



State of the System

September 2019



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Introduction

CAT 2020

Capital Area Transit System (CAT) is conducting a comprehensive assessment of its existing transit service and establishing a vision for what transit should be in 2020. This study is the first of its type in CAT's 45-year history, and it comes at an important time for CAT. With declining ridership and pending budget deficits, CAT must rethink the way transit services are provided and look for new ways to provide efficient and effective public transit.

State of the System

The State of the System is a complete assessment of the existing transit service conditions in CAT's service area. This provides a foundation of the current opportunities and challenges faced by CAT as the organization seeks to develop a vision for 2020.

This State of the System report provides:

1. A review of CAT's existing bus transit service and operating characteristics.
2. An assessment of CAT's bus ridership at the service type-, route-, and stop-level.
3. An assessment of challenges and opportunities with CAT's bus system.





Overview of Existing Services

CAT operates 34 routes, serving the City of Harrisburg and areas of Dauphin County and Cumberland County. These routes are categorized into five different service types:

- Urban
- Suburban
- Suburban Limited
- Commuter Express
- Express

These service types were identified in the 2013 *Capital Area Transit Planning Service Standards and Process* document. Note that some routes may fall into more than one service type depending on CAT's assessment of transit demand. For example, Route C is classified as both suburban service and express service.

Urban

Urban routes are defined as a route which operates primarily within Harrisburg city limits. These routes operate on weekdays and Saturdays.

- Route 1 – Market Street
- Route 2 – Capitol Complex / ROC Shuttle
- Route 3 – Third Street
- Route 6 – Sixth Street
- Route 3/6 – Night Loop (*not included in the 2016 definitions*)
- Route 9 – Cameron Street / HACC
- Route 13 – Paxton Street
- Route 17 – Union Deposit / Hamilton Health Center

- Route 19 – Steel ton

Suburban

Suburban routes originate or terminate in Harrisburg but operate out into suburban areas. The majority of these routes operate on weekdays only.

- Route 7 – Middletown
- Route 8 – Derry Street / Rutherford
- Route 12 – Colonial Park / Colonial Commons / Gateway / Linglestown
- Route 20 – High Pointe Commons
- Route 39 – Herr Street / Blue Mt. Commons
- Route A – New Cumberland
- Route B – Highland Park / Westport
- Route C – Carlisle Local Service
- Route D – Erford Road / Capital City Mall
- Route F – Enola
- Route M – Mechanicsburg Local Service



Suburban Limited

Like suburban routes, suburban limited routes originate or terminate in Harrisburg but operate out into suburban areas. Suburban limited routes only operate during weekday rush hours.

- Route 14 – Springford / Union Deposit

- Route 12 – Colonial Park / Colonial Commons / Gateway / Linglestown
- Route 20 – High Pointe Commons
- Route CX – Carlisle Express Service
- Route MX – Mechanicsburg Express Service

Commuter Express

Commuter express routes operate over limited express highways and/or make limited stops. With the exception of Route CY and Route HP, commuter express routes are weekday only routes that operate during rush hour.

- Route 23 – Elizabethville / Millersburg / Halifax
- Route 27 – Hall Manor via Hamilton Health Center
- Route 81 – Shippensburg / Newville / Carlisle / Harrisburg Express
- Route 82 – Shippensburg / Newville / Mechanicsburg NSA Express
- Route 114 – East Shore Grocery Shopper
- Route 322 – Hershey / Hummelstown
- Route CY – Carlisle Pike Warehouses
- Route HP – Hersheypark

Route W – Allen Road Warehouses

Express

Express Routes operate with limited stop access for a portion of the route. All of these routes operate on weekdays and Saturdays, except Route CX, which only operates on weekdays.

Figure 1: CAT Network

CAT Bus Network

AM Peak Frequency

-  Peak Hour Service
-  21 - 30 minutes
-  31 - 60 minutes
-  61 + minutes

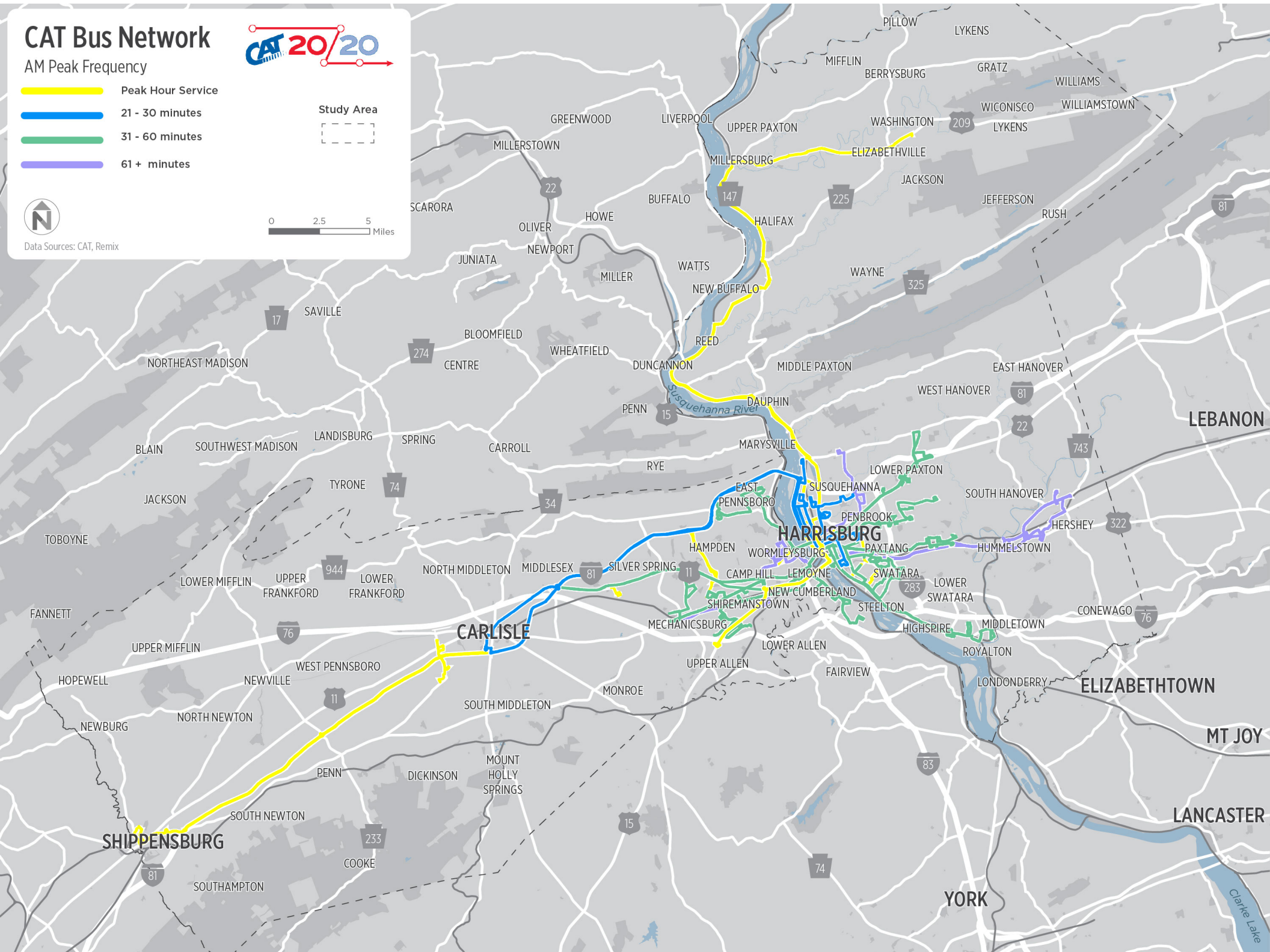


Study Area



0 2.5 5 Miles

Data Sources: CAT, Remix





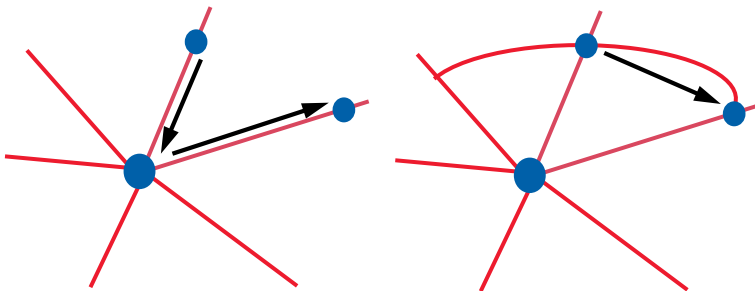
Network

Capital Area Transit operates a radial bus network, with most bus routes oriented toward bringing customers to and from Downtown Harrisburg. This service design is based on the historical reality that downtown areas were the center of employment, shopping, and entertainment. In addition to providing concentrated service, radial systems provide a single location to facilitate transfers between routes.

While ideal for access to downtown, this network design makes trips between residential areas and activity centers outside of downtown indirect, long, and difficult and therefore unlikely to be used by residents. In some cases, customers may even have to travel out of their way to make a transfer before heading back out on another route. Radial networks also limit a transit system's capacity to serve job centers and shopping areas that are outside of downtown.

To provide better access to areas outside of downtown, many transit systems utilize crosstown routes. Crosstown routes run along major corridors that do not run into downtown. They create direct connections between areas that would otherwise require a downtown transfer. They will often cross other radial routes in outlying areas, creating transfer opportunities and expanding the reach of the overall network. Figure 2 displays an example of how crosstown service can improve access within a transit network.

Figure 2: Network Structures



Within CAT's current system there are no routes that are designed for crosstown service that would permit customers to more easily transfer between routes and make it easier to reach other destinations throughout the region. Additionally, few bus routes cross the Susquehanna River to serve neighborhoods on both the west and east sides of the river. CAT's fare policy did not support bus transfers outside of Downtown Harrisburg until August 2019. Prior to August 2019, customers paid a full fare for each leg of their trip. However, transfers were available in Downtown Harrisburg.

CAT's service design has a significant impact on where CAT customers can travel. The following maps represent how far a customer can travel if starting at 7:00 AM from Market Square, Camp Hill Mall, or Colonial Park Mall (Figure 3 through Figure 5). As a peak service time, this represents the maximum range an individual can access employment, shopping, medical care, and recreational activity. True to the radial network, all three locations provide access to Downtown Harrisburg, but service to areas outside of the downtown are limited. For example, individuals living near Colonial Park Mall cannot easily access known areas of employment across the river in West Enola. Surprisingly, those same individuals cannot easily access employment in Progress either, despite being only two miles away by car.

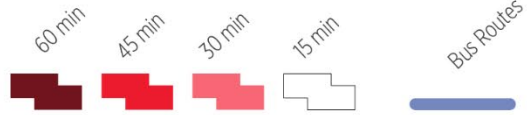
Figure 3: Market Square Transit Access

Transit Access

Weekdays 7 AM, Market Square



Where an individual can travel to within an hour from Market Square Transfer Center at 7 AM.



Data Sources: CAT, Remix

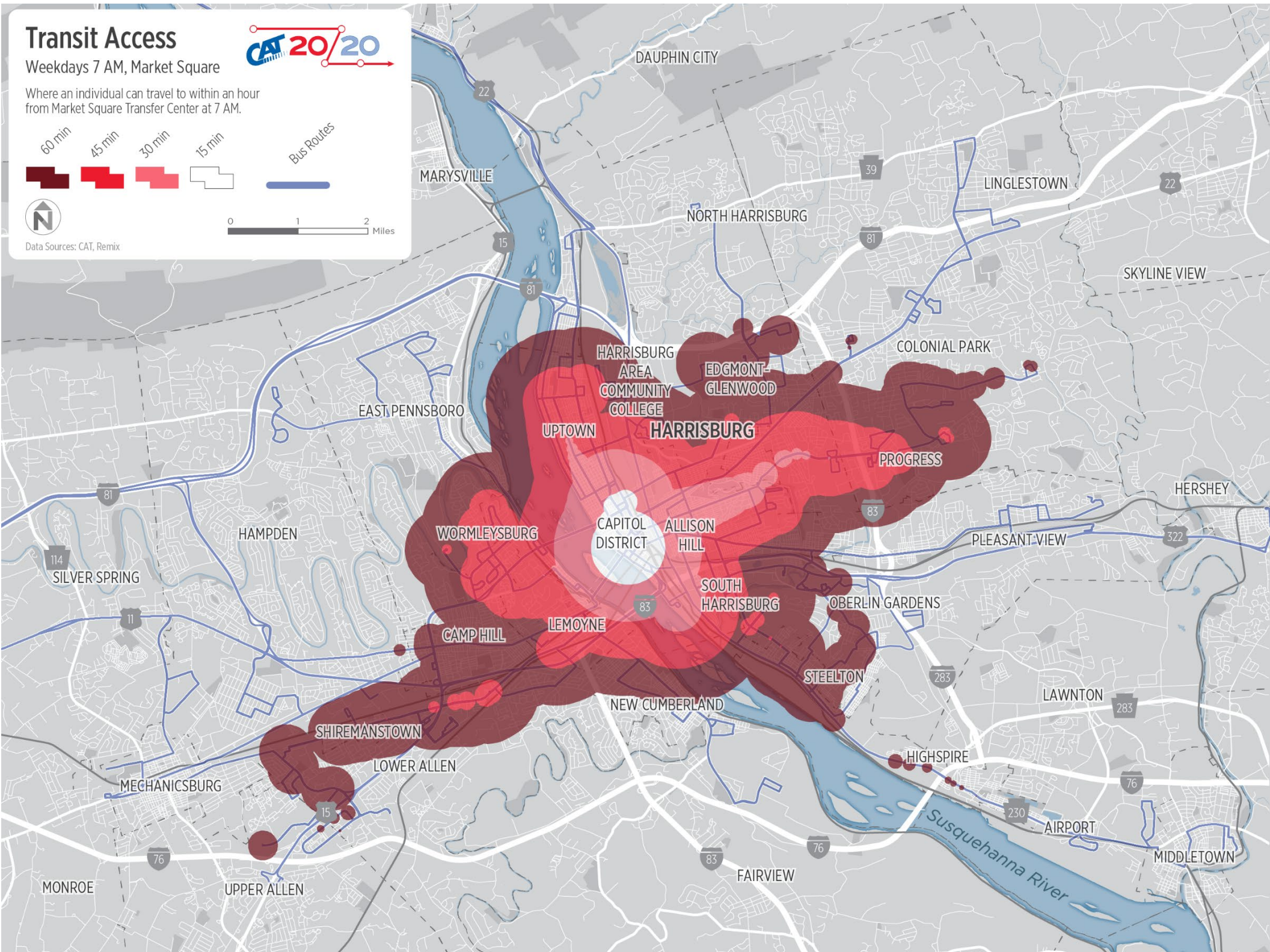
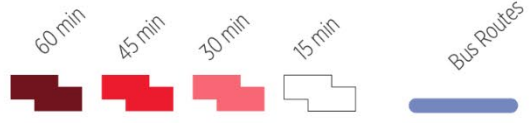


Figure 4: Camp Hill Mall Transit Access

Transit Access

Weekdays 7 AM, Camp Hill Mall

Where an individual can travel to within an hour from Camp Hill Mall at 7 AM.



