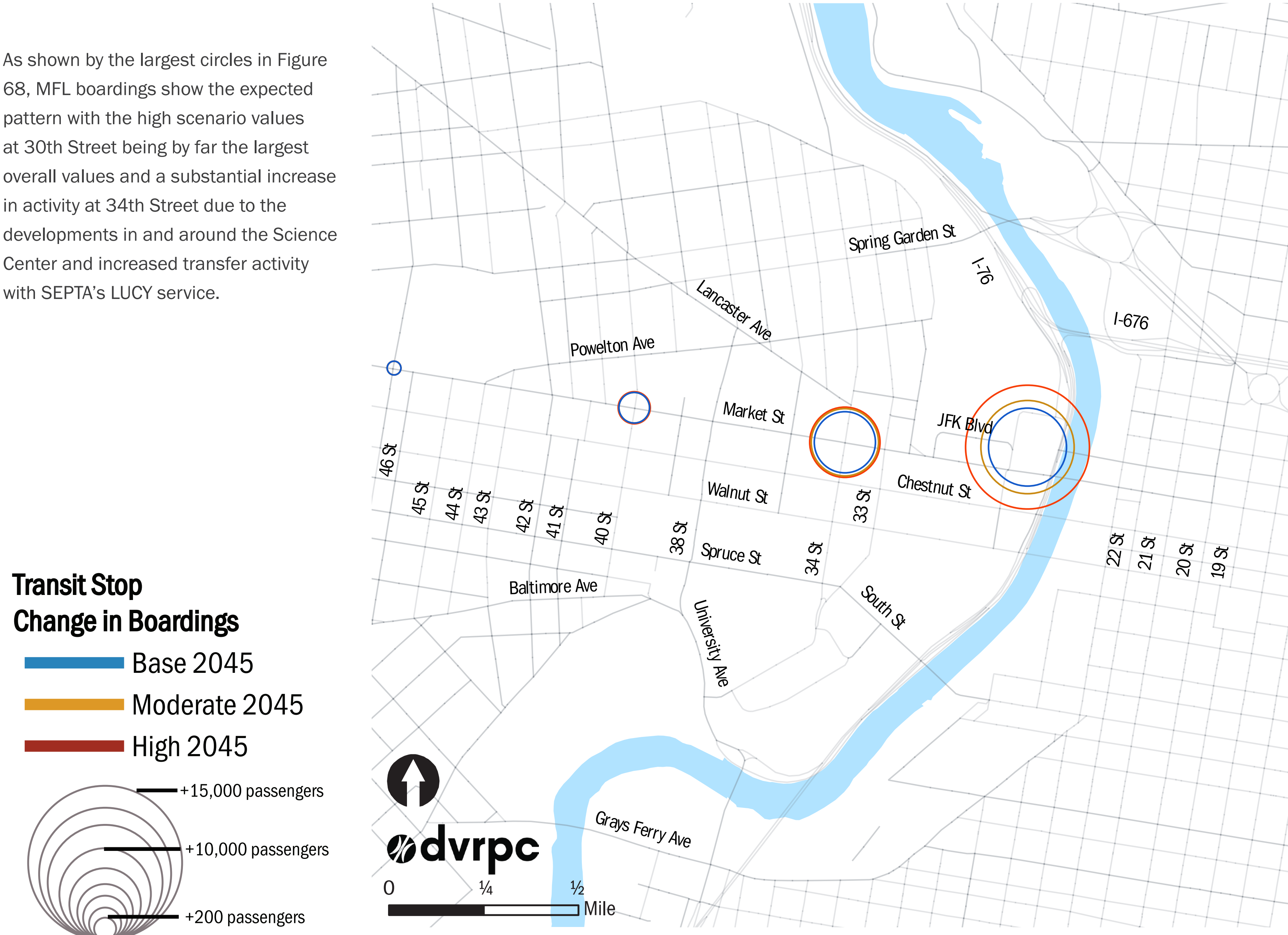


Source: DVRPC 2021

Subway Ridership Change

As shown by the largest circles in Figure 68, MFL boardings show the expected pattern with the high scenario values at 30th Street being by far the largest overall values and a substantial increase in activity at 34th Street due to the developments in and around the Science Center and increased transfer activity with SEPTA's LUCY service.

Figure 68: 2045 Subway Ridership Change

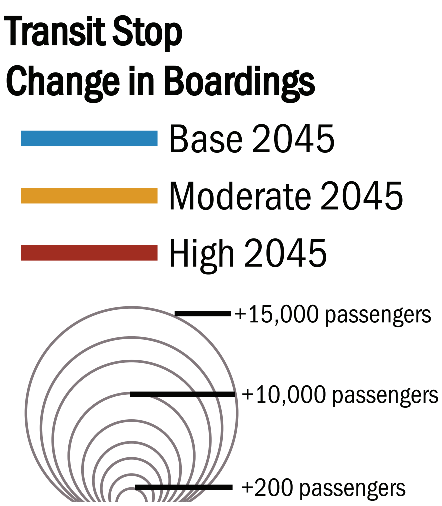


Source: DVRPC 2021

Trolley Ridership Change

A similar pattern of modest growth everywhere with increased demand for stations adjacent to new development is observed with the trolleys in Figure 69, although it should be noted that 38th & Lancaster shows a substantial demand increase under all scenarios driven by the expansion and redevelopment at 38th and Powelton.

