Downtown Ann Arbor Circulator Feasibility Study

Final Report

Ann Arbor Downtown Development Authority

NELSON NYGAARD

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EXECUTIVE SUMMARY

Why a Downtown Circulator?

A high-frequency downtown circulator bus offers an additional option for connecting the many districts of downtown Ann Arbor, beyond walking and biking, and in a way that is not as space-intensive as parking, taxis, and TNCs. It enables people of all abilities to experience Kerrytown and the State Street district in the same outing, regardless of the mood of Michigan weather. A circulator can offer visitors the flexibility to park once, and visit shops and restaurants on Main Street and South University. A service of this kind makes it possible for University of Michigan students to venture away from Central Campus for a visit to the Ann Arbor Farmers Market between classes, or quickly reach the Ann Arbor Train Station from dormitories in East Quad. For these reasons and more, a new circulator service is an opportunity to strengthen quality of life in downtown Ann Arbor.

Recommended Operating Configuration

Figure 1 and Figure 2 display the recommended service operating configuration and route alignments for a new downtown circulator.

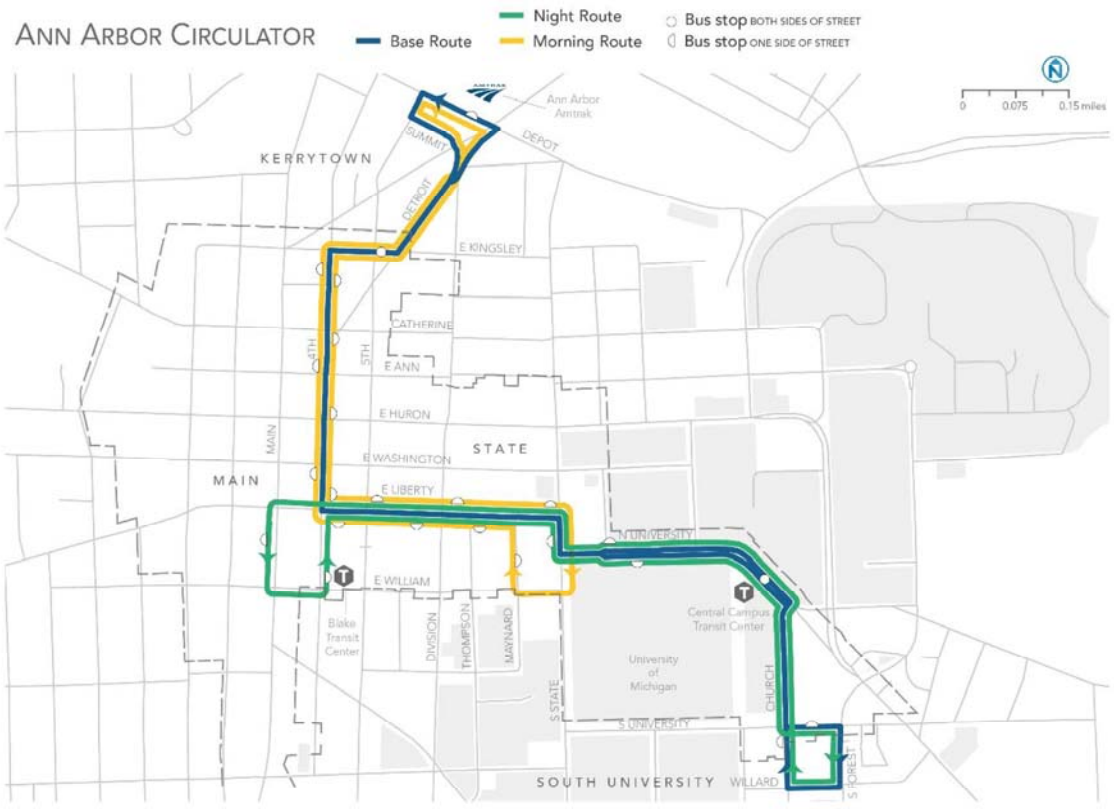
It is recommended that the circulator service be provided at no fare. In the event that it is determined that fares must be charged, an off-board or mobile payment system would be preferable to maintain efficient running times.

The optimal service provider would either be the Ann Arbor Area Transportation Authority (AAATA) or University of Michigan Logistics, Transportation & Parking (U-M LT&P). The recommended vehicle type for the service is a low-floor transit bus with capacity for at least 30 passengers.

Figure 1 Recommended Circulator Operating Configurations

Days	Route	Time	Frequency	Vehicles
Monday - Friday	Base	10 AM - 9 PM	10 min	3
	Night	9 PM - 2 AM	15 min	2
Saturday	Morning	7 AM - 10 AM	15 min	1
	Base	10 AM - 9 PM	10 min	3
	Night	9 PM - 2 AM	15 min	2
Sunday	Base	10 AM - 9 PM	10 min	3

Figure 2 Recommended Circulator Route Alignments



Benefits, Costs, and Constraints

The potential benefits of the circulator include increased retail spending and property values. Although a precise forecast of these benefits cannot be clearly guaranteed, it is reasonable to assume that the circulator would have a net positive effect on downtown marketability, and a positive impact on property values.

Many other benefits are likely to result, but less quantifiable in economic forecasting, including:

- Balanced occupancy of downtown parking, through better access to parking
- Improved circulation of daily workforce, downtown
- Expanded downtown ADA accessibility
- Enhanced perceptions of downtown safety in evening hours
- Increased pedestrian circulation in inclement weather
- Potential environmental benefits

The primary quantifiable costs of the circulator are the combination of initial capital costs – estimated to be between $2.0 and $3.8 million – and annual service operating costs – estimated to be between $1.5 and $1.8 million.

The variability of these costs primarily depends on who the service provider is and what type of fleet vehicles are used. It is recommended that the AAATA manage and operate the circulator service if it is financially feasible to do so. If U-M LT&P is willing to manage and operate the

service as part of its local fixed-route bus system, this is considered an optimal alternative. The following constraints to the circulator are known, but less quantifiable in forecasts:

- Circulator would have a limited impact on new development
- Downtown is configured in a way that most of the core retail areas and points of interest are already within a 15-minute walk from each other
- Proliferation of on-demand transportation will compete for ridership with the proposed circulator service

These estimates of costs and benefits do not account for the possible use of autonomous vehicles (AVs), as the market for commercial AVs is not yet well established.