Data Sources: CAT, Remix

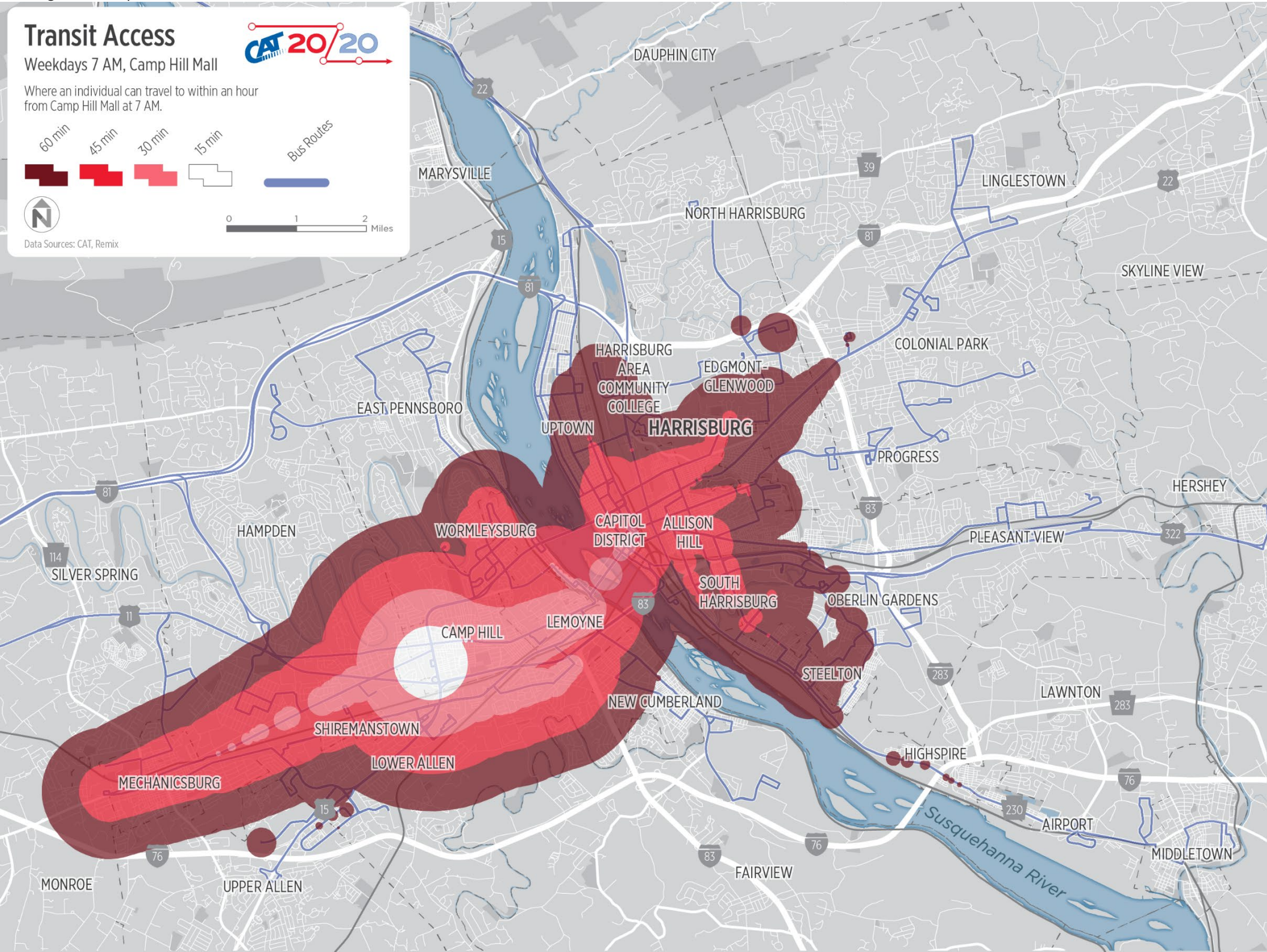


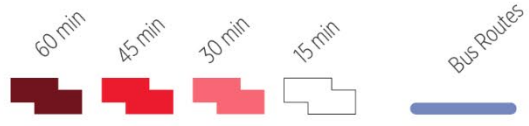
Figure 5: Colonial Park Mall Transit Access

Transit Access

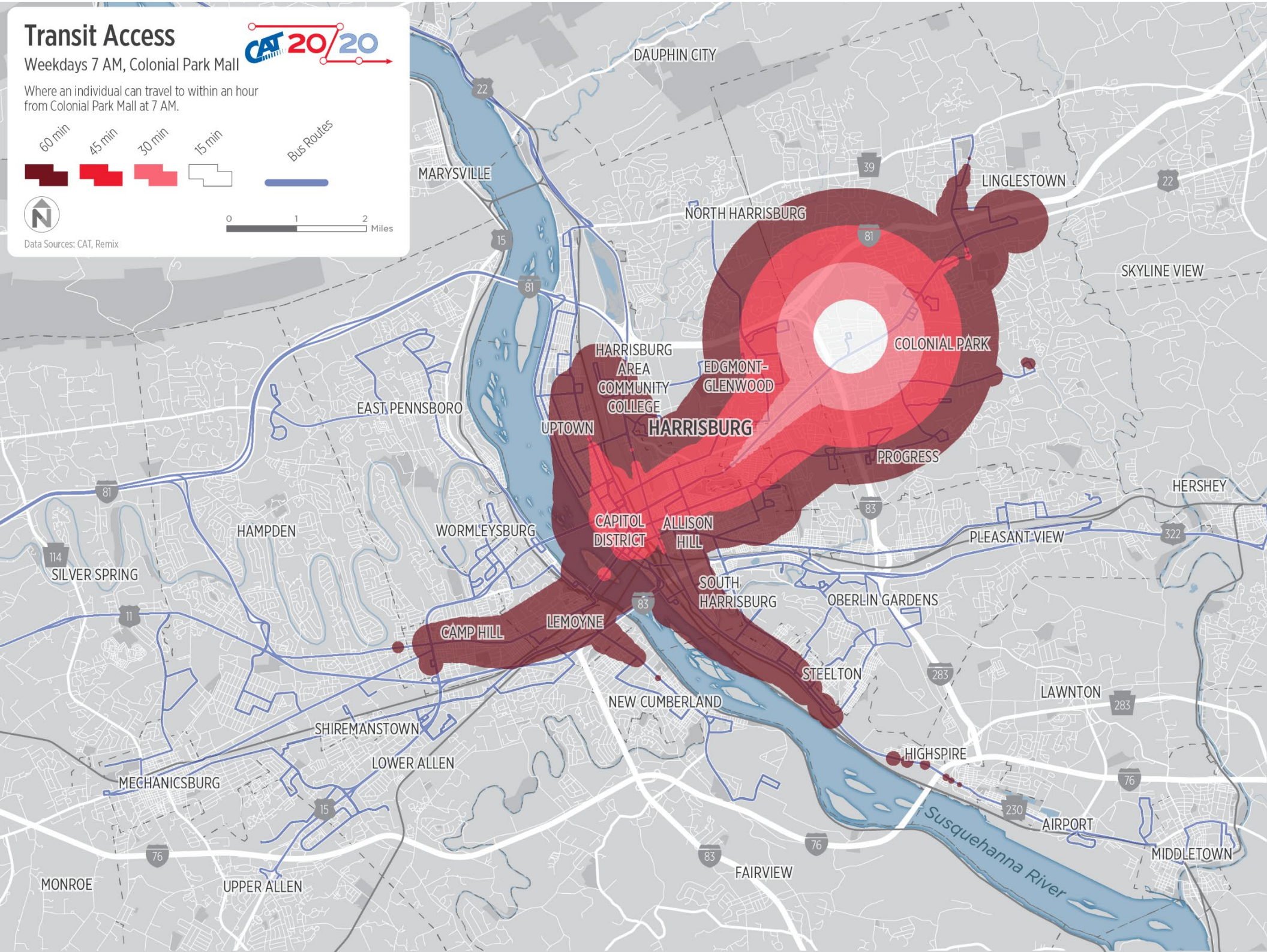


Weekdays 7 AM, Colonial Park Mall

Where an individual can travel to within an hour from Colonial Park Mall at 7 AM.



Data Sources: CAT, Remix





Service Frequencies

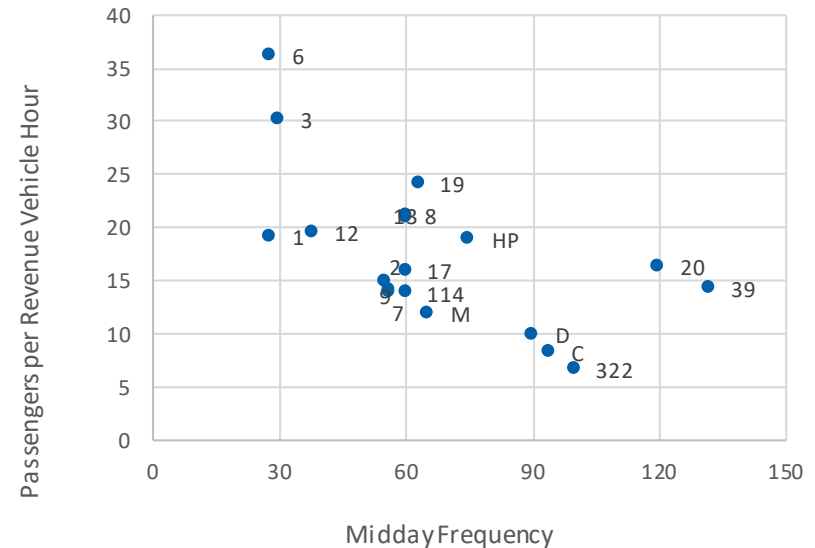
Frequency – how often the bus comes – is one of the most important factors in making transit a convenient choice for riders. Frequent service allows transit to better compete with the convenience of the personal vehicle, making it more attractive to people who have other options. Routes with frequencies of 15 minutes or better improve the flexibility and predictability of transit and increase the overall convenience of service, making transit a viable option for more people. However, frequency is very expensive. Increasing the frequency of a route from every 30 minutes to every 15 minutes would double the cost of the route. Additionally, frequency on longer routes cost more because it takes more vehicles and bus operators than shorter routes.

CAT Routes 1, 3, and 6 have the highest average frequencies of 30 minutes. Eleven of the 34 routes operate with average frequencies of 60 minutes. The remaining 20 routes provide limited commuter service, primarily operating during rush hours.

Only 16 of the 34 routes operate on Saturdays, and service on Saturdays operates less frequently. Routes 1, 3, 6, and 12 offer the most frequent Saturday service, with average frequencies of 45 minutes. Route HP serves Hersheypark operating hours, while all other services operate at frequencies greater than one hour or provide commuter-based service during shift times.

Despite the high cost of frequency, there are clear advantages to providing frequent service. More frequent service is generally associated with higher ridership and overall greater productivity. The most productive CAT routes are Routes 3 and 6, which also have the most frequent service. Services operating less than once per hour are notably less productive than more frequent services, and productivity continues to decline as frequencies decrease (see Figure 6).

Figure 6: Frequency and Productivity



The primary reason for this is convenience. The more frequent service is, the less restricted customers are.

Frequency has three primary benefits:

- **Reduces waiting time:** The frequency of a route represents the longest amount of time a customer would have to wait.
- **Makes transfers to other routes easy:** Routes that intersect frequently create easy connections and expand the reach of the overall network.
- **Improves service reliability:** In the event of a service disruption or breakdown, another bus will arrive sooner.



Service Spans

The span of service—the hours that a bus route operates during the day—is a second factor that strongly influences the convenience of a transit system. Service that runs for longer hours during the day is more convenient, allowing people to travel when they want.

On weekdays, the majority of CAT’s service operates from 6:00 AM to 6:00 PM, with select routes operating earlier and later service. Saturdays are more limited overall, with most routes operating from 9:00 AM to 6:00 PM, and select routes starting as early as 4:00 AM and ending as late as 11:00 PM.

When both span and frequency are considered it provides a clear depiction of when customers have access to transit and when that transit is operating most frequently (Figure 7 and Figure 8). CAT’s current service is heavily focused on the commuter market, with the majority of service operated during the rush hours. Early morning and evening services are very limited, with even less service on Saturdays, and no service on Sundays.

Throughout the service day, CAT’s bus routes fluctuate widely in frequency and geographic coverage. Figure 9 through Figure 11 depict how CAT’s service changes throughout the day.

Only three routes operate every 30 minutes throughout the day— Routes 1, 3, and 6.