Figure 69: 2045 Trolley Ridership Change

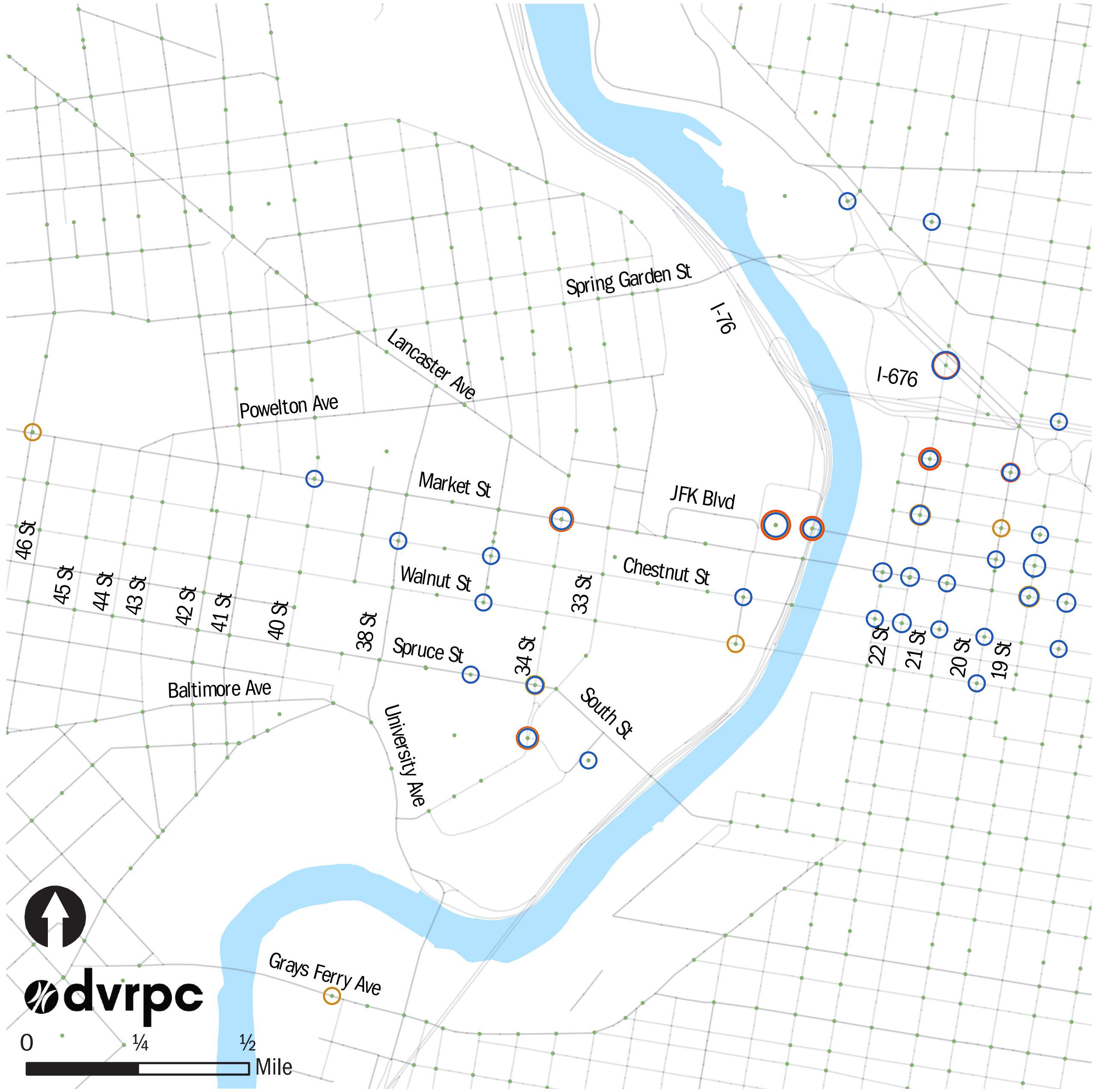


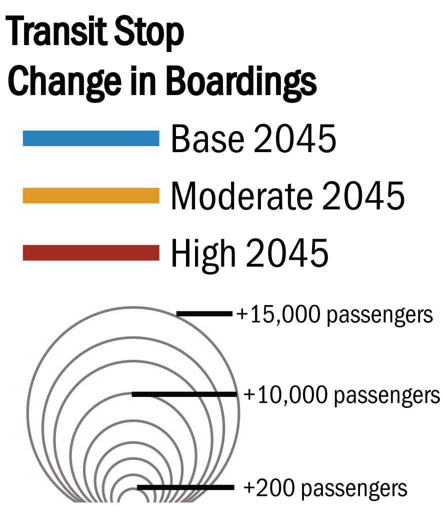
Source: DVRPC 2021

Bus Ridership Change

Significant increases in bus boardings (Figure 70) associated with scenario differences are predicted at 30th Street and MFL stations to the west as well as the HUP- and CHOP-associated stops on S 34th Street.

Figure 70: 2045 Bus Ridership Change





Source: DVRPC 2021

Regional Rail Ridership Change

In keeping with expectations, the higher ridership increase observed at 30th Street versus Universtiy City Station for regional rail (Figure 71) is reflective of more frequent service and, especially in the high development scenario, much higher density of new uses.

Figure 72 shows changes in modeled boardings by transit mode by stop.

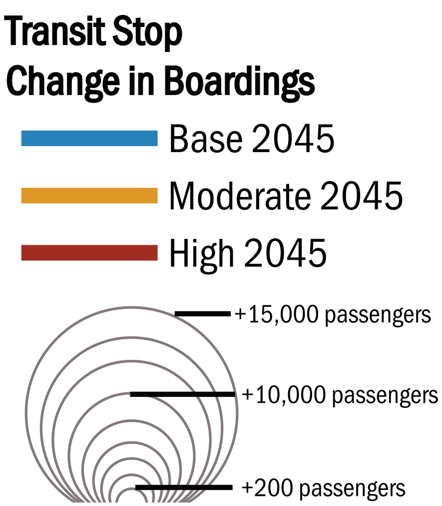
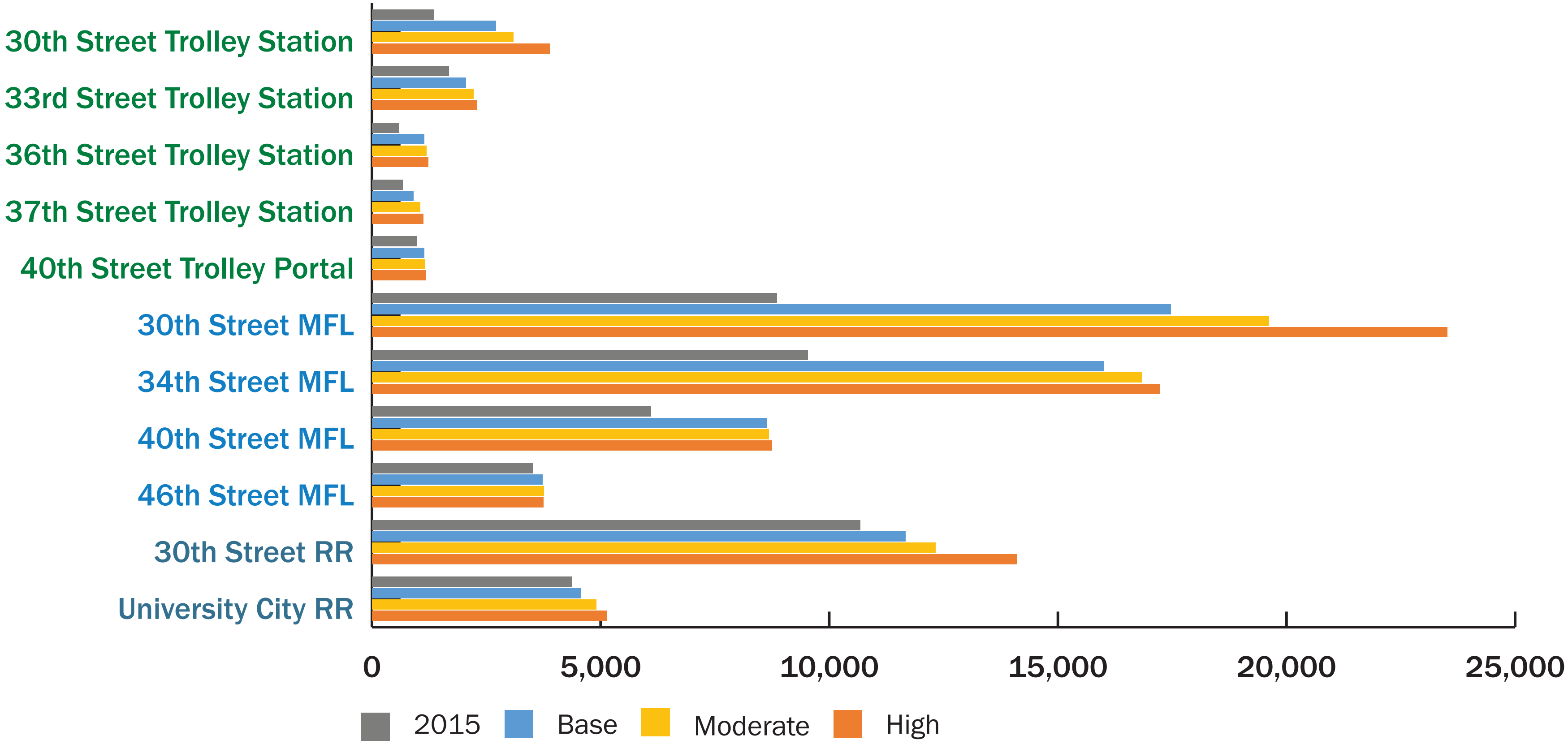