Potential for Driverless Vehicles

Given the driverless shuttle service beginning on U-M's North Campus in fall 2017,[1] the debut of driverless bus service on American public roads in January 2017,[2] and the growing driverless vehicle industry in Ann Arbor,[3,4,5] AVs could be a realistic option for circulator fleet vehicles. This could be as an extension of prototype testing, or with full-market production vehicles. With a confluence of AV research, development, and manufacturing growing quickly in and around Ann Arbor, a partnership with MCity, the American Center for Mobility, or a vehicle manufacturer to support a downtown circulator has significant potential. A circulator featuring AVs for some or all of its vehicle fleet could serve the community with public transportation, publically showcase the latest in AV technology, and promote Ann Arbor as a hub for AV technology.

Just as well, a circulator operating traditional buses branded to promote the leaders of the local AV industry could also promote the city as an AV hub, and inspire local pride in the industry. A 15-passenger AV, such as the one to be used on U-M's North Campus, is not optimal for adequately serving the estimated level of circulator ridership; the capital and operations costs of increasing vehicle numbers would likely exceed the wages of drivers for traditional low-floor transit buses with larger capacity.

A Circulator in the Era of New Shared Mobility

While TNCs are competing with public transportation service providers for trips within downtown Ann Arbor, shared-mobility services cannot replace public transportation without exceeding the space constraints of and compromising the street life of downtown Ann Arbor streets. A downtown circulator bus service can improve mobility between the four districts of downtown Ann Arbor, and is an optimal service model given the space constraints of downtown streets.

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[1] MCity, "*Driverless shuttle service coming to U-M's North Campus*," University of Michigan, 2017. https://mcity.umich.edu/driverless-shuttle-service-coming-u-ms-north-campus/

[2] Griswold, Alison, "*The first driverless bus on America's public roads travels only 1000 feet*," Quartz, 2017. https://qz.com/884564/the-first-driverless-bus-on-americas-public-roads-only-travels-1000-feet/

[3] Carney, Susan, "*U-M opens MCity test environment for connected and driverless vehicles*," Michigan News, University of Michigan, 2015. http://ns.umich.edu/new/multimedia/videos/23020-u-m-opens-mcity-test-environment-for-connected-and-driverless-vehicles

[4] Haynes, Jessica, "*Construction of autonomous vehicle-testing facility underway at old Willow Run site*," MLive, 2017. http://www.mlive.com/business/ann-arbor/index.ssf/2017/06/construction_of_vehicle-testin.html

[5] Navya, "*Navya Set To Open First U.S. Production Plant In Saline, MI*," 2017. http://navya.tech/2017/07/navya-set-open-first-u-s-production-plant-saline-mi/

INTRODUCTION AND BACKGROUND

One of Ann Arbor's most unique characteristics for a town of its size — its vibrant, veritable streets each with a distinct spirit — also challenges city and university leaders to create simple, convenient, and attractive transportation infrastructure that makes the city feel connected and cohesive. Currently, the Ann Arbor Area Transportation Authority (AAATA) provides downtown transit, but service is aimed toward bringing people in and out of downtown rather than circulating within downtown. While downtown Ann Arbor is a friendly walking and biking environment, for inclement weather days and getting between areas that are a far walk — between Kerrytown and South University Avenue, for example — no other transportation option exists other than a personal vehicle, taxi, or transportation network company (TNC; e.g., Uber, Lyft). A high-frequency downtown circulator bus could offer an option that is out of the elements, and less space-intensive than driving alone or hailing a TNC service. A circulator with quick wheelchair boarding access (e.g., low-floor bus, wheel chair ramp, level boarding, etc.) can also make downtown Ann Arbor far more accessible for people of all abilities.

Between 2005 and 2009, the Link, or sometimes colloquially referred to as "the purple bus," operated between the University of Michigan's (U-M) Central Campus and downtown via a circulator route including Liberty Street and North University Avenue with two large loops at either end. The Link was free to ride, with one large loop providing service to student housing southeast of Central Campus and another loop traveling around the Main Street and Kerrytown areas. According to a March 2008 rider survey, a majority of riders self-identified as students who were using the service to reach school or entertainment. With concerns about frequency and the balance of ridership,[6] the funding partners decided not to renew its funding.

This Circulator Feasibility Study set out to determine the market benefit to downtown by renewing investment in a circulator. This document presents an overview of viable circulator transit concepts for downtown Ann Arbor. These concepts allow the Ann Arbor Downtown Development Authority (A2DDA) to better understand the cost options for such services, which have been suggested as an important means of improving mobility in between the downtown districts of Ann Arbor. The following objectives were identified to guide concept development:

- Support the A2DDA's efforts to improve downtown identity, infrastructure, transportation, business encouragement, housing, development partnerships, community services, and sustainability.
- Connect the city's primary walkable downtown districts directly to each other:
  - Kerrytown District
  - Main Street District
  - State Street District
  - South University District
- Design a service that is appropriate in this new era of increased on-demand transportation

[6] Ann Arbor Area Transportation Authority, "*Proposal to Discontinue the Link Downtown Circulator Route: Summary of Feedback Received During Open Comment Period and Recommendations for Action,*" 2009.

Why a Downtown Circulator?

The accessibility of public spaces plays a fundamental role in how the built environment influences quality of life for people in downtown Ann Arbor. According to the Project for Public Spaces, access is one of the four key attributes of a great place, along with sociability, activities, and comfort or image.[7] Continuing the development of abundant access throughout downtown Ann Arbor is key to its identity as a place that is cherished and enjoyed by residents, employees, students, and visitors alike. According to a survey of agencies operating or involved in the administration of a downtown circulator, improving general mobility throughout a downtown area is the top reason for providing a downtown circulator.[8]

A high-frequency downtown circulator bus offers an additional option for connecting the many districts of downtown Ann Arbor, beyond walking and biking, and in a way that is not as space-intensive as single-occupancy vehicle or TNC trips. It enables people of all abilities to experience Kerrytown and the State Street district in the same outing, regardless of the mood of Michigan weather. A circulator can offer visitors the flexibility to park once, and visit shops and restaurants on Main Street and South University. A service of this kind can make it possible for U-M students to venture away from Central Campus for a visit to the Ann Arbor Farmers Market between classes, or quickly reach the Ann Arbor Train Station from dormitories in East Quad. For these reasons and more, a new circulator service is an opportunity to strengthen quality of life in downtown Ann Arbor.