CAT Service Across the Day

AM Peak (6:00 AM – 8:59 AM)

- 26 routes in service
- 7 routes operating every 30 minutes or better

Midday (9:00 AM – 3:29 PM)

- 22 routes in service
- 3 routes operating every 30 minutes or better

PM Peak (3:30 PM – 6:30 PM)

- 32 routes in service
- 9 routes operating every 30 minutes or better

34 Routes

Only 3 Routes provide 30 minutes service all-day

7 AM Peak Routes

3 Midday Routes

9 PM Peak Routes

Figure 7: Weekday Service Span

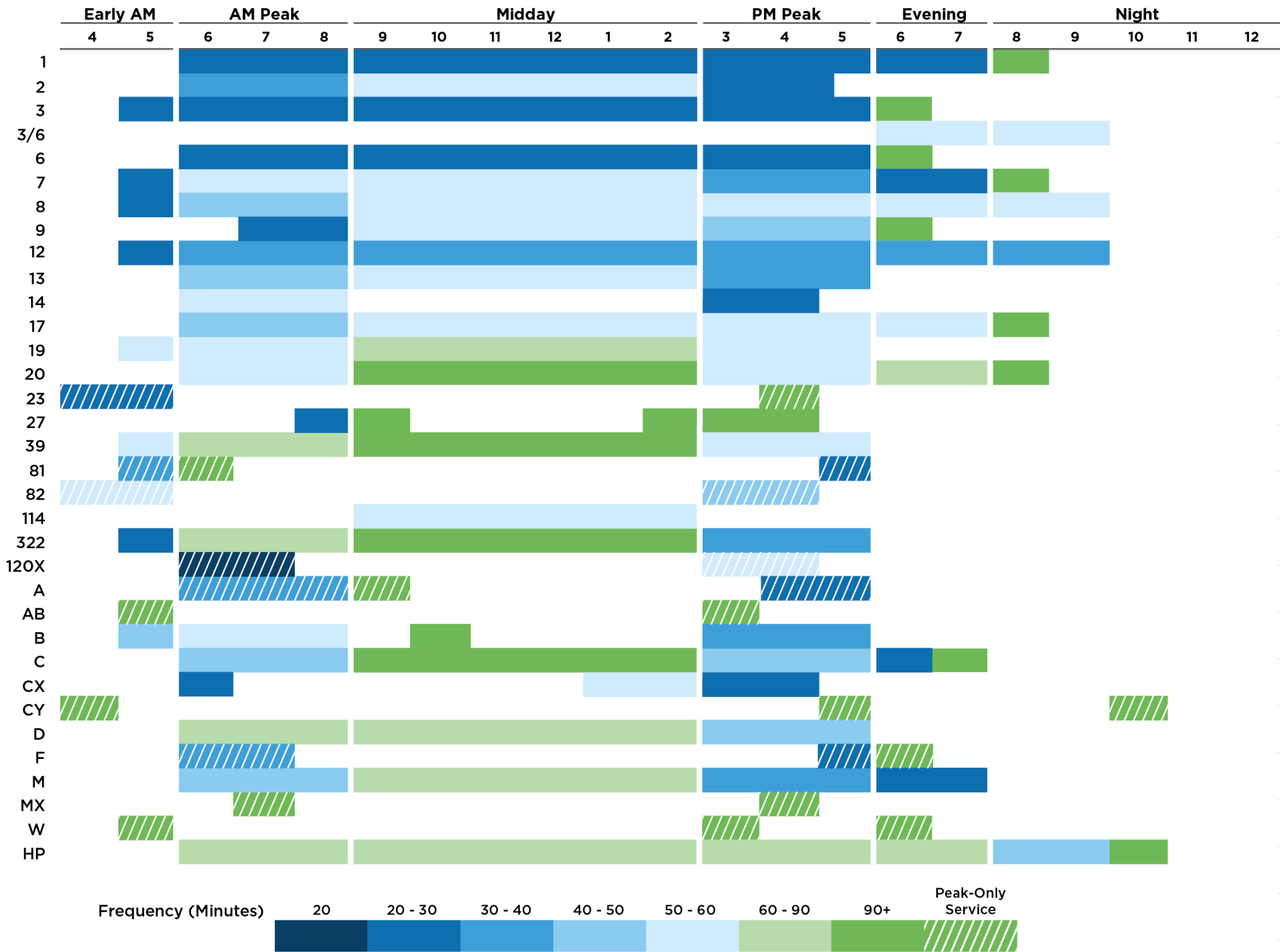
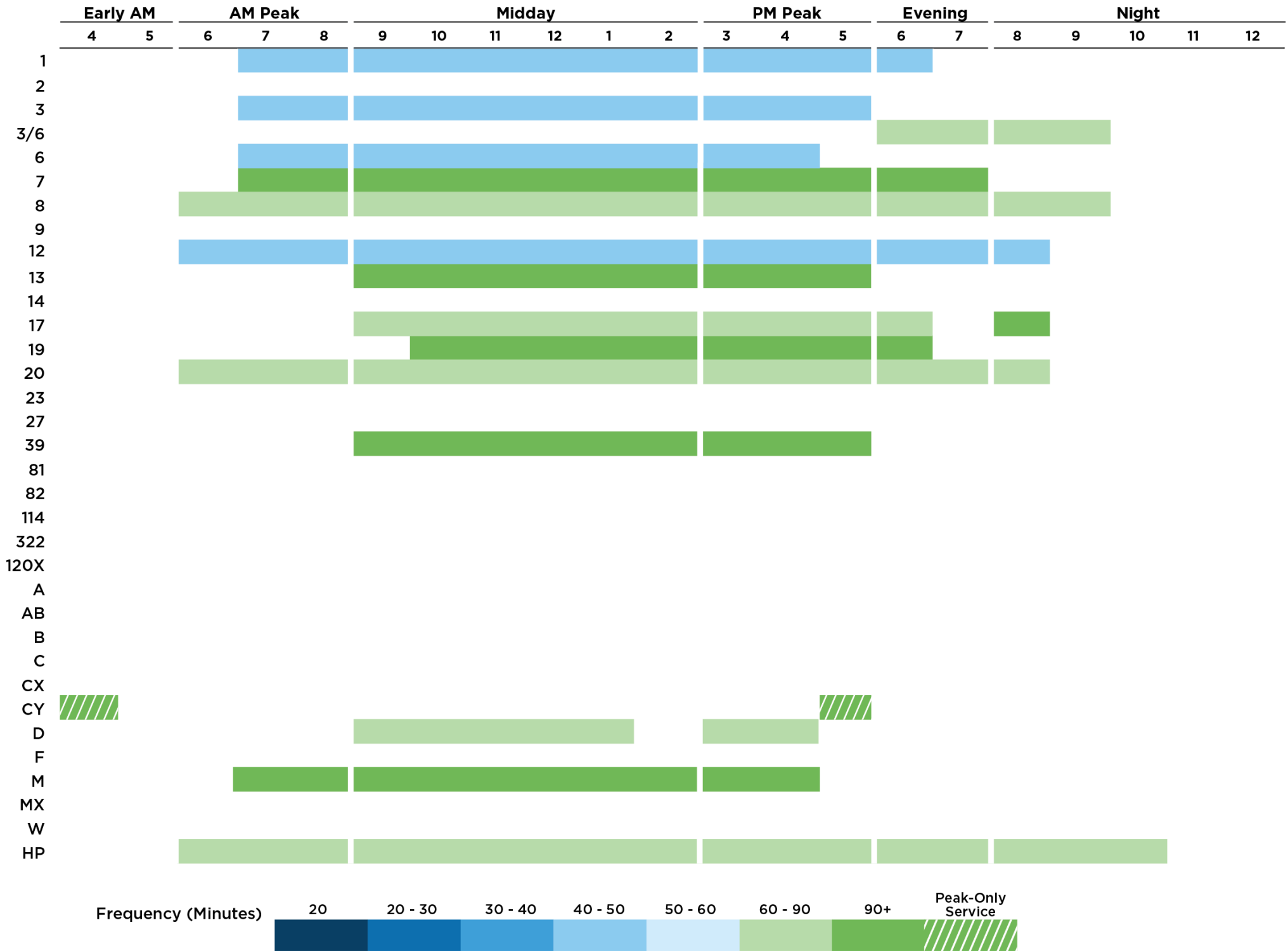


Figure 8: Saturday Service Span



Frequency (Minutes)