Figure 71: 2045 Regional Rail Ridership Change

Source: DVRPC 2021

Figure 72: Daily Boardings by Stop by Scenario



Source: DVRPC 2021

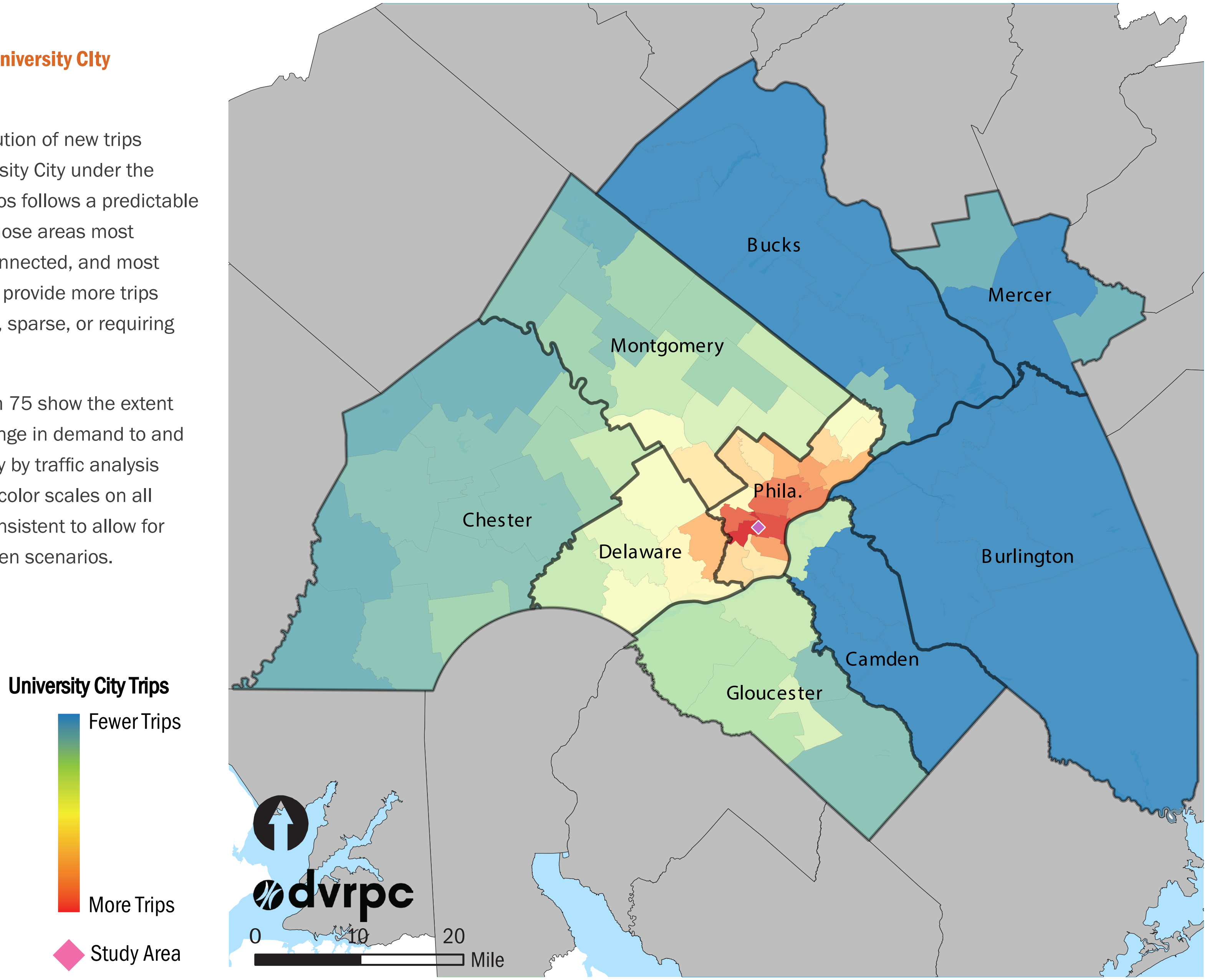
Geography of Demand

Trips to and from University CIty

The spatial distribution of new trips to and from University City under the respective scenarios follows a predictable pattern whereby those areas most proximate, best connected, and most densely populated provide more trips than those distant, sparse, or requiring circuitous routing .

Figures 73 through 75 show the extent and degree of change in demand to and from University City by traffic analysis district (TAD). The color scales on all three maps are consistent to allow for comparison between scenarios.

Figure 73: 2045 Base Scenario Combined Trips Per TAD To/From University City

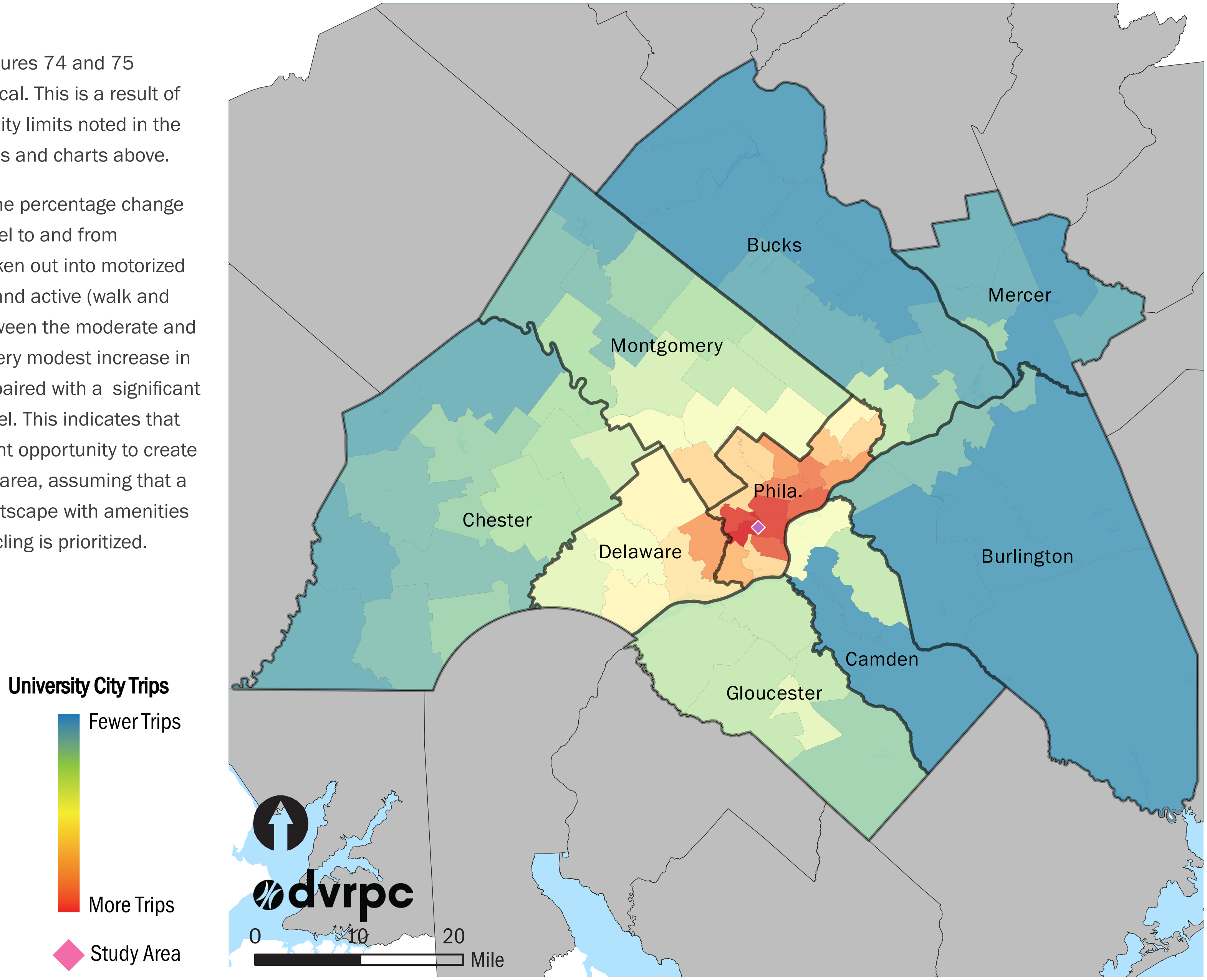


Data: U.S. Census Bureau 2010, DVRPC 2020

On comparison Figures 74 and 75 appear near identical. This is a result of the roadway capacity limits noted in the traffic volume maps and charts above.

Figure 76 shows the percentage change in demand for travel to and from University City broken out into motorized (cars and transit) and active (walk and bike) classes. Between the moderate and high scenarios a very modest increase in motorized trips is paired with a significant jump in active travel. This indicates that there is a significant opportunity to create a bustling, vibrant area, assuming that a human-scale streetscape with amenities for walking and cycling is prioritized.