RECOMMENDED SERVICE DESIGN

Routing and Schedule

The recommended circulator concept includes three route configurations, shifting based on the time of day. This includes a base route, morning route, and night route. Figure 3 and Figure 4 display the recommended service operating configuration and route alignments for all three routes. Figure 5, Figure 6, and Figure 7 display each route on their own. Figure 8 highlights the service area of the circulator. This recommended circulator concept ties together the South University, State Street, Main Street, and Kerrytown districts with U-M's Central Campus.

There are approximately 255 weekdays per year that the circulator will run if holidays are excluded. It is recommended that all three routes run throughout the year, and the schedule not vary based on seasons. A seven-day service week, relatively consistent frequency throughout each day, and a lack of season-based schedule variability are important ingredients to providing abundant access[9] with the circulator. As described in Chapter 9 of *TCRP Report 95: Traveler*

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[7] Project for Public Spaces, "*What is Placemaking?*" 2009. https://www.pps.org/reference/what_is_placemaking/

[8] Boyle, Dan, "*TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*," Transportation Research Board, 2011. https://www.nap.edu/download/14499

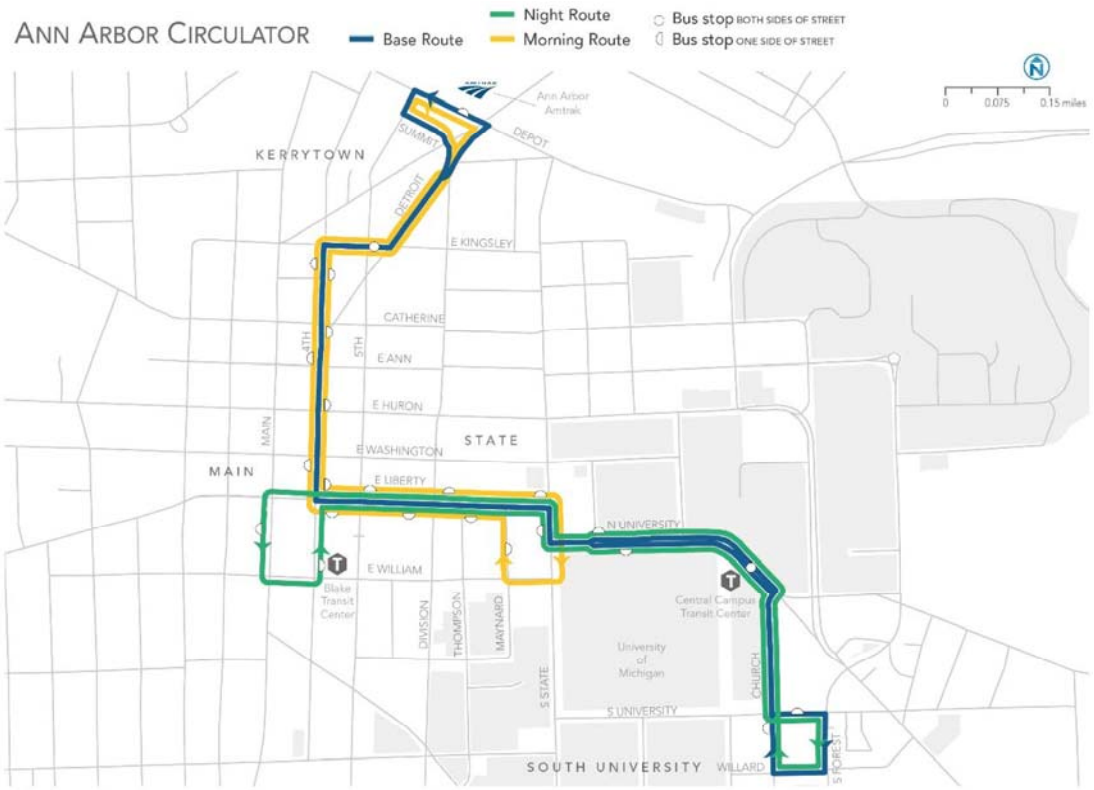
[9] Abundant access is defined as, "service that maximizes access for the great[est] possible number (and diversity) of people." Source: Walker, Jarrett, "A Map of Key Transit Choices," Human Transit, 2013. http://humantransit.org/2013/03/abundant-access-a-map-of-the-key-transit-choices.html

Response to Transportation System Changes, rider wait times are significantly affected by service irregularities; additionally, riders tend "to be more sensitive to unpredictable delay than predictable time requirements."[10] In other words, a reliably consistent schedule contributes to the perception that the circulator is generally available and not far away at most times of every day. High ridership overall tends to be correlated with consistent availability.[11]

Figure 3 Recommended Circulator Operating Configurations

Days	Route	Time	Frequency	Vehicles
Monday - Friday	Base	10 AM - 9 PM	10 min	3
	Night	9 PM - 2 AM	15 min	2
Saturday	Morning	7 AM - 10 AM	15 min	1
	Base	10 AM - 9 PM	10 min	3
	Night	9 PM - 2 AM	15 min	2
Sunday	Base	10 AM - 9 PM	10 min	3