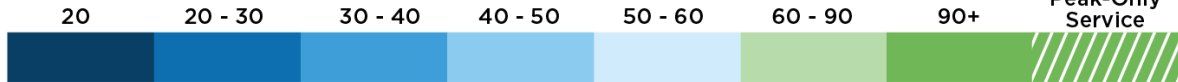


Figure 9: AM Peak Frequency

AM Peak Frequency



6 AM - 9 AM

- Peak Hour Service
- 21 - 30 minutes
- 31 - 60 minutes
- 61+ minutes

Study Area



0 2.5 5 Miles

Data Sources: CAT, Remix

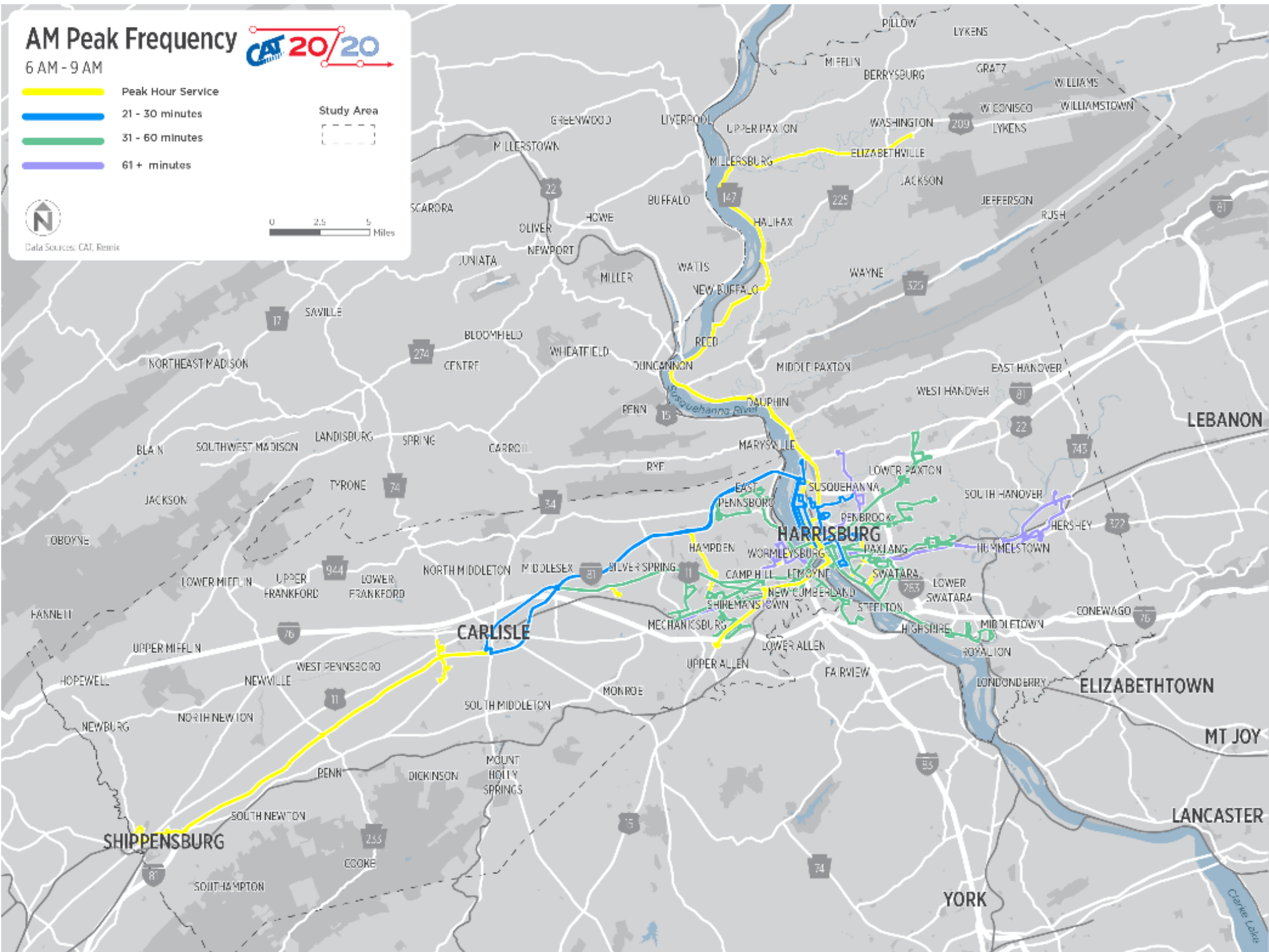


Figure 10: Midday Frequency

Midday Frequency

9 AM - 3 PM



- Peak Only Service
- 21 - 30 minutes
- 31 - 60 minutes
- 61+ minutes

Study Area



0 2.5 5 Miles

Data Sources: CAT, Remix

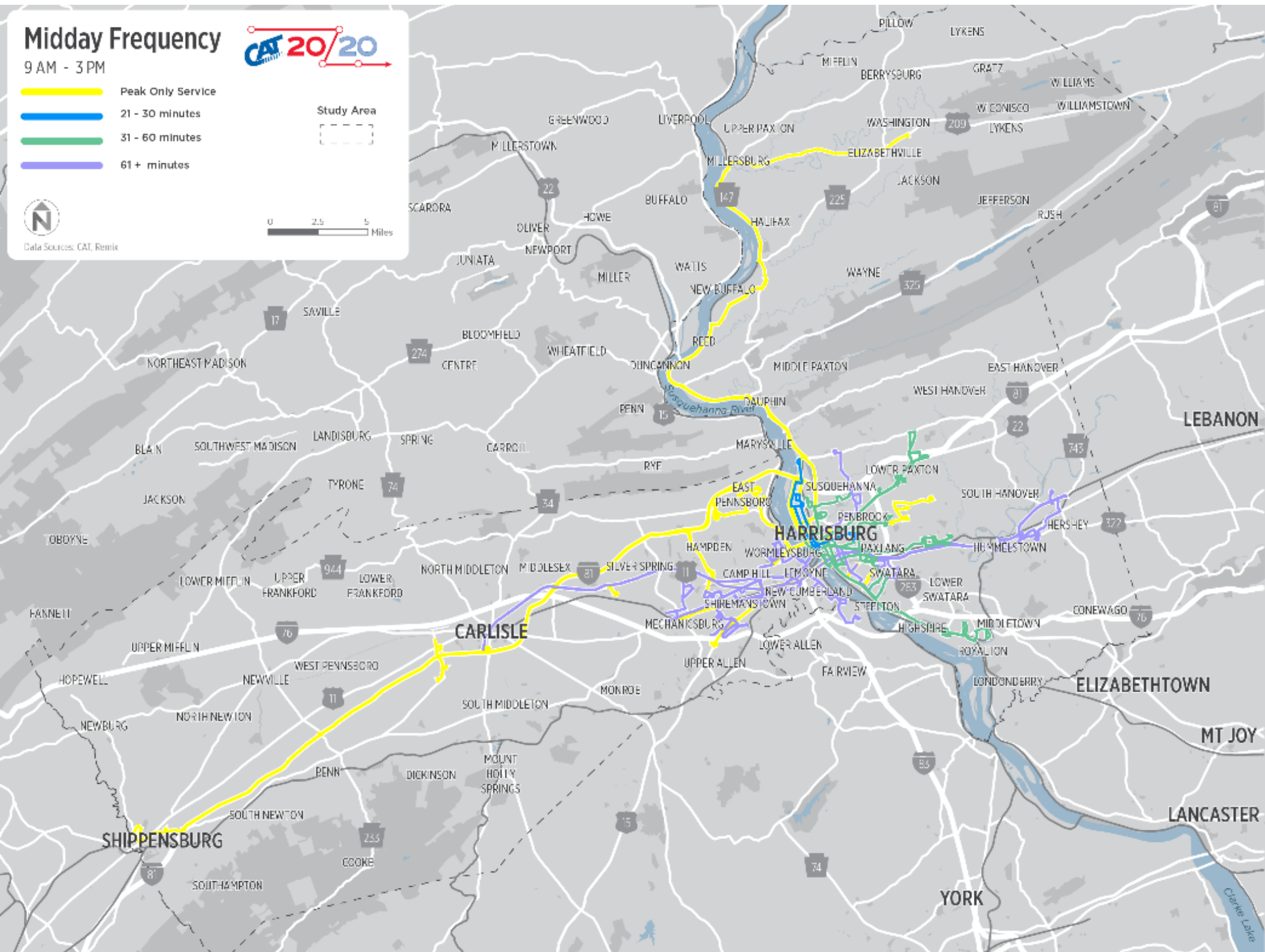



Figure 11: PM Peak Frequency


PM Peak Frequency

3 PM - 6 PM

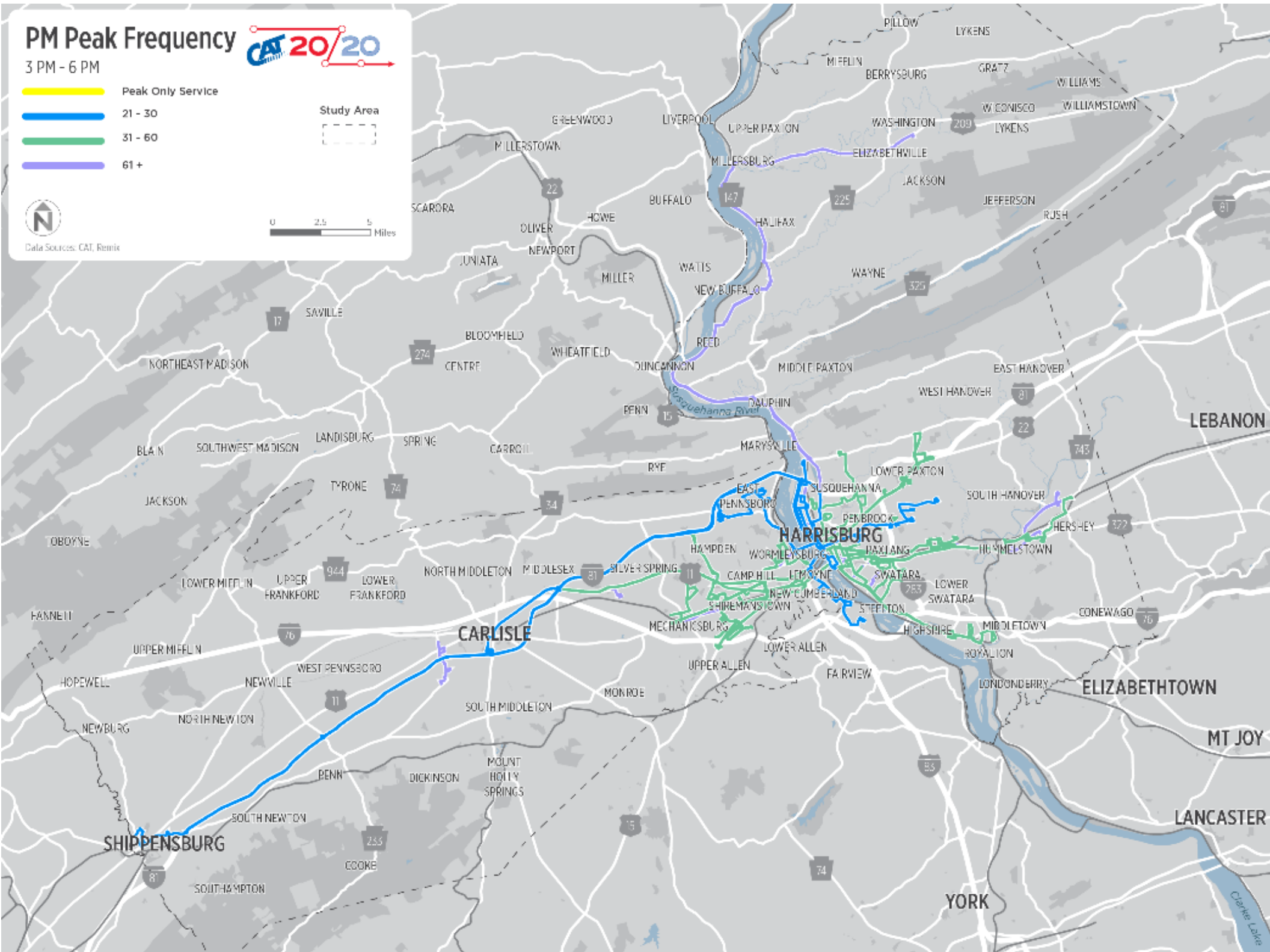


- Peak Only Service
- 21 - 30
- 31 - 60
- 61 +

Study Area



Data Sources: CAT, Remix





Route Alignment

Bus route alignments are the paths along which buses travel. Route alignments should be simple and easy for customers to understand. The ideal route alignment is direct, with minimal deviations from the primary corridor. For example, a route that travels along a single corridor is preferable to a route that winds through an area.

Service Variants

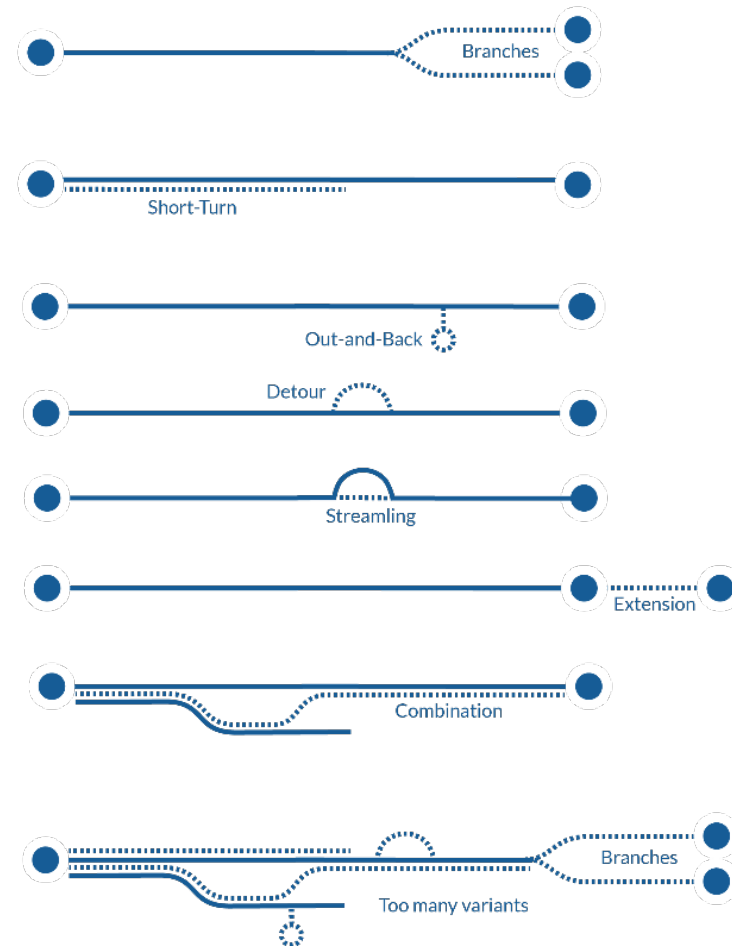
Ideally, bus routes should provide service that is as simple, consistent, and direct as possible. However, there are often important reasons to run some trips differently or to run “variant” services. Judicious use of variants can make a route more effective. However, excessive or unwise use of variants can make service worse.

Service variants allow bus systems to be flexible, serving populations and places that may not warrant their own bus line, but may still need transit service during certain parts of the day. For example, shopping malls only need service when open.

Despite the benefits that variants provide, transit systems should try to minimize the number of service variants. Too many variants can make routes overly complex, and cause confusion for transit customers. Additionally, variants often outlive their purpose and continue to operate long after the reason they were first implemented goes away. In these cases, variants hurt the route rather than improve it.

Within CAT’s system, many service variants exist, and the service is too complex. In many cases the variants are designed to serve small customized markets – sometimes as small as a single rider. The variant services, besides making service complex, degrade service for most riders. Most variants amount to a detour that increases travel times for other passengers. The additional time for the detour also puts that bus off-pattern when it returns to the regular route which creates gaps in service.

Figure 12: Variants



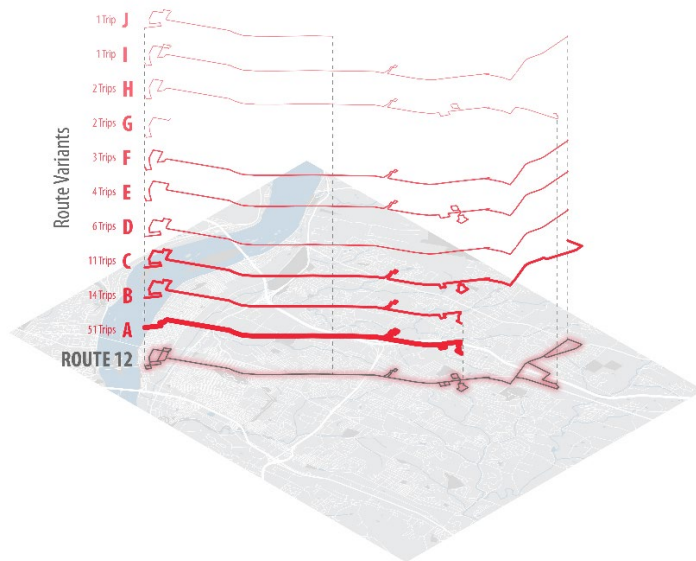
Simpler bus networks will attract more riders than complex networks, because complex and overly customized services discourage more people from using transit than the customized services attract. As stated in the Transit Cooperative Research Program’s “Traveler Response to Transportation System Changes” report, transit systems with more complex route structures “put off riders with only moderate inclination



to try transit.” CAT has reduced the number of variants, from an average of twelve per route in 2016 to seven in 2018 according to the “Capital Area Transit Service Analysis Study”.

Despite this reduction, many routes remain complex. For example, Route 12 operates ten service variants. This results in a very complex schedule that customers must learn in order to ensure that they will be able to access their destination.

Figure 13: Route 12 Service Variants





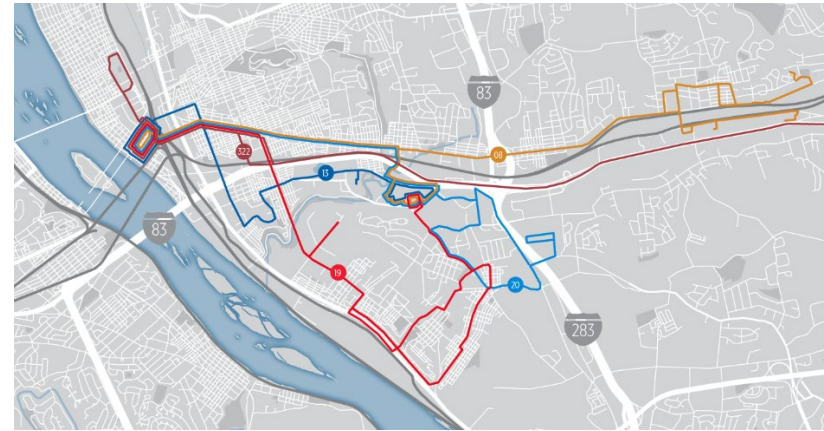
Service Duplication

Another consideration of route alignment is service duplication. Service duplication occurs when bus routes run along the same street during the same time periods. Duplication along major corridors, near transfer stations, and major locations are common and not problematic. However, when two or more routes serve the same street for a large portion of their alignment, service duplication is not an efficient use of resources and instead dilutes the productivity of the individual routes.

CAT's existing network prioritizes one-seat rides over transfers. This prioritization leads to service duplication. While the ends of routes may serve different neighborhoods, large portions of the primary alignment or "trunk" are shared. This adds complexity for customers, requiring them to learn multiple routes. Additionally, routes that share alignments are not always well coordinated. For example, two routes that operate 30-minute service should be equally spaced to provide a combined 15 minute service along the shared corridor. In practice, this is not the case and instead, the two buses directly follow each other closely, resulting in a lower effective frequency.

Routes 8, 19, and 20 represent an example of service duplication as a result of prioritizing one-seat rides. From Downtown Harrisburg, the routes share Derry Street before splitting off and reconnecting at Harrisburg Mall, where Routes 8 and 20 then continue to other neighborhoods. In addition, Route 322, which provides commuter service, also makes local stops along Derry street. This duplication and overlap requires customers to have an understanding of each route to know when they can take any route due to the shared service, or when they must take a specific route to access a unique location.