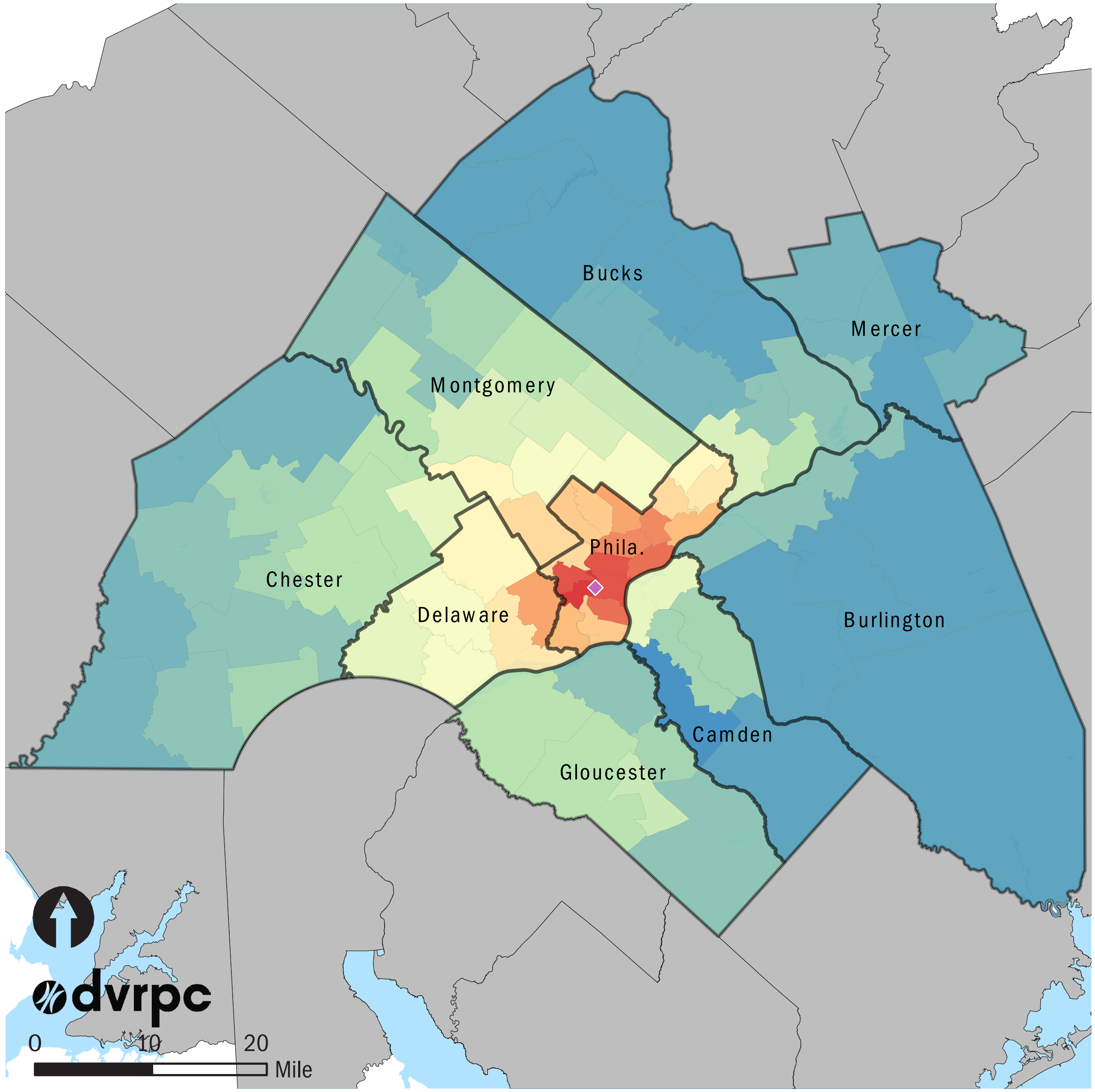
Figure 74: 2045 Moderate Scenario Combined Trips Per TAD To/From University City



Data: U.S. Census Bureau 2010, DVRPC 2020

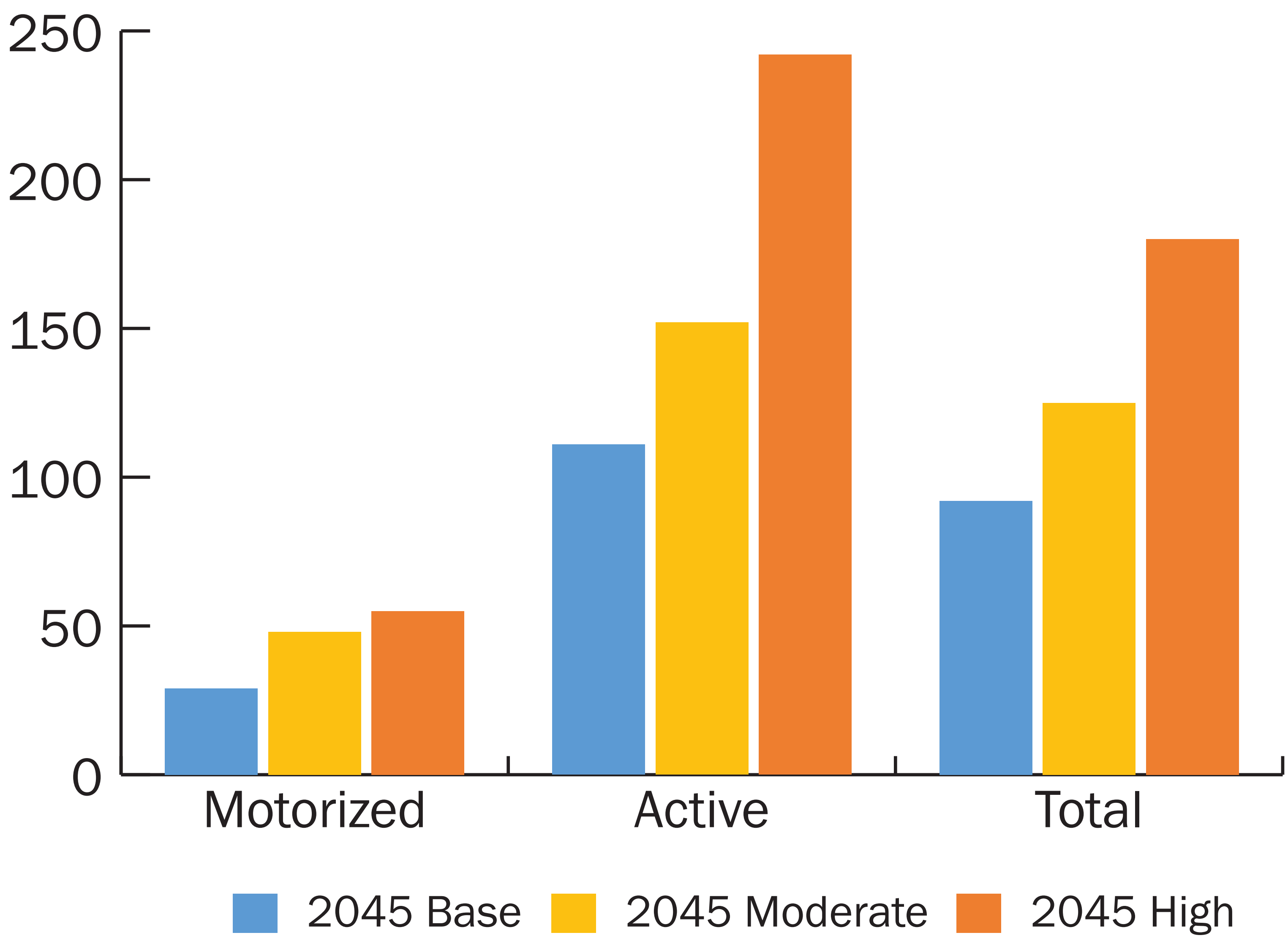
In light of the findings herein it is apparent that this area's future thriving will depend on taking measures to move the needle on traveler mode choice. To this end it is advised that the City of Philadelphia convene major developers, institutions, SEPTA, PennDOT, and other stakeholders to prevent a tragedy of the transport commons. Exploration of coordination in the provision and pricing of parking; evaluation of potential changes to transit operations; evaluation of potential ramp reconfigurations; and consideration of institutional policies, such as transit and bikeshare benefits or converting the cost of current parking benefits to annual transport payments spread evenly amongst all employees, should all be on the table. Although congestion may be a form of equilibrium, this will not be a self-solving problem.

Figure 75: 2045 High Scenario Combined Trips Per TAD To/From University City



Data: U.S. Census Bureau 2010, DVRPC 2020

Figure 76: Percentage Change in Travel Demand by Major Classification



Source: DVRPC 2021

Appendices

A: Bikeshare Ridership by Station

B: TIP Projects within Study Area

C: Study Area Calibration

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APPENDIX A

Bikeshare Ridership by Station

The following graphs provide a breakdown of inbound, outbound, and internal trips for each Indego station within the study area. Outbound and inbound trips are trips that start or end within the study area, respectively. Internal trips are those that start and end within the study area, and these trips were assigned to the destination station. The data for all of these graphs was provided by Bicycle Transit Systems.