Figure 4 Recommended Ann Arbor Downtown Circulator Map

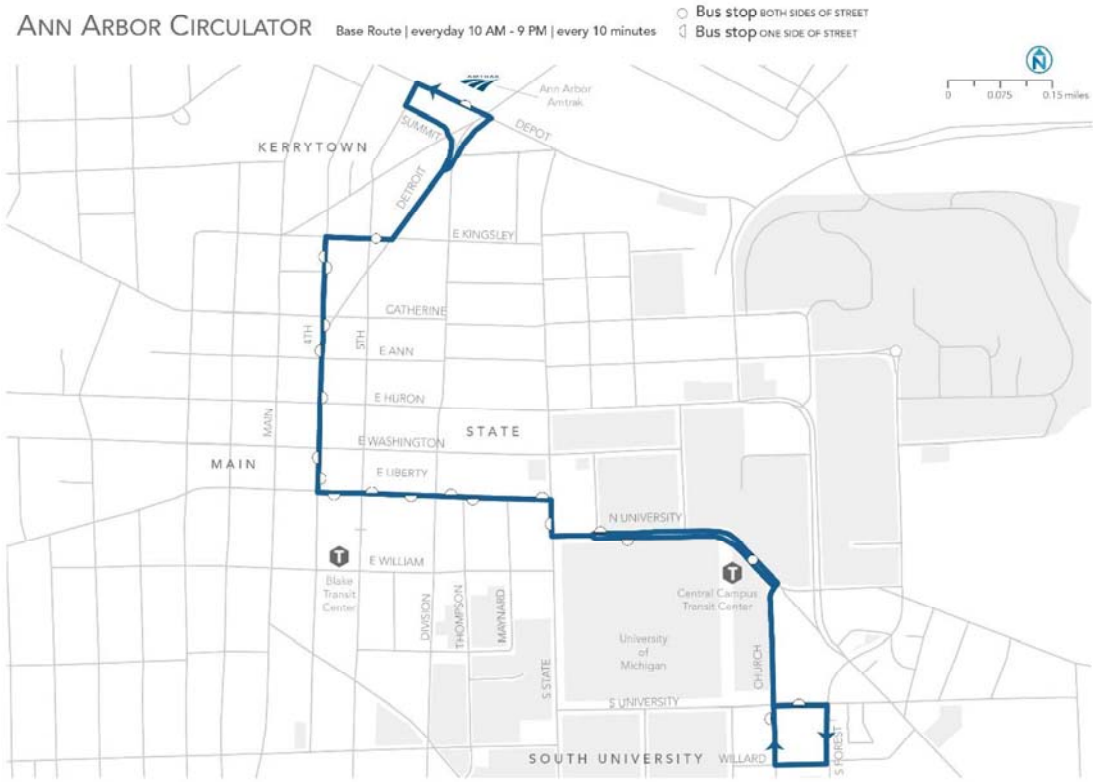


[10] Evans IV, John E. (Jay), et al., "Transit Scheduling and Frequency," in *TCRP Report 95: Traveler Response to Transportation System Changes*, Transportation Research Board, 2004.
https://pdfs.semanticscholar.org/869c/5ad9b5ba2022a6377b0e0323effd9194f784.pdf

[11] Walker, Jarrett, "*Explainer: The Transit Ridership Recipe*," Human Transit, 2015.
http://humantransit.org/2015/07/mega-explainer-the-ridership-recipe.html

The base route will operate seven days a week from 10 a.m. to 9 p.m. with 10-minute frequency (Figure 5). The base route goes from South University up through U-M Central Campus, passing the Blake Transit Center, and up 4th Avenue. It ultimately circles into Kerrytown to reach the Ann Arbor Train Station, and back down 4th Avenue.

Figure 5 Recommended Base Route



The recommended base route was designed based on transit design principles and best practices, input from the A2DDA and stakeholders, and the study's service area profile. Within the service area profile, the study team determined the demand for transit based on population and employment density, as well as other factors such as major activity centers and employers. This revealed that nearly every block within the A2DDA area has extremely high demand for transit and can support a circulator running at least every 10 minutes during peak times.

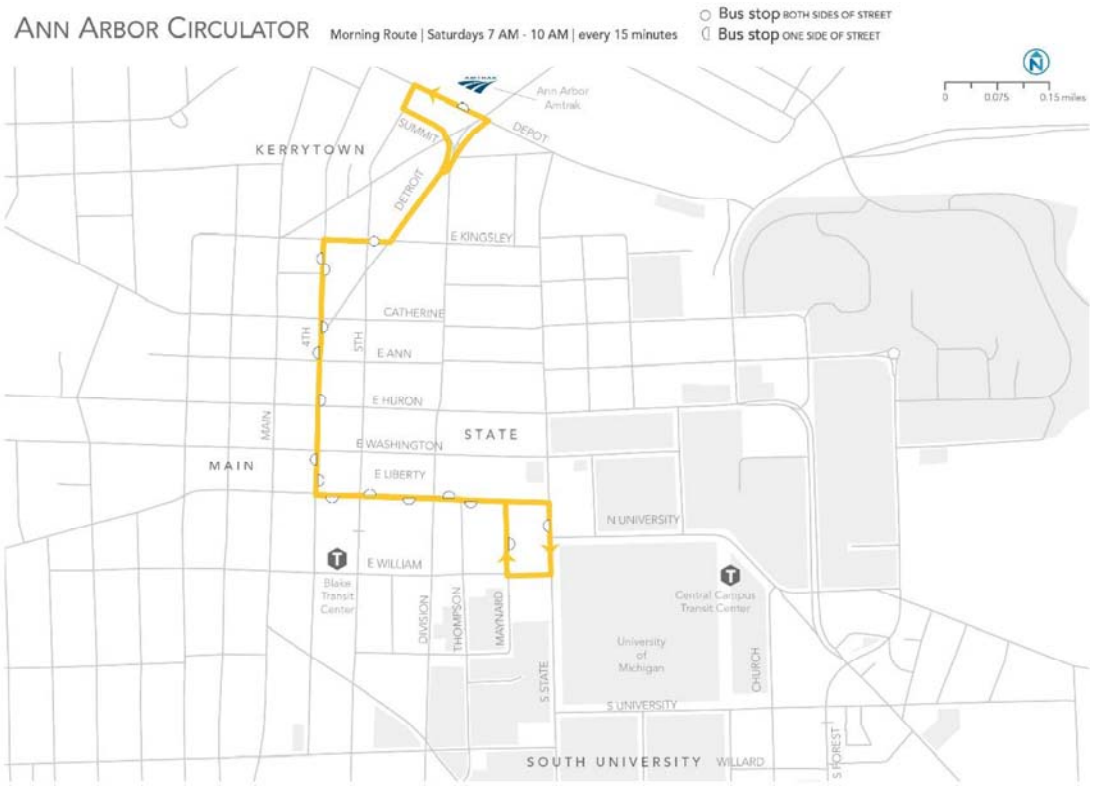
A more fine-grained analysis of specific street segments within the area, conducted using numerous metrics of transit supportiveness, confirmed that the most active streets are also the best for a circulator. The highest scored street segments include Main between Huron and Liberty Streets, 4th Avenue, Liberty Street, State Street, North University Avenue, and South University Avenue. Though the analysis was not meant to be prescriptive, these corridors provide easy access to the circulator, high visibility, and dense foot and retail traffic, among other benefits. The activity on some of these streets has caused problems for smooth transit operation for local routes in the past, but for a circulator-type service, the benefits outweigh potential challenges. Design and operational strategies that can mitigate some of these challenges also exist. Main Street, as the busiest street as well as the one with the most closures for local events and activities, was avoided. Fourth Avenue, just one block to the east of Main Street, actually showed greater transit

potential than Main Street because of the extremely high density that continues for at least two blocks east and west and a high concentration of points of interest, employers, and activity centers. Fourth Avenue helps keep the route shorter, straighter, and closer to all four downtown districts.