Figure 14: Routes 8, 19, 20, & 322 Service Duplication



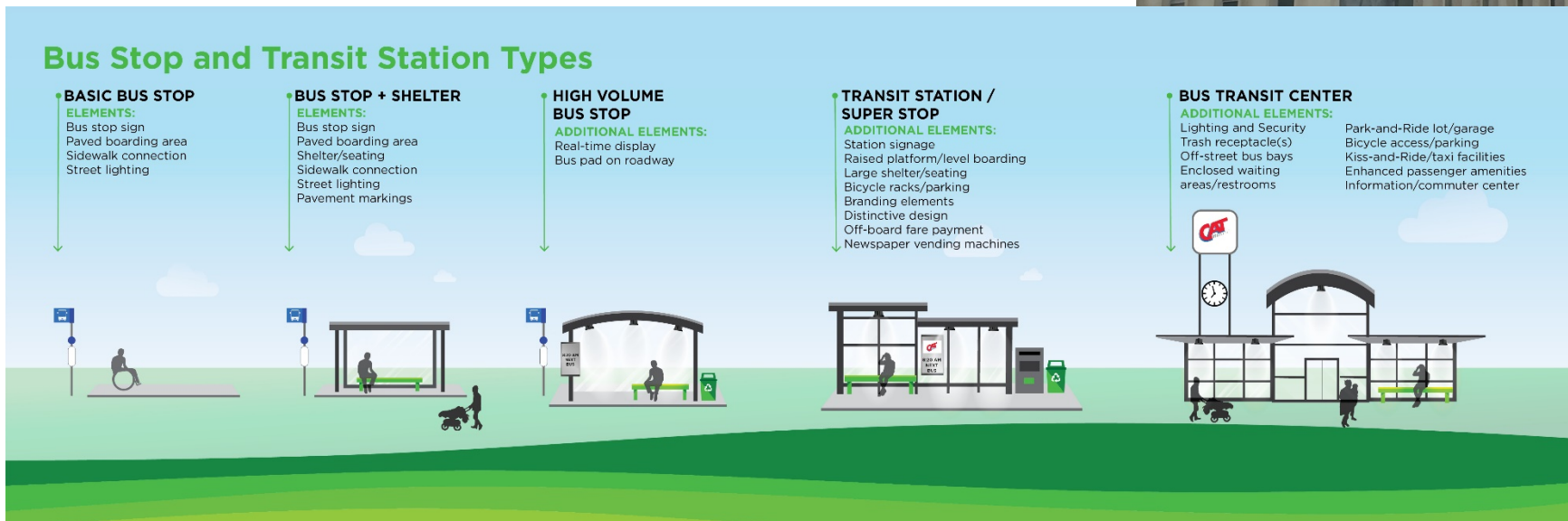
Transit Facilities

Bus Stops

Waiting for the bus is a significant part of every transit trip. Well-designed bus stops enhance the transit experience, decrease perceived wait times for transit services, and can contribute to increased ridership. Conversely, poorly designed bus stops can decrease customer satisfaction, make transit less attractive to potential new customers, and make waiting at stops unsafe for riders. Investing in high-quality bus stops is often a low-cost, high-reward strategy for transit agencies.



Figure 15: Bus Stop Amenities





Certain key bus stop design characteristics are essential for ensuring a quality transit experience. While it is not possible for every stop to be perfectly designed, there are a number of principles for good bus stop design and locations:

- **Convenient, Comfortable, and Safe Locations:** Bus stops should be located in places where passengers will feel comfortable and safe waiting for transit service. Stop locations should be well lit, offset from fast-moving traffic.
- **Visible and Easily Identifiable:** Bus stops should have a strong and consistent brand identity and be located in places where passengers can easily find them.
- **Information on Available Services:** All bus stops should include basic information including routes that serve the stop and a customer service phone number.
- **Amenities that Make the Wait Comfortable:** The provision of amenities like benches or covered shelters at stops can make using transit more convenient and comfortable.
- **Pedestrian and Bicycle Access:** Nearly all transit riders are pedestrians or bicyclists at some point in their journey. Therefore, it is important that each bus stop have a safe and defined pathway and crosswalk.

CAT has over 1,700 bus stops. Of these, less than 4%, or only 63 stops, have shelters and may lack amenities. The bus stop in Figure 16 is one example of a bus stop without amenities. This stop is in need of a bus pullout, ADA-compliant bus pad, sidewalks, and a crosswalk to safely connect people to the bus stop. Within CAT's system there are numerous stops without even a boarding sign. These "flag-stops" require customers to know which streets routes operate along and hail the bus similar to a cab. This creates clear challenges for new riders as well as bus operators serving customers and areas without defined bus stops.

Figure 16: CAT Bus Stop in Need of Amenities



Source: GoogleMaps

Stop Spacing

Bus stops are a point of entry to a transit system and having a bus stop that is easy to access makes for a more positive transit experience. However, when a bus makes frequent stops, the route operates less efficiently, as the time it takes customers to board and alight the bus at each stop adds up across the trip and can lengthen travel times. To balance accessibility and speed, particularly for local routes, the ideal bus stop spacing is four to six stops per mile, with no more than six stops per mile.

Within the CAT system, there are about five stops per mile, on average, along non-commuter routes. While this average stop spacing is appropriate, many individual routes have stops that are too close together.



Transit Hubs

CAT maintains four large transit hubs and uses several other locations throughout the service area as smaller “unofficial” hubs. These are areas where multiple bus routes converge, facilitating transfers and connections. The large transit hubs have more capital infrastructure and amenities for passengers, while the smaller hubs do not necessarily contain such features.

The three hubs include:

Market Square Transfer Center: Market Square Transfer Center is located within downtown Harrisburg at 2nd Street and Market Street; 33 CAT bus routes make stops here. This is the central hub of the CAT system and the most active location in the network due to its downtown location and the available transfers. While this transfer is integral to the system, there are several challenges with this site. First, buses can only enter the transfer center in one direction, requiring circulation through the congested streets in Downtown Harrisburg. Additionally, buses must queue behind each other, restricting when buses can leave. Finally, the waiting platforms and shelters in the center are very narrow and do not adequately accommodate the number of waiting customers. Combined, these factors make the transfer center a less-than-ideal location for CAT’s primary transit hub.

Harrisburg Transportation Center: The Harrisburg Transportation Center is the train station for Harrisburg, serving Amtrak; 20 CAT bus routes make stops at this location. Many of the routes that serve the Harrisburg Transportation Center also service the Market Square Transfer Center, which is less than 1,200 away.

Lemoyne Station (West Shore Transfer Center): Lemoyne Station is located in Lemoyne along State Street near Karns Foods. The station has two bus bays with shelters. Despite these amenities, only two CAT bus routes stop at the station.

Figure 17: Market Square Transfer Center



Transfer Locations

Other transfer locations include:

Middletown Amtrak Station: CAT’s Route 7 stops at the Middletown Amtrak Station, located in Middletown, PA.

Camp Hill Shopping Center: Three CAT bus routes serve the Camp Hill Shopping center, located off of 32nd Street. While there are no amenities in this location, the connection is one of the few places where customers can transfer outside of Downtown Harrisburg.

Harrisburg Mall: Four CAT bus routes serve the Harrisburg Mall, providing access to employment and shopping, and allowing for key transfers. However, the location does not have any stop amenities. The Harrisburg Mall hub is two miles from the Kline Plaza hub, which is very close for transit hubs.

Kline Plaza: Two CAT bus routes serve Kline Plaza near the Giant Food supermarket. As with the other hubs in shopping locations, there are no



stop amenities. The location is only two miles from the Harrisburg Mall hub, which is very close for transit hubs.

Hershey Intermodal Transportation Center: The Hershey Intermodal Transportation Center is served by CAT and Lebanon Transit. One CAT route stops at the Center. The Transportation Center is located between Hersheypark and Chocolate Avenue. The Intermodal Transportation Center is less than two miles from the hub at the Tanger Outlets.

Hershey Tanger Outlets: The Hershey Tanger Outlets is served by CAT and Lebanon Transit. One CAT bus route stops at the Outlets. The Outlets are less than two miles from the Hershey Intermodal Transportation Center, which is very close for transit hubs.

Point Mall: Two CAT bus routes serve the Point Mall in Carlisle. Buses enter the Point Mall to pick up and drop off passengers.

17th & Derry: The interception of 17th & Derry is served by seven CAT bus routes.

3rd & Market, Lemoyne: Many CAT buses enter the West Shore via Market Street and four CAT bus routes stop at the 3rd and Market Street stop.

Uptown Shopping Center: Uptown Shopping Center is served by three CAT bus routes.

Park & Rides

CAT serves 17 park & ride locations (see Table 1), which are designated places that customers can leave their car for the day and take a bus to their final destination. Park & rides are ideal for commuters who live beyond a walkable distance to a bus stop but can use the bus to get to and from their destination.

Table 1: Park & Ride Lots

Park & Ride Lots
Walmart, ShippensburgBon-
Newville/I-81
Point Mall, Carlisle
Walmart, Carlisle
Weis, Simpson Ferry Road, Mechanicsburg
Winding Hill Road, Mechanicsburg
Bon Ton Parking Lot, Camp Hill
Fairview Commons, New Cumberland
Olympic Skating Center, Enola
City Island, Harrisburg
Colonial Park Mall, Harrisburg
Harrisburg Mall
North Mountain Road (Clermont Plaza), Linglestown
Hershey Intermodal Transportation Center (also serves Lebanon Transit), Enola
Hershey Tanger Outlets (also serves Lebanon Transit)
Hummelstown
Walmart, Elizabethtown

Source: 2018 Capital Area Transit Service Analysis Study, Pennsylvania Department of Transportation



Speed and On-Time Performance

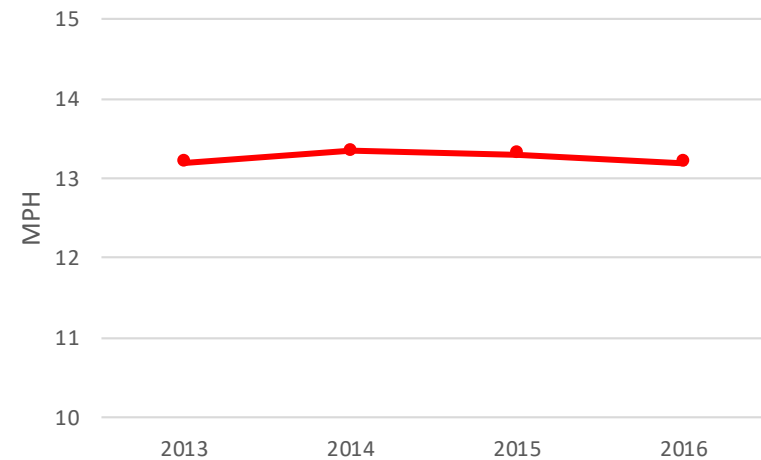
Speed

How fast a bus can travel is determined by not only the speed limit, but also the number of bus stops, traffic signals, and the amount of traffic a bus must interact with. To remain competitive with other modes, buses must be able to move as quickly as possible. CAT's average bus speeds have remained steady between 2013 and 2017 at approximately 13 MPH. Most city bus services range between 12 and 15 MPH.

Despite operating at an acceptable average speed, there are opportunities to increase CAT's bus speeds, such as:

- Reduce the number of bus stops per mile. There are bus stops that are too close on many routes.
- Install bus-only lanes along high-traffic corridors and areas where traffic congestion causes delays. This includes corridors in Downtown Harrisburg, corridors where more than one route operates, and choke points such as bridges.
- Implement transit priority signals to reduce the time buses spend at red lights. This includes areas where there are consecutive traffic signals and areas where traffic signals cause turning delays.
- Utilize curb cuts to improve operations.
 - Install bus bulbs to allow buses to remain in traffic lanes where passengers board and alight the bus. This includes areas of high vehicle traffic.
 - Install bus pull-offs allowing buses to pull out of traffic in higher speed areas such as state routes and highways.

Figure 18: Average Speed



Source: Capital Area Transit, 2013 - 2016

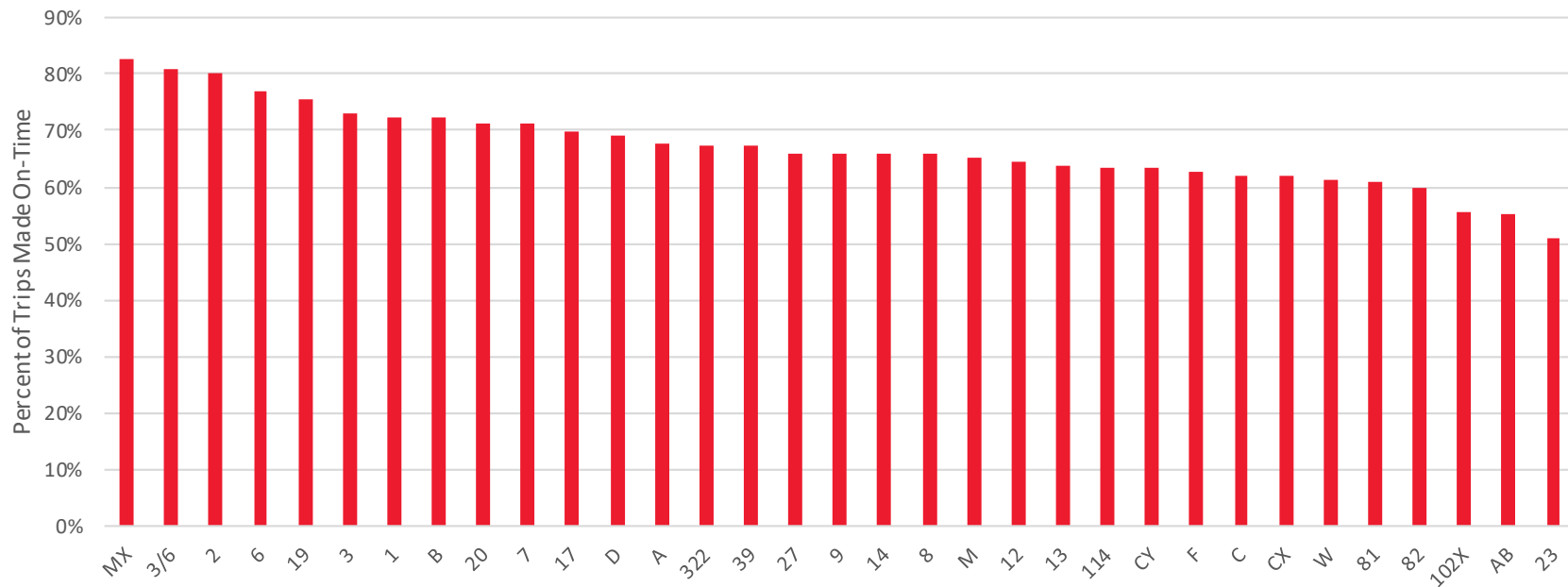


On-Time Performance

Capital Area Transit aims for their routes to operate on-time 80% of the time. A bus is considered to be on-time if it arrives between one minute early and five minutes late. In 2018, between March and December, only Routes MX, 3/6, and 2 met the 80% on-time performance objective. On-time performance ranged from 51% on Route 23 to 83% on Route MX.

CAT's schedules are the number one determining factor of on-time performance. Additionally, the same barriers that reduce bus speeds also impact on-time performance. To ensure that buses can meet the printed schedule, CAT must continue to conduct regular assessments and adjust schedule times to match real operating conditions.