Figure A-1: University City Station

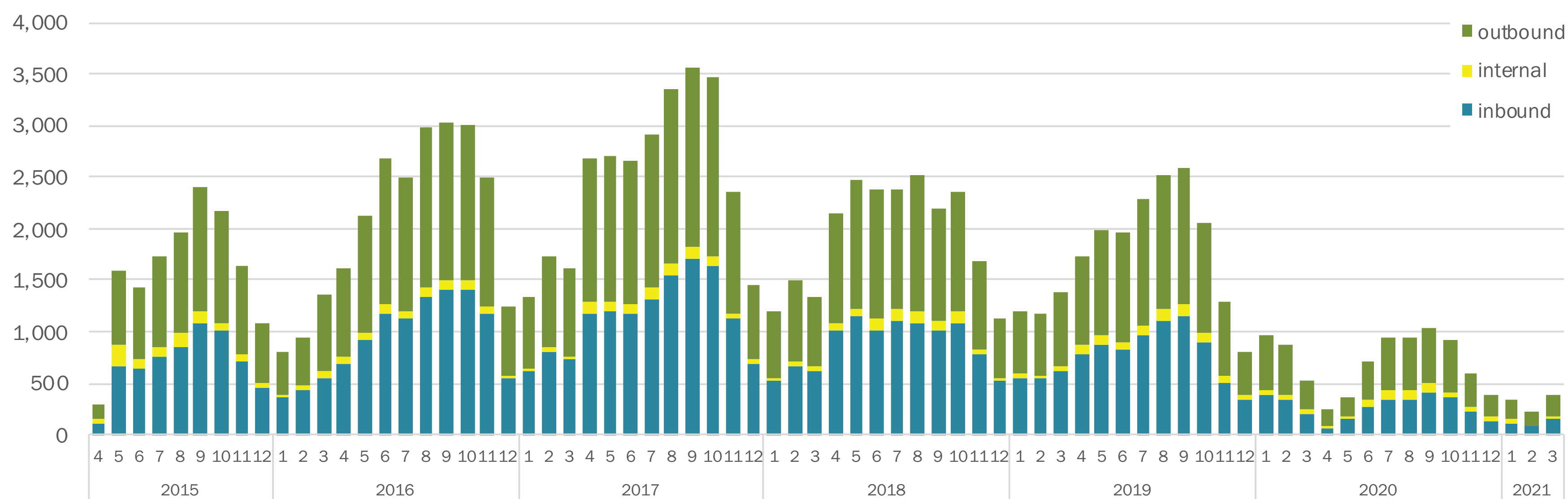


Figure A-2: Amtrak 30th Street Station

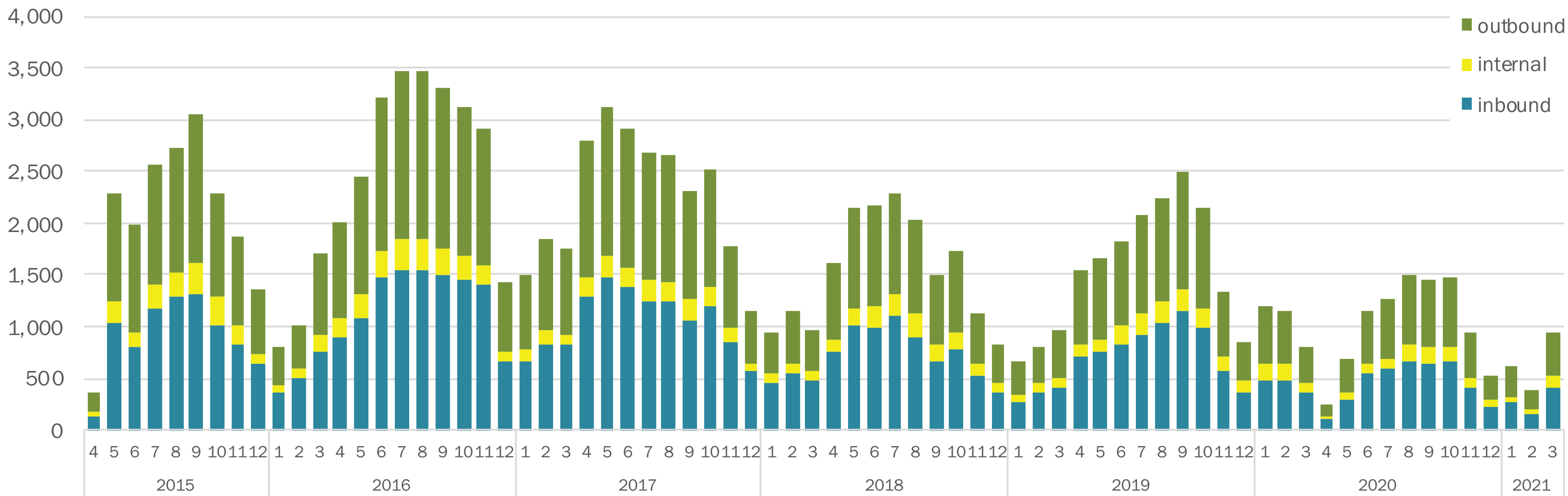


Figure A-3: 36th & Sansom

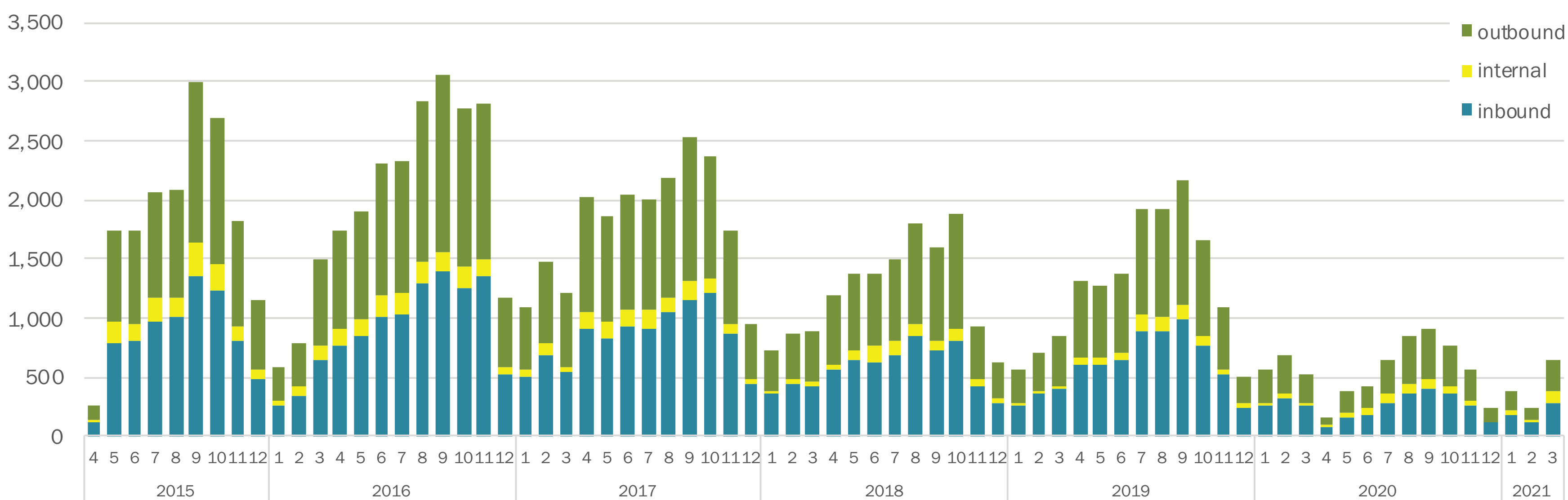


Figure A-4: CHOP

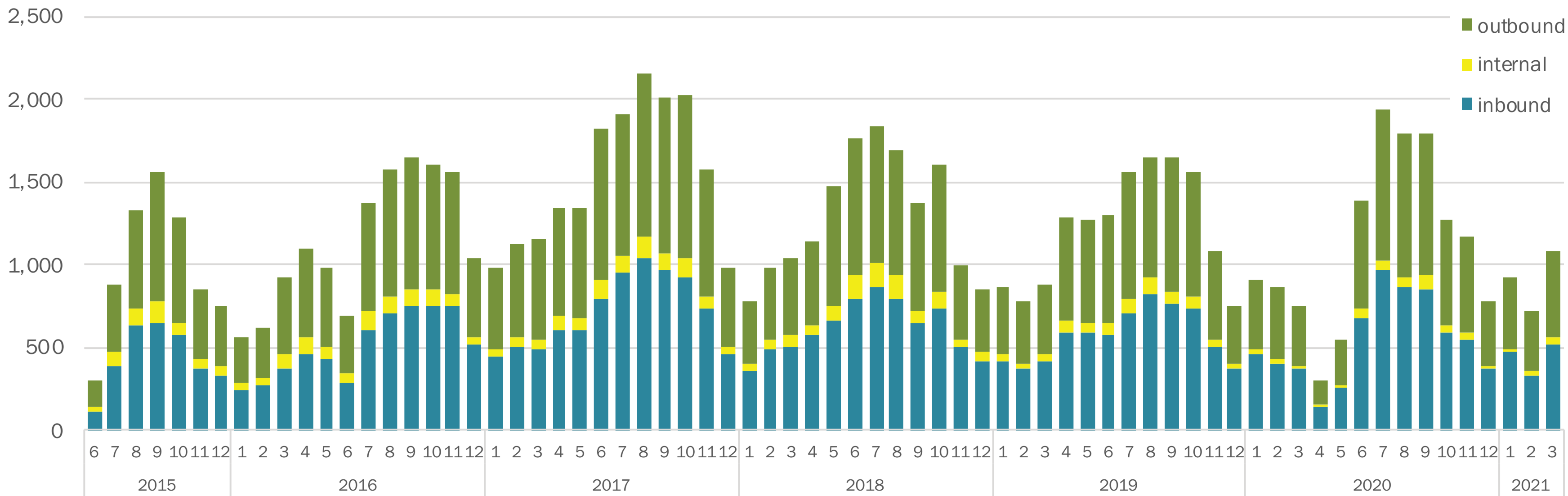


Figure A-5: CHOP: Osler Circle (closed in 2020)