As conceived, the base route provides frequent service to important Ann Arbor corridors while also keeping the route simple and direct, connecting all four downtown districts, and serves the most points of interest, major employers, and activity centers. Many of the major public parking lots and structures are located on or within two blocks of the route. The route also serves the Ann Arbor Train Station, which will provide better multimodal connections as well as a convenient layover location. The Central Campus Transportation Center, the primary hub for U-M buses, and the Blake Transit Center, the AAATA's Ann Arbor transit center, are both served directly or within a half-block of the designed circulator route. The base route is 3.7 miles long round-trip, so a one-way trip between Kerrytown and South University Avenue should take approximately 10-11 minutes (assuming an average speed of 10 miles per hour).

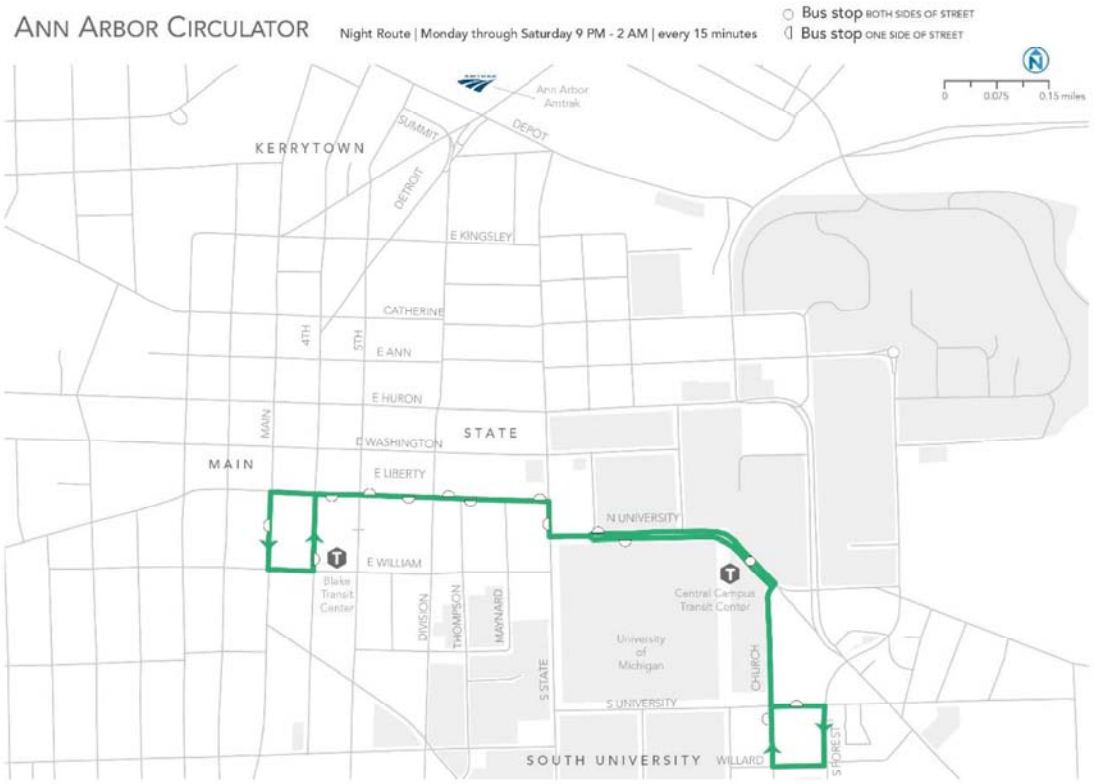
The morning route operates on Saturdays from 7 a.m. to 10 a.m., with 15-minute frequency (Figure 6). It goes up Liberty Street from State Street to 4th Avenue, and then through Kerrytown via 4th Avenue, and Kinglsey and Detroit streets. It loops on the north end of Kerrytown by the Ann Arbor Train Station, before returning via Detroit Street and back down 4th Avenue. At 10 a.m. on Saturdays, the morning route transitions into the base route configuration. The morning route is 2.5 miles long round-trip, so a one-way trip between Kerrytown and State Street should only take 5-6 minutes.

Figure 6 Recommended Morning Route



The night route will operate Monday through Saturday from 9 p.m. to 2 a.m., with 15-minute frequency (Figure 7). It primarily serves the southern side of downtown. The route extends from the Forest Avenue parking garage to Main Street and the Blake Transit Center, via North University Avenue and Liberty Street. The night route is 2.5 miles long round-trip, so a one-way trip between Main Street and S. University Avenue should only take 7-8 minutes.

Figure 7 Recommended Night Route



Research and experience shows that people are typically willing to walk up to a quarter-mile to reach transit. Since most transit riders are pedestrians on one or both ends of their trip, a quarter-mile is a typical catchment area for a standard local bus. However, the type of transit and size and density of the community affect that distance. Research suggests that people may be willing to walk farther for rail or bus rapid transit-type services that have high capacity and greater infrastructure. [12]

With downtown Ann Arbor being small and walkable, the distance people will walk to a circulator will likely be smaller than typical. However, the service proposed will run at a high frequency, which could merit a further walk. Given these factors, the service area for the proposed circulator is considered to be within a 1/5-mile buffer around stop locations – roughly equivalent to 3-6 blocks. At 10-15 minute frequencies, and a total one-way trip time end-to-end of no more than 15 minutes, the circulator would be competitive with walking, biking, and driving. The higher the frequency, the more the service facilitates abundant access between the districts of downtown Ann Arbor.