Figure 19: On-Time Performance



Source: CAT



Transit Demand and Service

Geographic Demand

Population density and employment density drive demand for public transit services. The underlying demand for transit is very high in the core urban area and generally declines with distance from the core, with some exceptions. These exceptions include central Carlisle, areas near Shiremanstown, and areas near Hummelstown. The current system serves these areas, but much of that service is infrequent and does not directly connect to key destinations based on the radial route network.

As shown in Figure 20, only the Capital District, Uptown, and Allison Hill receive consistent 30-minute service. Based on demand, these areas are underserved. Additionally, outside of the core, there are areas with higher potential demand for service than they are currently receiving, including:

- Wormleysburg
- South Harrisburg (Shipoke)
- Steelton
- Lemoyne
- Hummelstown/Hershey
- Shiremanstown
- Carlisle



Figure 20: Geographic Demand vs. Service

Composite Transit Demand + Weekday Service



Potential Service Frequency Supported Based on Adjusted Population and Employment Density



Every 30 minutes or better

Greater than 30-minute frequencies

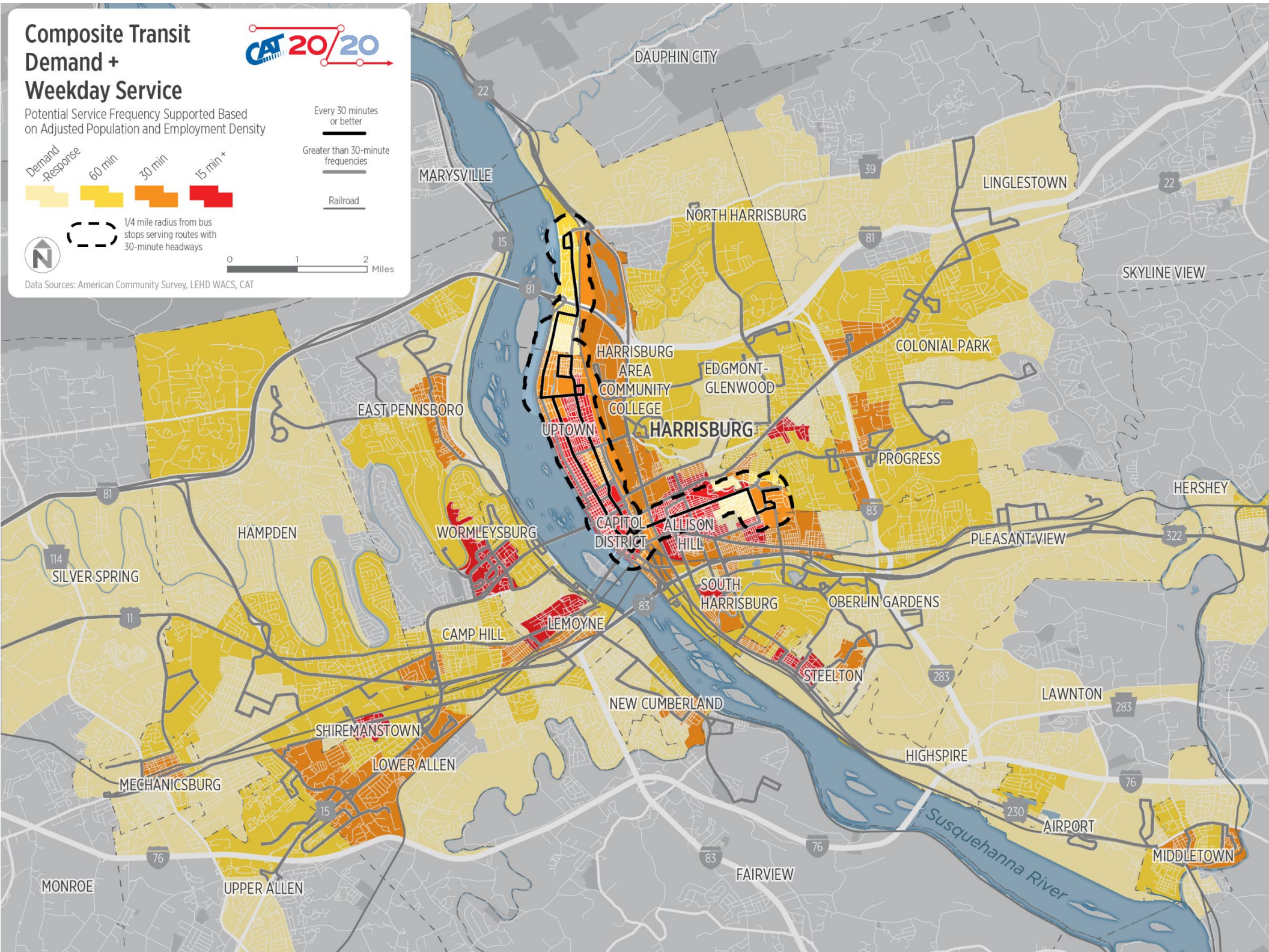
Railroad



1/4 mile radius from bus stops serving routes with 30-minute headways



Data Sources: American Community Survey, LEHD WACS, CAT





Current Ridership

Ridership by Location

On weekdays, Capital Area Transit provides just over 7,500 rides, while Saturdays generate 3,000 rides, on average. Ridership is highest within downtown Harrisburg, with the greatest amount of passenger activity occurring at the Market Square Transfer Center and Harrisburg Transportation Center. Outside of downtown Harrisburg, activity at stops throughout the system is variable, but there is notably higher activity around:

- Transit hubs
- Shopping centers
- Medical facilities
- Large employers
- Dense residential and mixed-use neighborhoods

Ridership by Route

Ridership is highest on CAT's most frequent routes: Routes 3, 6, and 12. Combined, these three routes account for 30% of CAT's total weekday ridership. The next highest ridership routes are Routes HP, 7, and 8, which, combined with the three highest-frequency routes, account for 50% of CAT's total weekday ridership across all 34 routes. On the opposite end, 13 of CAT's routes generate less than 100 boardings per weekday. These 13 routes only account for 8% of CAT's total weekday ridership (Figure 22).

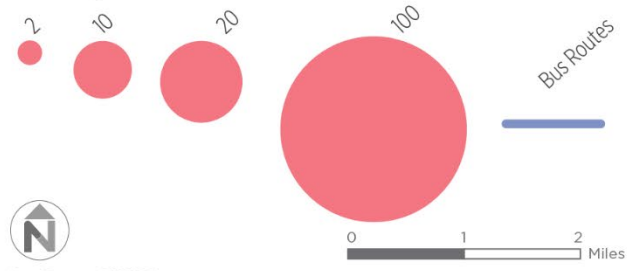
On Saturdays, the trend is similar, with the top four highest ridership Routes HP, 12, 8, 3 accounting for over 50% of CAT's total Saturday ridership. Seven of the 16 routes operated on Saturdays generate less than 100 boardings on average. (Figure 23).



Figure 21: Ridership by Stop

Ridership by Stop

Boardings



Data Sources: CAT 2018

Note: The Market Square Transfer Center is not presented (1,547 passengers)