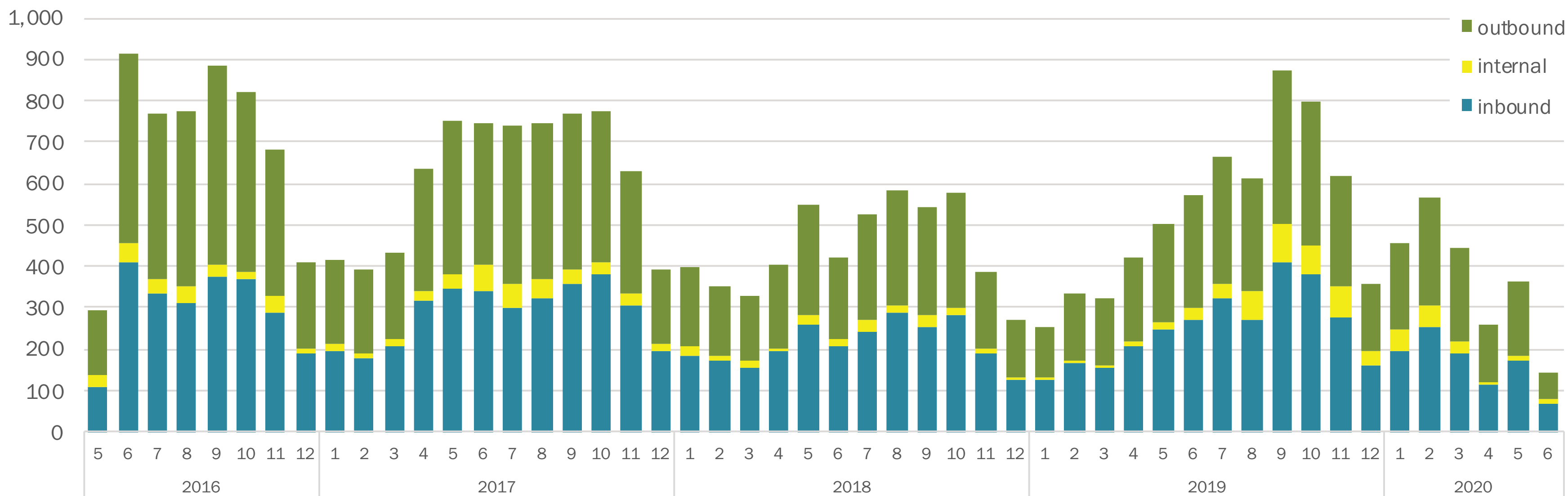


Figure A-6: 30th Street Station East

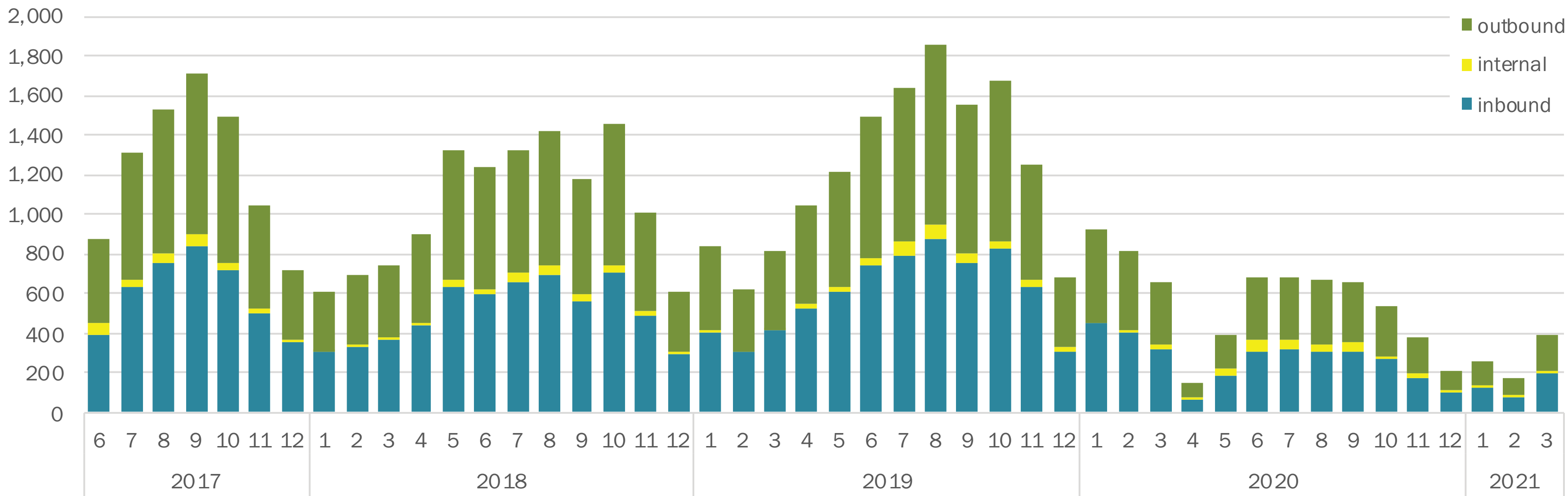


Figure A-7: Health Sciences Drive

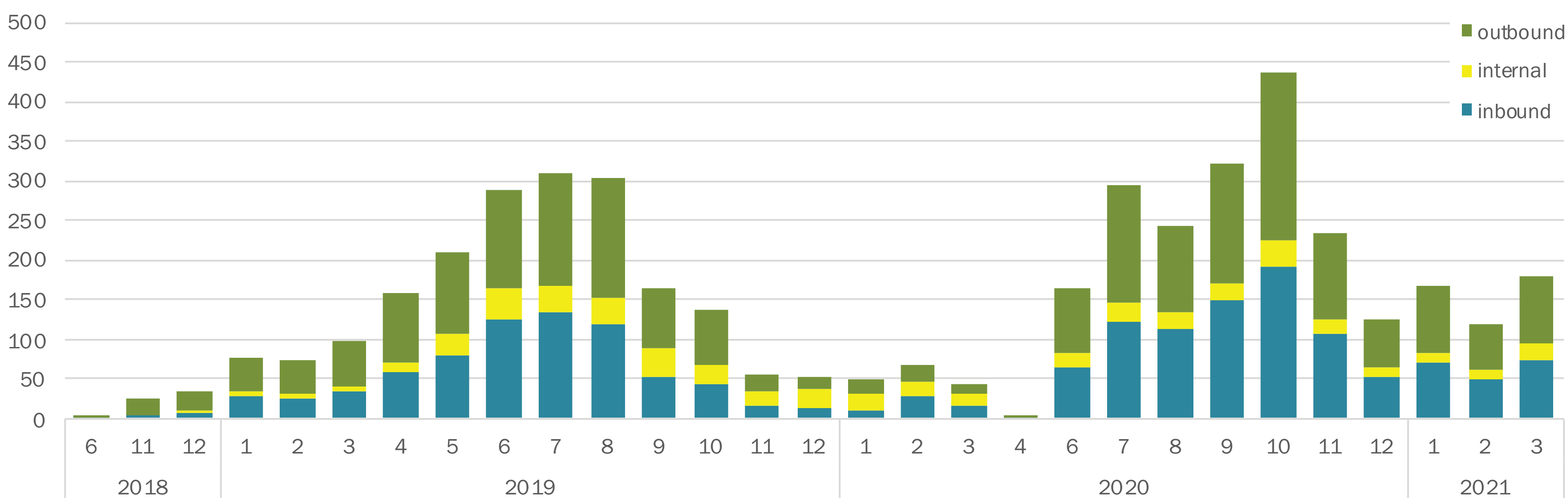


Figure A-8: 34th & Chestnut

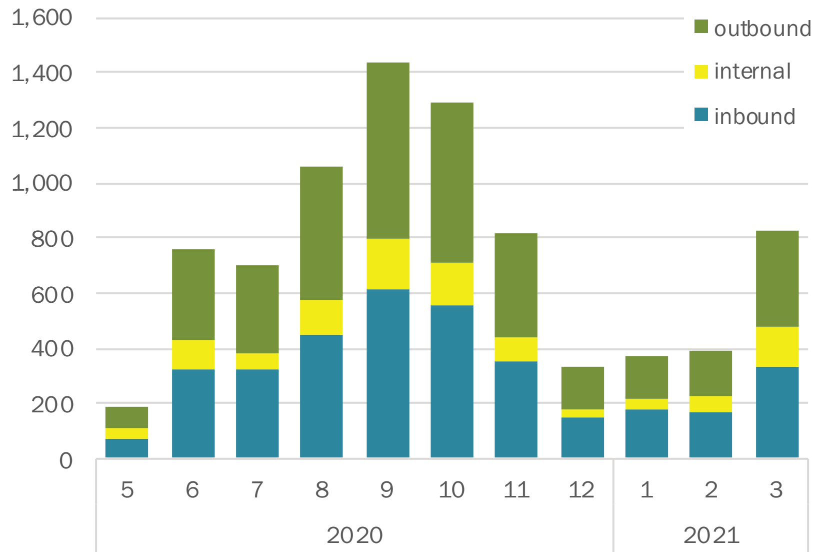
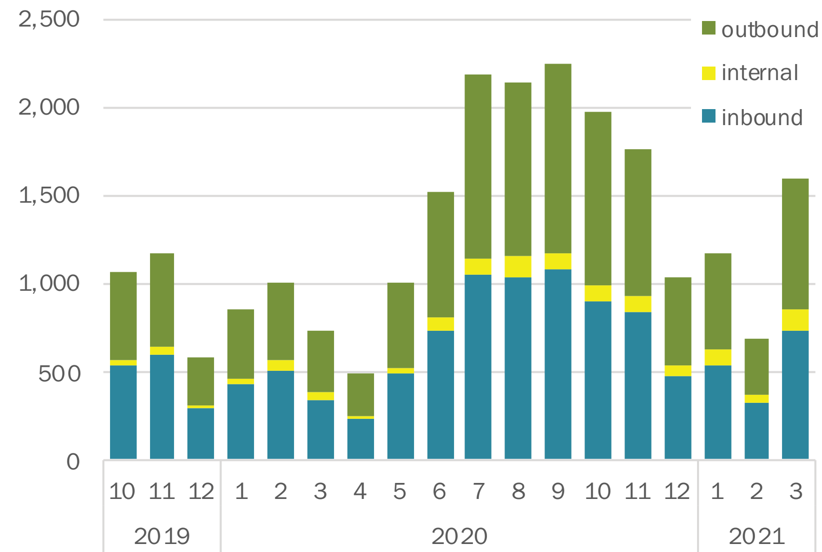


Figure A-9: 34th & Spruce 3208



APPENDIX B

TIP Projects within Study Area

Table B-1: TIP Projects: Bicycle/Pedestrian Improvements

ID	Facility	Year(s)
7	Mid-block Crossing in University City - Drexel University	2023 - 2024
11	Schuylkill Banks Christian to Crescent (TIGER)	2021
15-18, 30	Safe Spaces for Cyclists: Building a Protected Bicycle Network (TAP)	2021

Table B-2: TIP Projects: Bridge Repair/Replacement

ID	Facility	Year(s)
0	Market Street Bridges (2) Over Schuylkill River and CSX Railroad (MSB)	2021 - 2032
1	University Av/CSX Rail (Bridge)	2021 - 2022
8	JFK Boulevard at 32nd Street over SEPTA (30th Street Station) (Bridge)	2021 - 2023
13	30th Street Viaduct over 30th Street Lower (Bridge)	2021 - 2032
14	I-76 Bridge Repair Section SRE - I-76 Arch Street to University Avenue	2021 - 2022
2-6, 9	Chestnut Street Bridges and Ramps, (9) at 30th Street	2021

Table B-3: TIP Projects: Intersection/Interchange Improvements

ID	Facility	Year(s)
22	University Avenue and I-76 Off Ramp Intersection Safety Improvements	2020

Table B-4: TIP Projects: Roadway Rehabilitation

ID	Facility	Year(s)