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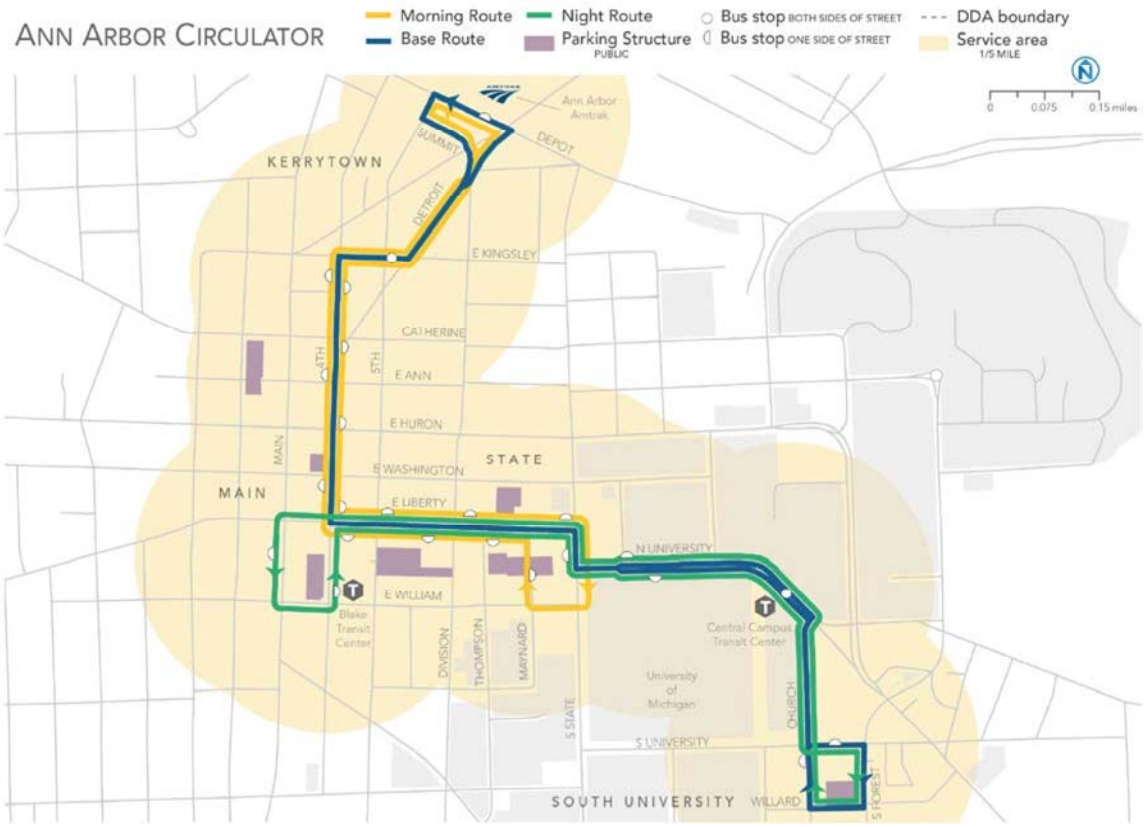
[12] Walker, Jarrett, "*basics: walking distance to transit*," Human Transit, 2011. http://humantransit.org/2011/04/basics-walking-distance-to-transit.html

The service area shown in Figure 8 represents the 1/5-mile buffer and covers the entire DDA service area. The service area additionally extends beyond the DDA borders on all sides, capturing U-M's central campus, Kerrytown, and South University.

Figure 8 Circulator Service Area



Stop locations

Based on preliminary route design, approximate stop locations have been included in the maps above. These are approximate stop locations, and going forward, more precise locations will be defined more explicitly based on locations of loading zones, meters, and other obstructions.

The westbound/northbound stops include:

- Church at South University
- Central Campus Transit Center / Ruthven Museum
- North University at Thayer
- East Liberty at South State
- East Liberty at South Division
- East Liberty at South 5th Avenue
- South 4th Avenue at East Liberty
- North 4th Avenue at East Huron
- North 4th Avenue at Catherine
- North 4th Avenue at Hollander's

- East Kingsley at North 5th Avenue (northbound)
- Ann Arbor Amtrak

The eastbound/southbound stops include:

- Ann Arbor Amtrak
- East Kingsley at North 5th Avenue (southbound)
- North 4th Avenue at Farmer's Market
- North 4th Avenue at East Ann
- South 4th Avenue at East Washington
- East Liberty at South 4th Avenue
- East Liberty at South Division
- East Liberty at Thompson
- South State (between North University and East Liberty)
- North University at Kraus Natural Science Building
- Central Campus Transit Center
- South University (between Church and South Forest)

One additional morning stop includes Maynard at Republic Parking Structure. Two additional night stops include the Blake Transit Center and Main Street at the 300-block mid-block crosswalk.

Projected Ridership

Annual ridership can be estimated based on the level of service provided. This estimation is calculated by multiplying 20 passengers by the number of revenue vehicle hours[13] per year. The recommended service configuration provides 15,073 annual revenue vehicle hours. Based on this, the projected annual ridership for the circulator is 301,460.

The 20 passengers per hour figure is derived from an estimate based on calculations in *TCRP Report 55: Guidelines for Enhancing Suburban Mobility Using Public Transportation*.[14] In addition, equations provided by TriMet were used to calculate approximate passengers per hour, which came to 16-24 to validate our estimate of 20 based on *TCRP Report 55*.

For most months after the initial Link pilot was complete, ridership was between 35 and 55 passengers per hour.[15] Link ridership was high, but also had a captive student ridership between student residences and Central Campus. Under this context, 20 passengers per hour may be conservative, but it is reasonable given that the recommended circulator configuration will primarily serve trips between downtown districts, rather than separate university destinations.

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[13] Revenue vehicle hours (RVHs) are, "the time when a vehicle is available to the general public and there is an expectation of carrying passengers." RVHs include layover/recovery time, and exclude deadhead time and vehicle maintenance testing. Source: Federal Transit Administration, "National Transit Database Glossary," updated: October 6, 2017. https://www.transit.dot.gov/ntd/national-transit-database-ntd-glossary.

[14] Urbitran Associates, et al., "*TCRP Report 55: Guidelines for Enhancing Suburban Mobility Using Public Transportation*," Transportation Research Board, 1999. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_55-a.pdf

[15] The Link pilot ran from August 2003 through June 2005. The Link was then restarted in the fall of 2005, and ran until May 2009.