Bus Routes

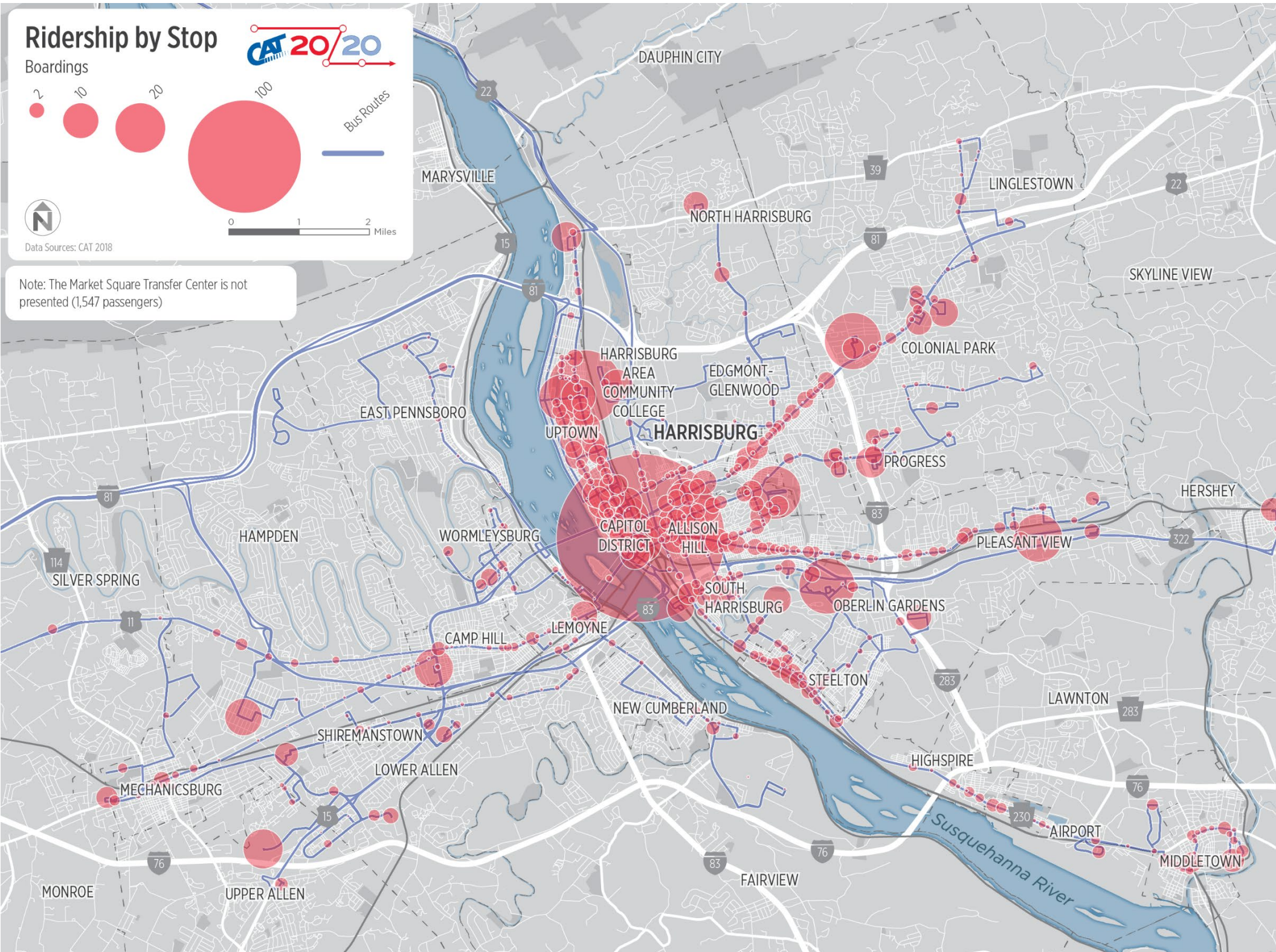


Figure 22: Average Weekday Ridership

Source: Data from Capital Area Transit, April 1, 2018 - March 31, 2019

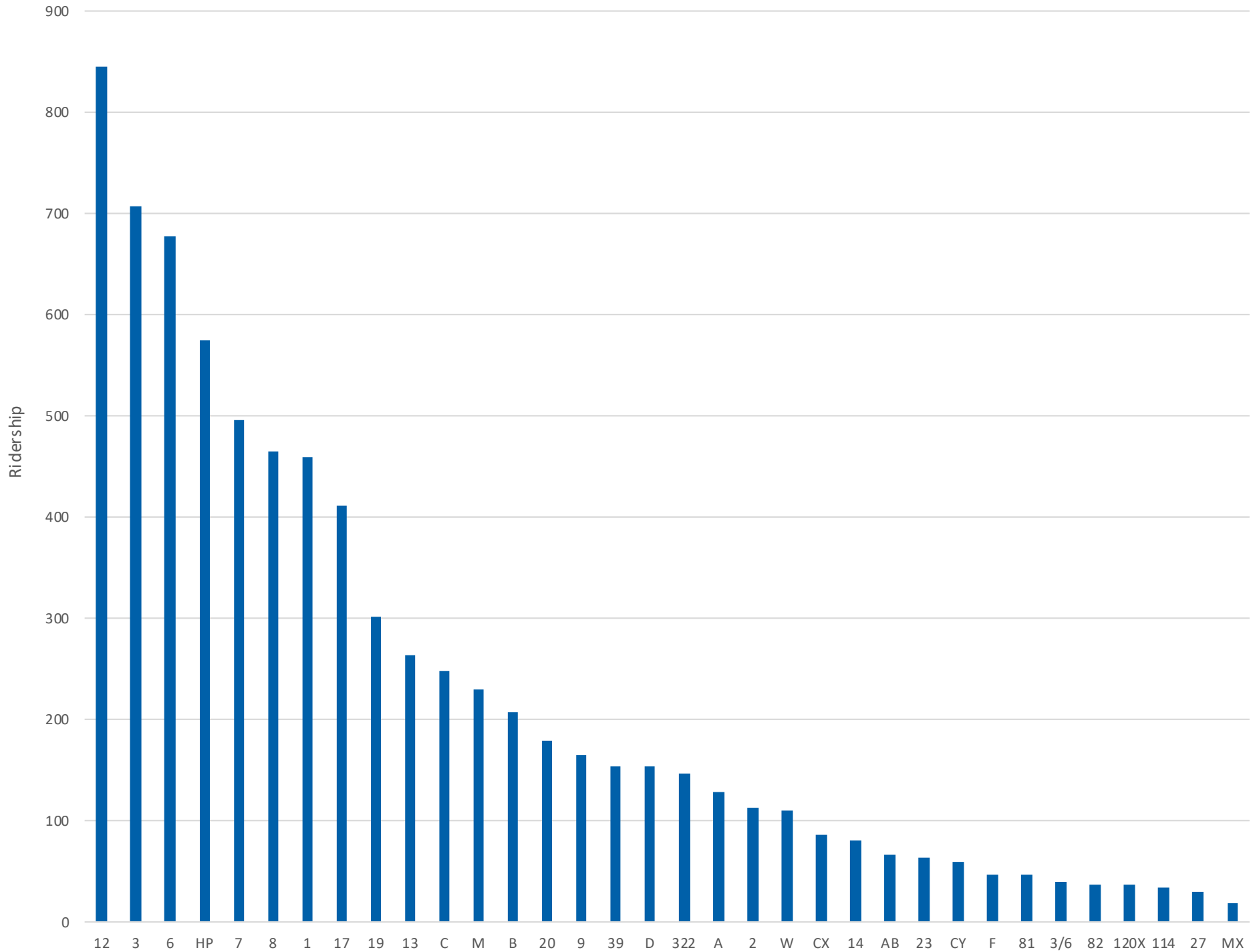
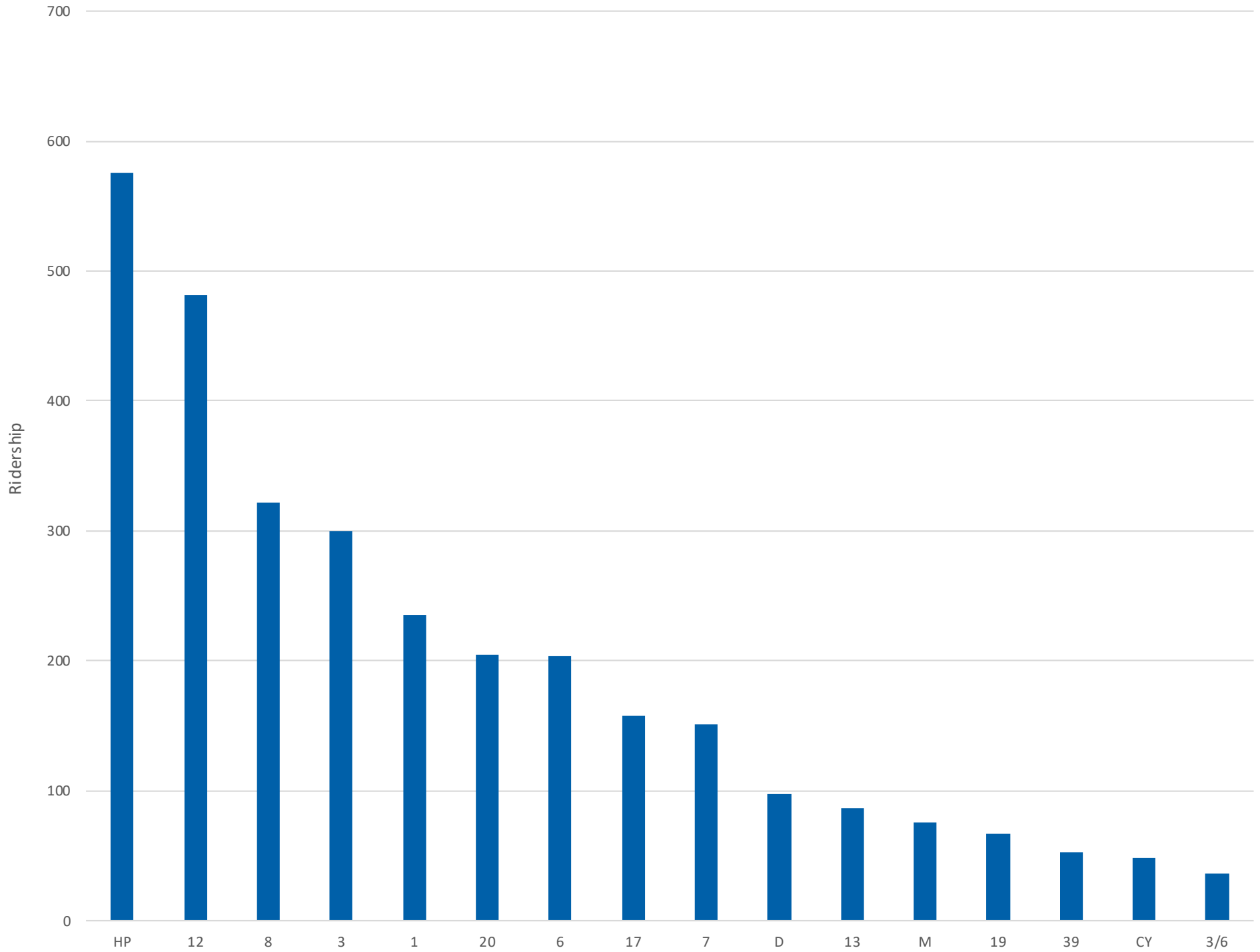


Figure 23: Average Saturday Ridership

Source: Data from Capital Area Transit, April 1, 2018 - March 31, 2019





Service Trends

Ridership

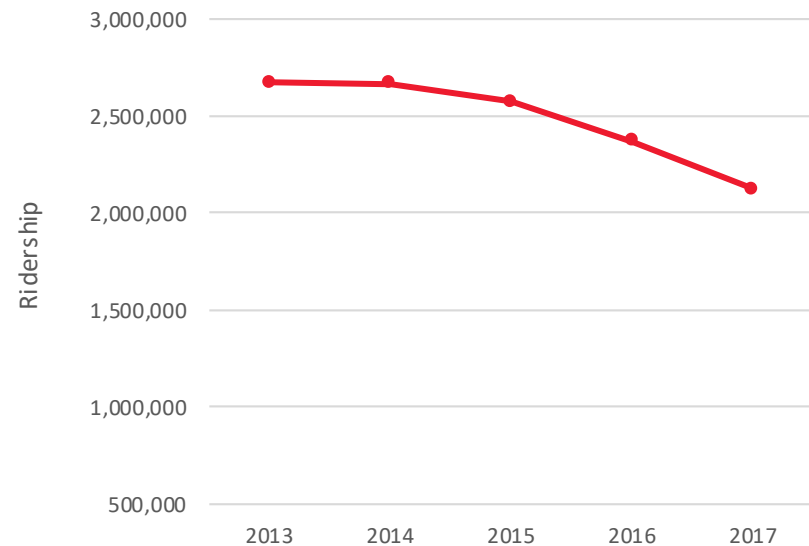
Between 2013 and 2017, ridership on CAT’s bus services fell steadily. Ridership declined by 20%, or 549,266 boardings, over that time.

While there is no single reason for this ridership decline, it is clear that customers are choosing other transportation options. The following reasons have contributed to the decline in CAT’s ridership:

- The elimination of service due to budget constraints.
- An increase in alternative transportation options that are competitive with transit, including ridesharing (Uber, Lyft, etc.)¹ and bike share.
- An increase in telecommuting (or working from home).

To address these factors, CAT has made changes to the bus routes they provide, including adding new services (like the job-based service to Chewy), changing route alignments, and optimizing stop spacing. However, these changes have not been enough to curb the loss of ridership.

Figure 24: Ridership (2013 - 2017)



Source: National Transit Database, TS2.1, 2017

¹ https://www.pennlive.com/news/2016/01/uber_success_ride-hailing_serv.html



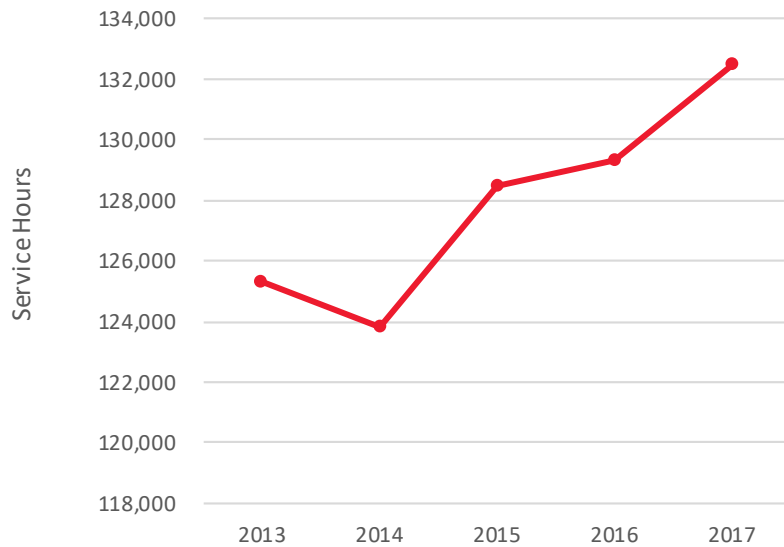
Service Hours

In 2017, CAT operated 132,400 hours of revenue service. Overall, revenue hours rose 5.7% between 2013 and 2017, an addition of 7,000 hours. The reasons for this increase in revenue hours are:

- Conversion of deadhead (non-revenue) service to revenue service.
- Merger of Route 17 and Route 18
- Addition of service to Chewy

All of these additional service hours were focused on providing additional coverage service to customers.

Figure 25: Service Hours (2013 - 2017)

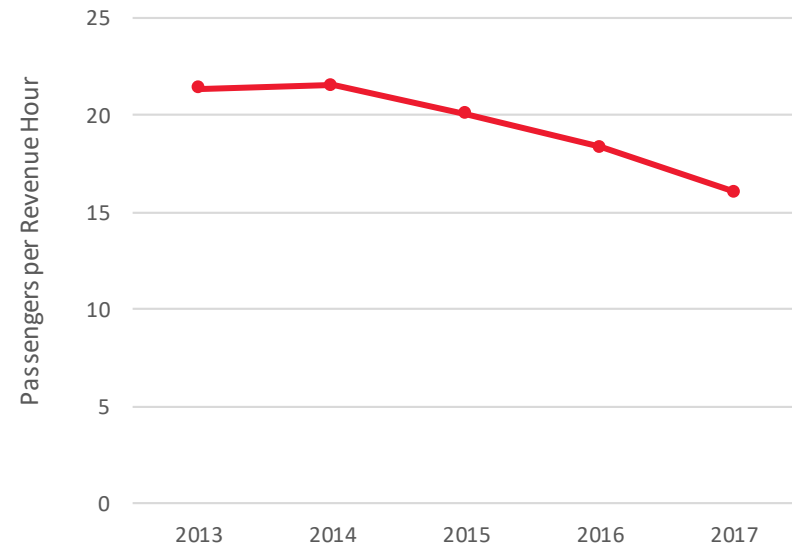


Source: National Transit Database, TS2.1, 2017

Productivity

Transit productivity is measured in passengers per revenue hour. CAT's productivity declined between 2013 and 2017 from 21 passengers per revenue hour to 16. This decline indicates that CAT's services are transporting fewer customers per hour of service provided. This is in part because of a decrease in total ridership, as well as the addition of less productive service, such as the conversion of deadhead service to revenue service. This further indicates that customers are choosing alternative transportation options and the decline in ridership is not only related to reductions to CAT's bus service.

Figure 26: Passengers per Revenue Hour



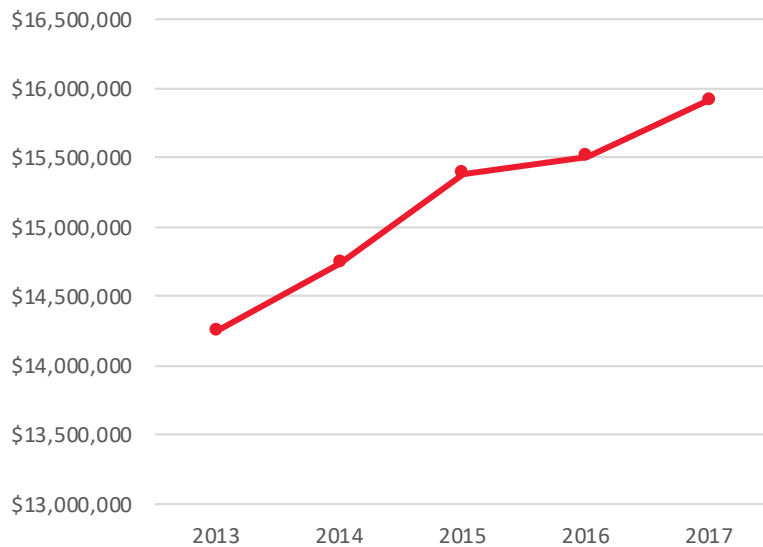
Source: National Transit Database, TS2.1, 2017



Cost

In 2017, CAT's fixed-route operating costs were just under \$16 million. Between 2013 and 2017, the costs of operating CAT service rose 11%, from over \$14 million to just under \$16 million, meaning that CAT is paying more for each hour of service. As these costs escalate, CAT is forced to reduce the total number of service hours to remain within the annual budget. Cost also ties directly to productivity. As productivity declines and cost per hour increases, service is costing CAT more while transporting fewer customers.

Figure 27: Operating Cost



Source: National Transit Database, TS2.1, 2017





Policies and Procedures

CAT has a number of unique policies and procedures that affect service delivery, scheduling and fare payment.

Ends of Lines

CAT policy does not allow riders beyond the ends of lines (EOL). Riders are expected to pay a new fare if riding beyond the timepoint at which route patterns end and headsigns are changed. In discussions with operators and staff, there appears to be confusion regarding circulator services, including Route 3/6 Night Loop and Route 2 Capital Complex/ROC Shuttle, as to whether or not riders can continue beyond EOLs to reach another destination along the route. Additionally, some routes have looped EOLs serving neighborhoods in only the inbound or outbound direction. There is no clear policy on whether or not riders are allowed to ride beyond the defined EOL in order to reach their final destination.

Blocking

CAT does not distinguish between blocks and runs. All buses leave and return to the garage at the beginnings and ends of every piece of operator work. There are no street reliefs except in rare unscheduled circumstances.

Service Changes and Implementation

CAT Service Standards define two types of service changes: regular service changes and major service changes. Regular service changes occur in accordance with the bid schedule as defined by the labor agreement; these occur a minimum of three times per year. A major service change occurs when there is a 25% or greater change in the level of service for a given route. Major service changes must go through a public hearing process as well as the board approval process; such changes can be implemented at any time following board approval.

Public Notice

CAT keeps their Service Standards and other policy documents readily available on their website, www.castransit.com. An "About Us" landing page allows riders and potential users to navigate to public documents, history of the agency, Title VI information, Disadvantaged Business Enterprise statement, Equal Opportunity Employment information, and other federally required documents.