10, 12, 24	Citywide Resurfacing 108	2021 - 2022
25-26	Citywide Resurfacing 107	2021 - 2032
27	I-76: Route 1 - I-676	2021 - 2032
28-29	Citywide Resurfacing 110	2021

Table B-5: TIP Projects: Signal/ITS Improvements

ID	Facility	Year(s)
23	Expressway Service Patrol - Philadelphia	2021 - 2032

Table B-6: TIP Projects: Transit Improvements

ID	Facility	Year(s)
19	Transit and Regional Rail Station Program - 30th Street Station Improvements Phases A & B	2021 - 2024
20	Maintenance & Transportation Facilities - Powelton Yard Facility Improvements	2021 - 2022
21	Bridge Program - Mainline-Schuylkill Bridges (Mile Post 0.76 over the Schuylkill River)	2026 - 2032

Study Area Calibration

Traffic Volumes

Figures C-1 through C-4 show comparisons of the current state of the model relative target to sets for modeling automobile demand within and adjacent to the study area. The cordon volumes in Figure C-1 show that the model is reproducing aggregate flows into and out of the study area by cardinal direction of approach with a reasonable degree of fidelity. The individual facility volumes in the scatterplots of Figures C-2 and C-3 show that, although a little high overall, the model is reproducing demand at the segment level within better than 20 percent of target values on average.

Taken together these outputs indicate that the road network behavior of the model is suitable for demand forecasting.