OPERATIONS AND ORGANIZATION

Service Administration

Management

The service should be managed by a local agency with experience administering public transportation service in the local region. There are two public transportation service providers active in downtown Ann Arbor who have capacity to both manage and operate the service. Approximately three-quarters of downtown circulator operating and supporting agencies responding to a survey for *TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*, reported that their local circulator service is operated by a local transit agency;[16] both of these agencies fit this precedent.

It is recommended that the AAATA manage and operate the circulator service if it is financially feasible to do so. If U-M Logistics, Transportation and Parking (LT&P) is willing to manage and operate the service as part of its local fixed-route bus system, this is considered an optimal alternative.

Ann Arbor Area Transportation Authority

The AAATA is the primary local government agency operating public transportation in the Ann Arbor-Ypsilanti Area. It has provided continuous service to Ann Arbor for over four decades, including the former Link circulator service in downtown Ann Arbor. The City of Ann Arbor was the founding member of AAATA, before the City of Ypsilanti[17] and Ypsilanti Township[18] became members of the Authority in 2013. The AAATA currently provides local public transit services to Ann Arbor, Ypsilanti, Ypsilanti Township, Pittsfield Township, Superior Township, and Scio Township. Commuter transit service is also available to and from Canton Township and Chelsea.

The AAATA is experienced in managing contracted transit services operated by private service providers. It currently contracts Indian Trails to operate its AirRide express service to East Lansing and Detroit Metro Airport, and RideCorp to operate its ARide demand response service.

As a service provider experienced both as the operator of Link, the former downtown circulator, and with managing transit services contracted to private providers, the AAATA is a strong candidate to manage a future downtown circulator. The AAATA fits the precedent of a local transit agency operating a local circulator service, as is common for downtown circulator services around the country.[19] It is also an eligible recipient of state and federal operations and capital

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[16] Boyle, Dan, "*TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*," Transportation Research Board, 2011. https://www.nap.edu/download/14499.

[17] Ignaczak, Nina, "*AATA gets new name and new member as Ypsilanti joins regional transit agency*," Concentrate Ann Arbor, Second Wave Media, 2013. http://www.secondwavemedia.com/concentrate/devnews/AATAbecomes3ATA0252.aspx.

[18] Cluley, Andrew, "*Ypsilanti Township Approved to Join Ann Arbor Area Transportation Authority*," WEMU, 2013. http://wemu.org/post/ypsilanti-township-approved-join-ann-arbor-area-transportation-authority#stream/0.

[19] Boyle, Dan, "*TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*," Transportation Research Board, 2011. https://www.nap.edu/download/14499.

funding for public transportation service, through the Southeast Michigan Regional Transit Authority (RTA).[20] AAATA service vehicle operators are represented by Transport Workers Union of America, AFL-CIO, Local 171.

University of Michigan Logistics, Transportation, and Parking

U-M LT&P provides intra-city public transit between U-M's central, medical, north, and south campuses, as well as park-and-ride lots around the city. In addition to local public transit services, LT&P also provides charter services to various departments, colleges, and organizations within the university system.

LT&P is also a well-equipped candidate for operating a downtown circulator, as the majority of its current fixed route services serve a similar function of circulation between high demand points within a small section of the city. At this time, LT&P does not contract its transit services to clients outside of the university system, however LT&P fits the service operator identity precedent, as reported in TCRP Synthesis 87.[21] LT&P's vehicle operators are a mix of unionized permanent staff members, and non-union student drivers.

Local Private Operators

If neither the AAATA or LT&P is able to operate the circulator service, a private operator could be contracted by a service manager to provide this service. If this service model is used, an operator should be chosen from existing, local, and established operators in the immediate area. Some private service operators active in the area are:

Trinity Transportation

Trinity Transportation is a for-profit transportation services company based in southeast Michigan. Trinity's operations facilities are located through the Detroit metropolitan area, with its closest facility located in Dearborn Heights. Trinity's primary service markets are students, sports teams, weddings, special events, corporate events, airport travel, conventions, and fundraisers. The Ann Arbor Art Fair has contracted with Trinity Transportation, as well as the AAATA, to provide park-and-ride shuttle bus services to and from the annual event.[22]

First Transit

First Transit is a for-profit company operating public transportation services on contract throughout the country. Its services include transit management, fleet maintenance, and service operation for fixed-route paratransit, shuttle, bus rapid transit, campus transit, healthcare transportation, and passenger rail. It is a subsidy of FirstGroup, based in the United Kingdom, with its American operations based in Cincinnati, Ohio.

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[20] Public Act 387 of 2012 established the Southeast Michigan Regional Transit Authority (RTA), and assigned the RTA as the new designated recipient of federal and state public transportation grants for Macomb, Oakland, Washtenaw, and Wayne counties, effective October 1, 2013. Under this law, the AAATA receives these funds as pass-through funds from the RTA. Source: William Hamilton, "*The Comprehensive Transportation Fund and State Support for Local Public Transit Agencies – Updated and Revised*," House Fiscal Agency, 2013. http://www.house.mi.gov/hfa/PDF/Transportation/CTFLocalBusOperating.pdf

[21] Boyle, Dan, "*TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*," Transportation Research Board, 2011. https://www.nap.edu/download/14499.

[22] Ann Arbor Street Art Fair, The Original, "*Getting Here*," 2017. http://www.artfair.org/page/getting-here

Detroit Bus Company

The Detroit Bus Company (DBC) is a private low-profit limited liability company founded in Detroit in 2011 to fill in gaps in Detroit Department of Transportation (DDOT) service. Currently its primary services are private charters, group tours, and school transportation. The company is known locally for its buses featuring vibrant and unique paint jobs. It's Ride for Ride program incorporates the cost of school bus services in Detroit into its private charters and group tour services, so that it can provide low- to no-cost school transportation services to students in Detroit. While DBC's current vehicle fleet is predominantly refurbished school buses, its past work in providing backup services for DDOT and reinvestments into Metro Detroit communities are well respected.

TransDev

TransDev is a global for-profit transportation services company, based in France. It's service markets include fixed-route transit, bus rapid transit, intracity passenger rail, autonomous vehicles, transportation demand management, long-distance intercity transportation, and ferry boat service. TransDev is currently contracted by M-1 RAIL to operate Detroit's QLINE streetcar service.