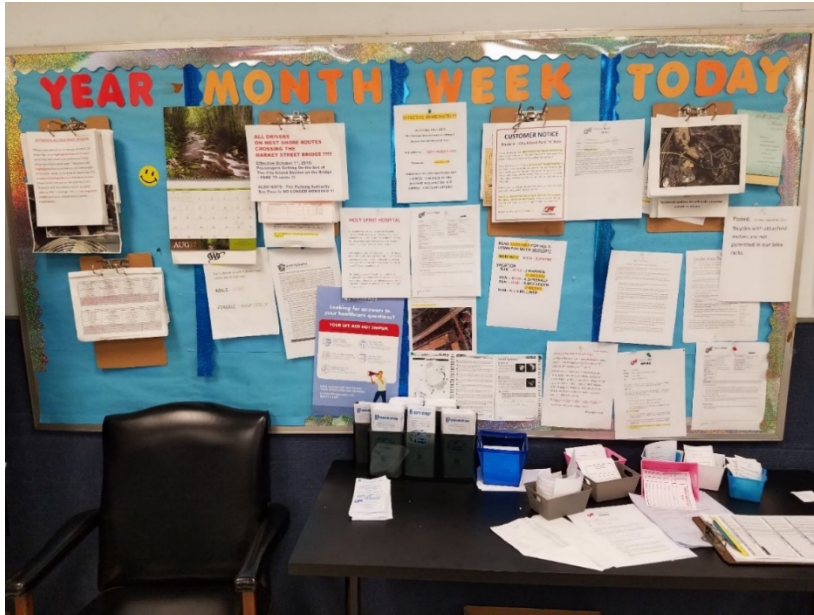
Service changes are generally advertised at main transfer points and on their website, but no clear policy on notification of service changes to riders exists, with the exception of Title VI-mandated public meetings for changes affecting service greater than 50%.

Operator and Staff Notice

Operator policies and procedures are clearly posted in operator waiting areas at the garage. General postings are on various wall spaces, while timely postings are displayed on a main message board, shown in Figure 28. Dispatch maintains and updates the main message board with the most pertinent information regarding policy changes, detours, and service changes. Additionally, a CAT Communications monitor in the Driver Quiet Room displays the most important updates in a slideshow.



Figure 28: CAT Message Board



2013 Service Standards

Capital Area Transit (CAT) management most recently updated its service standards in January 2013. These standards are used as benchmarks in evaluating service year-to-year as well as defining service categories and processes. The document references an Annual Service Plan, to be submitted with the Annual Operating Budget each year. CAT has not produced any such plan in the years following this approval of the Service Standards.

Below are key definitions and guidelines established in the document.

Route Definitions

CAT Service Standards outline five definitions for service types:

- Urban Routes: Routes which operate within the city
- Suburban Routes: Routes which originate or terminate in the city but operate out into suburban areas
- Rural Routes: Routes that operate solely in outlying rural areas
- Express Routes: Suburban routes operated with limited stop access for a portion of the route
- Commuter Express: Routes which operate over limited-access highways and/or make limited stops

Additionally, Urban Limited and Suburban Limited definitions exist for routes within a service type which are exempt from service standards due to more limited frequencies.

Service Coverage

CAT Service Standards establish guidelines for routes by type to be used in determining whether or not service areas are considered “well-served” by transit.

According to the document, residents are considered “well-served” from a coverage perspective if they are:

1. Not more than $\frac{3}{4}$ mile walking distance from an Urban Route; or
2. Not more than 1 mile from a Suburban Route.

Additionally, the section makes a note on Commuter Express Routes, stating that riders often drive 20-30 miles to reach Park & Rides that service these routes, but does not give a specific guideline on the distance from these facilities in order to be considered “well-served.”



Service Frequency

CAT Service Standards establish “acceptable” frequencies by route type by time period in order to assess whether or not routes are meeting standards. Routes not meeting standards are tasked with being actively monitored by planning staff in order to determine opportunities to improve service and meet standards.

Service Frequency Standards are outlined in Table 2 and Table 3. Urban Limited, Suburban Limited, Commuter Express, and Express Routes are excluded from service frequency standards.

CAT Service Standards define two types of frequency: Demand Frequency and Policy Frequency. Demand Frequency determines frequencies on bus routes based on Load Standards (defined below). Policy Frequency determines frequencies on bus routes based on the Frequency Standards outlined in the adjacent tables. Policy Frequencies should be maintained at all times except in peak period when demand increases beyond the capacities outlined under Load Standards. During these periods, Demand Frequency takes priority over Policy Frequency in order to prevent overcrowding.

Table 2: Service Frequency Standards - Weekday

	Weekday AM Peak (6:00 AM- 9:00 AM)	Weekday Off-Peak (9:00 AM- 3:30 PM)	Weekday PM Peak (3:30 PM- 6:30 PM)	Weekday Other Times (6:30 PM- 6:00 AM)
Urban	30 mins	90 mins	30 mins	150 mins
Suburban	60 mins	120 mins	60 mins	---
Rural	60 mins	90 mins	60 mins	---

Table 3: Service Frequency Standards - Saturday

	Saturday (8:30 AM-6:30 PM)	Saturday Other Times
Urban	60 mins	150 mins
Suburban	120 mins	---
Rural	90 mins	90 mins



Load Standards

CAT Service Standards define acceptable maximum loads by bus type. These standards are used at the trip level to determine whether or not additional vehicles or capacity should be added to a trip or route. “Maximum Load Factor” is the metric used in this section, and is a ratio of peak passengers on board to the number of seats on the vehicle. Maximum Load Factors range from 1.25 to 1.5 depending on vehicle type. A full breakdown of Load Standards is reflected in Table 4. CAT has since added 60’ articulated buses to its fleet and has not updated the official standards to reflect that.

On-Time Performance

CAT’s published Service Standards define an on-time performance (OTP) window to be used as a measure of service performance. The OTP window was defined by CAT as zero minutes early and four minutes late. This means that bus drivers are never allowed to arrive at a timepoint early, and can be up to four minutes past schedule without being considered late. Service Standards set a target OTP of 80%. In March 2017, CAT’s Service Standards were revised by executive decision. The current OTP window ranges from one minute early to no more than five minutes late. This standard has not been formally adopted by the Board of Directors.

Additional Topics

In addition to the above outlined key sections, the CAT Service Standards document also discusses, in more generic terms, the topics of trip generators, transfer points, fleet assignment, service monitoring, and distribution of amenities.

Table 4: Maximum Passenger Loads by Bus Type

Vehicle Type	Seats Available	Maximum Load Factor	Maximum Standing Load	Maximum Total Passengers
30’ standard bus	26	1.5	13 persons	39 persons
30’ low floor bus	26	1.5	13 persons	39 persons
35’ standard bus	37	1.5	18 persons	55 persons
35’ low floor bus	31	1.5	15 persons	46 persons
40’ low floor (city)	38	1.5	19 persons	57 persons
40’ low floor (Suburban)	39	1.25	10 persons	49 persons
45’ coach bus	55	1.29	15 persons	71 persons



Summary

The existing CAT service has not been comprehensively updated since CAT was first established. As a result, the current system does not adequately serve the current transit needs in Cumberland and Dauphin Counties. Existing services are limited both in geography and by day of week and time of day.

- **Service standards are outdated.** The existing CAT service standards are complex and do not provide clear guidance on when to adjust service based on a route's above- or below-average performance. Service guidelines should be simple and clear, with defined thresholds for when to adjust low- and high-performing routes to ensure that service is operated with maximum efficiency. Additionally, the existing CAT service standards are not compliant with Pennsylvania Act 44.
- **Frequent service is lacking across the system.** CAT does not operate any service with a frequency of more than every 30 minutes, instead focusing resources on providing greater coverage in Cumberland and Dauphin Counties. This limits the activeness of transit service and makes competitive transportation options more viable to potential customers.
- **There is limited weekend service.** CAT has limited weekend service, with only 13 of 34 routes operating on Saturdays and no Sunday service. This limits the overall usability of transit among workers who do not work traditional weekday "9-to-5" jobs. Additionally, limited weekend service reduces access to shopping and other non-work trips. This limitation requires customers to utilize other transit options on weekends, which also reduces weekday ridership as customers become accustomed to other modes.
- **There is no crosstown service.** The radial design of the transit network is focused on Downtown Harrisburg. As jobs, shopping centers, and entertainment centers continue to grow outside of

the core urban area, this radial structure does not meet the travel needs of the community. In many cases, customers are required to travel out of direction into downtown and transfer in order to return in the same direction to their destination. This forced travel to downtown is inconvenient and increases trip times for customers. Additionally, connections between destinations on the opposite side of downtown have been severed by forcing a transfer. There's strong connectivity between destinations on the East and West shores as well as north and south of downtown.

- **There is a lack of transfer centers.** Within CAT's system, there are only three large transit hubs, and all but Market Square have limited connectivity to other routes. Similar to crosstown service, CAT could better utilize the existing transfer centers and create new ones to reduce the need for customers to go to Downtown Harrisburg.
- **Routes are too complex.** CAT's existing service is complex and requires customers to understand many facets of transit service to use the system. Examples of this complexity include route variations that serve many different locations throughout the day, service duplications in which multiple routes serve the same market, and service overlays in which routes operate as a commuter service during rush hour and as a local variation during other times.
- **Service is getting slower.** Data trends show that overall service speeds have been slowing. There are many reasons for this, including increasing traffic congestion, stop spacing, and longer dwell times for customer boarding and at traffic lights. This has been a national trend in the transit industry, resulting in declining ridership as customers look for faster transportation alternatives. Improvements such as bus lanes, queue jumps, and transit signal priority are often used to improve bus speed.
- **Lack of on-time performance and reliability.** In addition to a decrease in speed, CAT has experienced a decrease in on-time



performance and service reliability for many of the same reasons. While CAT has adjusted schedules in an attempt to maintain on-time performance and reliability, this has not been enough to offset the reductions. This issue is further complicated by the fact that longer routes are more difficult to keep on-time, and many of CAT's existing routes are very long and encounter long periods of service variability due to incidents and occurrences beyond the control of schedules and operators. As service has become more unreliable, customers have shifted to alternative transportation options.

- **Areas of high demand are underserved.** While CAT's existing footprint is geographically extensive, the span and frequency of routes do not match the underlying demand for transit. This includes a need for earlier and later service, more frequency, and weekend service. This challenge is particularly true of service in the core urban environment.
- **The majority of service has low productivity.** CAT's service covers a large geographic area, and as a result, the majority of service is focused on coverage rather than generating higher ridership. Routes that operate over longer distances and traverse areas of lower densities cannot generate the high levels of productivity sought after by stakeholders. While this is not inherently a challenge, it does indicate that if CAT continues to provide long-distance routes to areas outside of the urban core, the cost per riders will continue to rise and the number of customers per hour will drop.
- **Service hours are increasing on low productivity routes.** Over the last several years CAT has invested in lower-productivity routes in an effort to meet community demands. This includes:
 - Service to warehouse jobs, which only generates ridership taking customers to and from work and are operated over a long distance.

- Circulator service, which competes with walking and relatively low parking costs outside of Downtown Harrisburg.
- Service simplification, which added miles and hours of service in low ridership areas to make service easier to understand for customers.
- **Costs are increasing.** Increasing costs represent a compounding challenge to CAT. As expenses increase, CAT must either find new revenues to offset this increase or reduce service to keep costs within available resource limits.
- **CAT's mission statement is unclear.** CAT maintains reasonably effective service throughout the region, providing fixed routes to urban, suburban, and rural communities, express and local trips, and circulator service. However, the mission of CAT is not clearly defined and the varying types of service create confusion over where to prioritize investments in service. As a result, the system can sometimes feel like a collection of routes as opposed to a system. As an organization, these goals and priorities should become more clearly defined.
- **The labor agreement is unclear.** CAT's labor agreement leaves room for misunderstanding. While the terms as negotiated are acceptable, some policies remain undefined. A clear bid schedule should be created and distributed to set deadlines for service changes. This will allow proper time for schedule changes to be communicated to the public, adequate time for operators to review runs, and necessary time for planning staff to complete data input tasks for CAD/AVL, GTFS, and other database maintenance. Additionally, thought should be given to creating a window of opportunity between bids to adjust service within runs by marginal times. This would allow for sudden service changes to occur immediately following a potential relocation of a large trip generator or in the event of a long-term construction project. This could help to avoid ridership losses.



- **The Transfer Policy is not customer friendly.** CAT's transfer policy is not clearly defined. The agency maintains route-specific transfers and sometimes only allows transfers to be used in downtown Harrisburg. Some routes are now creating transfer points outside of downtown and multiple options for accessing some destinations. The transfer policy should be updated to allow for riders to transfer where they need or want to transfer.
- **Existing land-use patterns can hinder transit access.** Many areas of need throughout the service area remain inadequately served due to land use issues. Often there are a lack of sidewalks, large elevation changes between major roadways and destinations, or railroad tracks and highways which create barriers to pedestrians trying to access fixed routes.

While capital funding for these improvements often does not fall under the purview of transit agencies, opportunities to leverage transit access as an economic generator exist. When new projects or roadways reconstruction occurs, CAT management should work to have a seat at the table in order to include these pedestrian improvements as often as possible.

- **Geographic areas of need.** The Transit Market Analysis defined a few areas of need. They include:
 - Serving Messiah College
 - Adding evening and weekend service to Hershey
 - Rerouting service to the business district of Newville
 - Exploring circulator service in Northern Dauphin County
 - Adding evening and weekend service to Carlisle
 - Utilizing the Lemoyne Transfer Center as a West Shore Hub
 - Creating a West Shore crosstown route connecting Enola to Lemoyne
 - Adding evening and weekend service to Carlisle Pike

- Extending some West Shore routes to Allison Hill and East Harrisburg
- Creating a transfer hub in East Harrisburg, potentially at Kline Village
- Creating crosstown service from Uptown to Allison Hill and Harrisburg Mall via Harrisburg Area Community College
- **Public information can be improved.** CAT currently does not provide an accurate system map or trip planner. Riders must navigate paper schedules and compare timepoints in order to determine if a potential destination is reachable. In order to create more legibility for the system, a number of potential improvements exist:
 - Update the system map
 - Share GTFS data publicly to allow for trip planning via Google Maps and other applications
 - Streamline the text alerts system to allow for route-specific alert information
 - Maintain and distribute a regular newsletter alerting riders of impending changes and positive stories related to the system. (the last newsletter was published in October 2014)
 - Look into applications for on-street real-time arrival displays
 - Update bus stop signage to unify sign types. Include route information and website/phone number to allow riders to find their schedules from the stop
 - Brand and publicize a main transfer point, where riders know they'll be able to catch all buses and be able to find up-to-date information on schedules.



CAT 20/20

The logo features the text "CAT 20/20" in a bold, white, sans-serif font. The "CAT" is slanted upwards to the right. The "20/20" is positioned to the right of "CAT". A white graphic element, resembling a circuit board or a stylized arrow, is overlaid on the text. It consists of a horizontal line at the top with a dot at its left end, a vertical line connecting the top and bottom lines, and a horizontal line at the bottom with a dot at its left end and an arrowhead pointing to the right. The "20/20" text is partially obscured by the top and bottom horizontal lines of this graphic.