Figure C-1: Cordon Traffic Counts versus Modeled Volumes

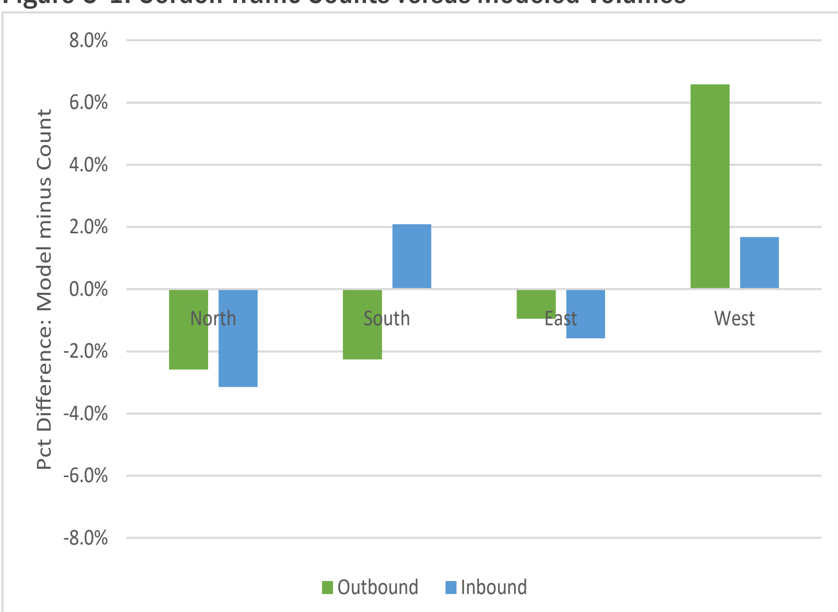


Figure C-2: Roadway Traffic Counts versus Modeled Volumes

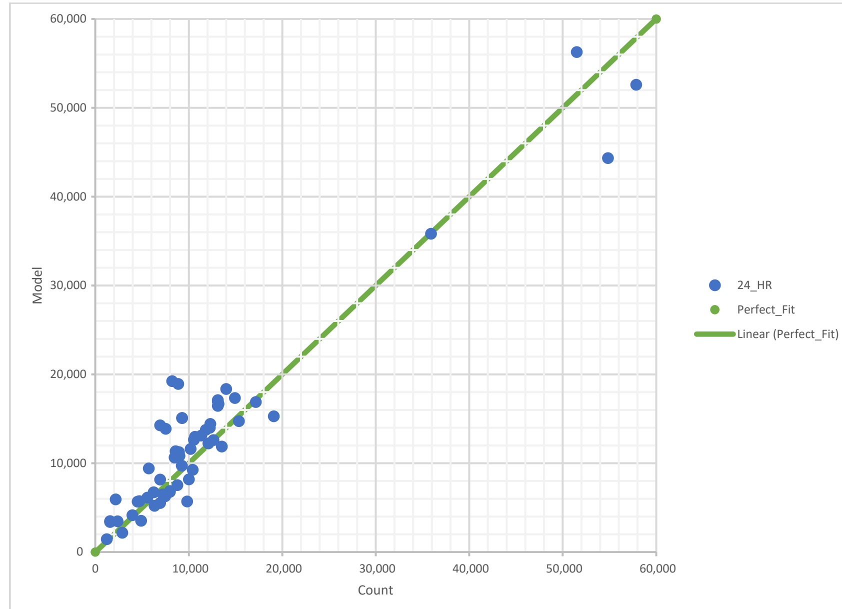
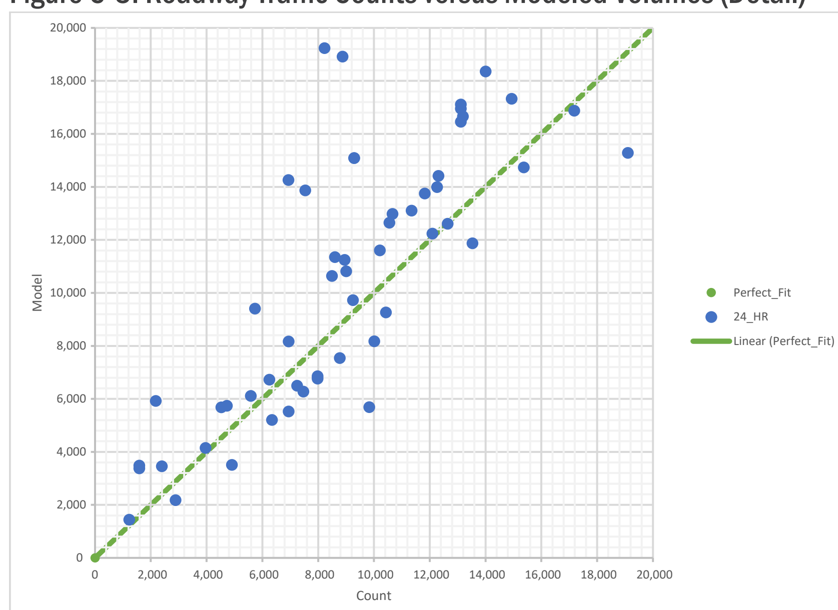


Figure C-3: Roadway Traffic Counts versus Modeled Volumes (Detail)

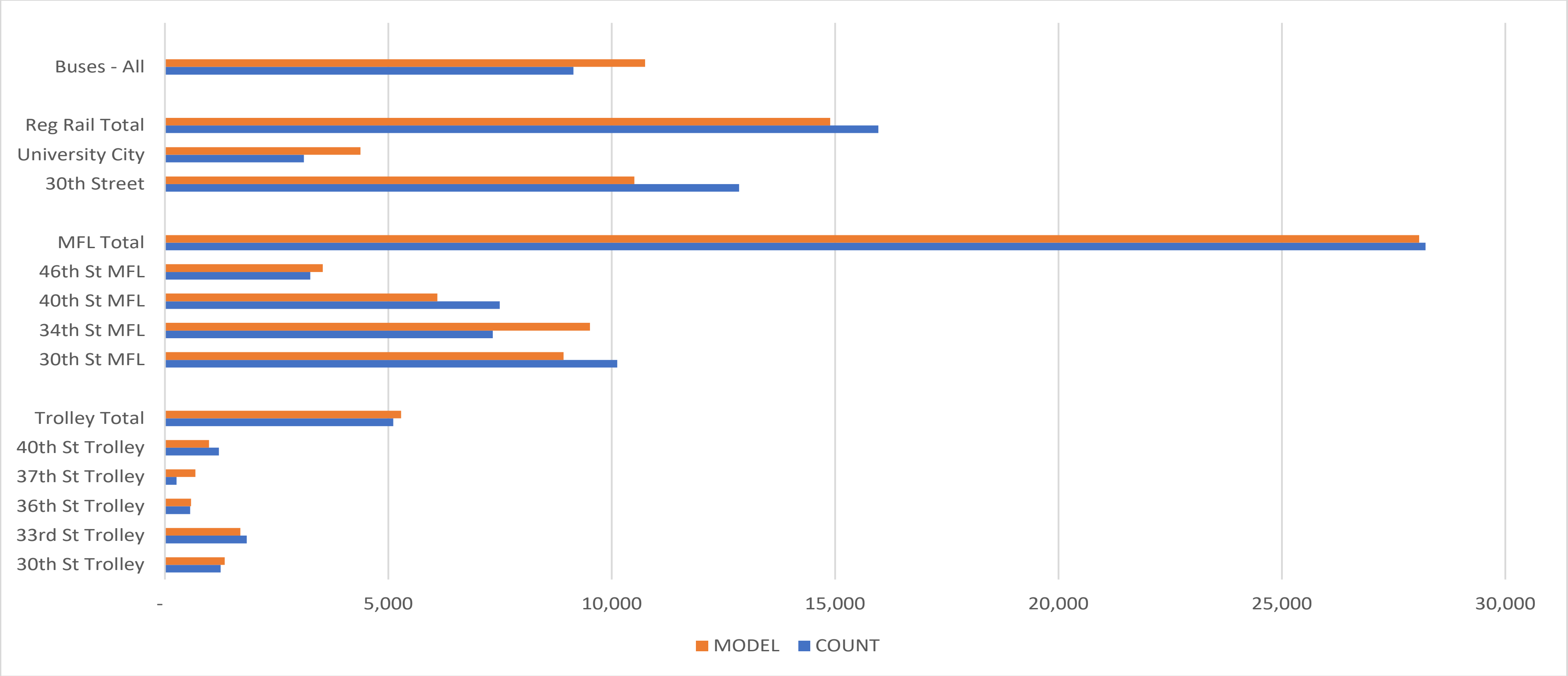


Transit Boardings

Figure C-4 shows boardings by transit submode for stops and stations located within the study area. Although individual boarding locations by line vary as to degree of difference, all services are within +/– 20 percent for aggregate demand, and overall transit demand is within 5 percent for the study area.

These results, in conjunction with the roadway outputs, indicate that aggregate demand and mode choice behaviors within the study area are sufficiently understood by the base model to begin coding and running development scenarios.

Figure C-4: Boarding Counts versus Modeled Boardings by Transit Submode



University City Multimodal Capacity Study

Publication Number:
TR 21050

Date Published:
June 2022

Geographic Area Covered:
West Philadelphia, University City

Key Words:
Development, Mobility, Mulitmodal, Traffic

Abstract:
This report contains the findings of a set of analyses requested by the Philadelphia City Planning Commission (PCPC) to determine the transportation system impacts of multiple development scenarios. The foci of these scenarios were the 30th Street Station District, the Science Center on Market Street, the Children's Hospital of Philadelphia (CHOP)/Hosptal of the University of Pennsylvania (HUP) medical campus, and the Pennovation Center.

Findings were that all futures included increases in congestion on I-76, with higher intensity scenarios causing greater congestion and delay while also having the potential to severely impact the surface street grid. At the same time significant spare transit capacity remained. It is recommended that coordinated strategies for demand reduction and modal shift be pursued

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