Golden Limousine

Golden Limousine is a private for-profit transportation service operator based in Milan, Michigan. Its primary services are transportation network services dispatched by mobile app, limousine rentals, airport shuttles, parking shuttles, and charter service. Golden's Mode Car service offers transportation network service similar to global providers, Uber and Lyft, but via staff drivers operating fleet vehicles, as opposed to independent drivers operating private vehicles not owned or operated by the service company. Golden is known for its involvement in local chambers of commerce, convention and visitor bureaus, and other area business associations. The Ann Arbor Art Fair has also contracted with Golden Limousine to provide park-and-ride shuttle bus services to and from the annual event in the past.

Possible Autonomous Vehicle Partnership

Autonomous vehicle (AV) research, development, and testing is a fast growing industry in the Ann Arbor-Ypsilanti area. During the Fall 2017 semester, U-M is debuting a driverless shuttle service on its North Campus. It will serve a 2-mile circuit with 10-minute frequencies, using Navya Arma 15-passenger driverless vehicles. The same vehicle was also used in the pilot of the first driverless public transportation service on American roads, in Las Vegas, Nevada.[23] While this concept for public transit on public roads is still new, it is an acknowledgeably likely future.

For AVs to be used in a public transportation fleet the operation component shifts from a combination of maintenance, dispatch, and vehicle operators, to more of a maintenance and engineering model. With that, an AV fleet provider could either be solely the vehicle manufacturer or a combination of the manufacturer and operator. In either configuration, it is recommended

[23] Keolis, Navya, and the City of Las Vegas *operated the first driverless public transportation service on American roads* in January 2017. Navya has also deployed its Arma driverless shuttle vehicle for public transportation service in Australia, France, and Singapore. Source: Griswold, Alison, "*The first driverless bus on America's public roads travels only 1000 feet*," Quartz, 2017. https://qz.com/884564/the-first-driverless-bus-on-americas-public-roads-only-travels-1000-feet/

that a service manager with public transportation service planning experience, such as the AAATA or U-M LT&P administer the circulator service.

Operating Costs

The basis of operating costs is a calculation of the total vehicle hour requirement of the route network configurations. Annual operating costs associated with the conceptual routes will vary depending upon the service operator. Vehicle hours and four potential operating costs variables for these conceptual routes are displayed in Figure 9, Figure 10, and Figure 11. These concepts assume a vehicle fleet comprised of vehicles in Figure 12.

The base route has a requirement of three buses for about 11 service hours per day, Monday through Sunday. The morning route is proposed to only run on Saturdays, with three service hours per day and one vehicle. The night route schedules five service hours per day among two vehicles, and is proposed to operate Monday through Saturday.

With these assumptions, an operator would be responsible for 294 vehicle revenue hours per week and 15,073 vehicle revenue hours per year. Depending upon the operating cost per vehicle revenue hour for the service operator, annual operating costs have an estimated range of $900,000 and $1.8 million.

Under these routes concepts, three vehicles is the maximum number required to be in operation at peak service. It is recommended that a service operator have at least one additional vehicle in its service fleet available for transitions between driver shift changes, refueling, and maintenance relief.

Figure 9 Vehicle Hours and Operating Cost by Route - Weekday

Route Concept	Vehicles	Daily Service Hours	Daily Vehicle Revenue Hours	Annual Vehicle Revenue Hours	Annual Operating Cost Estimate ($60/hr)	Annual Operating Cost Estimate ($80/hr)	Annual Operating Cost Estimate ($100/hr)	Annual Operating Cost Estimate ($120/hr)
Base Route	3	11	33	8,415	$504,900	$673,200	$841,500	$1,009,800
Night Route	2	5	10	2,550	$153,000	$204,000	$255,000	$306,000
Full Service Day Total	3	16	43	10,965	$657,900	$877,200	$1,096,500	$1,315,800

Figure 10 Vehicle Hours and Operating Cost by Route - Saturday

Route Concept	Vehicles	Daily Service Hours	Daily Vehicle Revenue Hours	Annual Vehicle Revenue Hours	Annual Operating Cost Estimate ($60/hr)	Annual Operating Cost Estimate ($80/hr)	Annual Operating Cost Estimate ($100/hr)	Annual Operating Cost Estimate ($120/hr)
Base Route	3	11	33	1,716	$102,960	$137,280	$171,600	$205,920
Morning Route	1	3	3	156	$9,360	$12,480	$15,600	$18,720
Night Route	2	5	10	520	$31,200	$41,600	$52,000	$62,400
Full Service Day Total	3	19	46	2,392	$143,520	$191,360	$239,200	$287,040

Figure 11 **Vehicle Hours and Operating Cost by Route - Sunday**

Route Concept	Vehicles	Daily Service Hours	Daily Vehicle Revenue Hours	Annual Vehicle Revenue Hours	Annual Operating Cost Estimate ($60/hr)	Annual Operating Cost Estimate ($80/hr)	Annual Operating Cost Estimate ($100/hr)	Annual Operating Cost Estimate ($120/hr)
Base Route	3	11	33	1,716	$102,960	$137,280	$171,600	$205,920
Full Service Day Total	3	11	33	15,073	$102,960	$137,280	$171,600	$205,920

Capital Costs

Vehicle Type

The vehicle selection for a prospective circulator network will be dependent upon a number of factors including, costs, ridership demand, operability, and environmental considerations. The vehicles displayed in Figure 12 provide a range of vehicle types that are most applicable to the city's needs and goals, geography, and operability concerns.

The low-floor transit bus is currently the primary transit vehicle for the AAATA and U-M LT&P fixed-route transit services. The low-floor transit bus and all-electric bus each contain a level of capacity that would meet a level of ridership estimated for this type of service; however, each of these buses has a higher cost than the other options in Figure 12. The cutaway bus has adequate capacity and is relatively inexpensive, but as it can only board and alight from a single door its operation characteristics are not optimal for this type of service. The body-on-frame bus has ideal size and operability characteristics, and its cost point is relatively low. Both the cutaway and body-on-frame bus can be ADA-accessible through wheelchair lifts, however, this method of accessibility is significantly more time-intensive than the wheel chair ramps on the low-floor transit and all-electric bus models. The schedule lag time that is required for wheel chair access on the cutaway and body-on-frame buses is not conducive to the frequency scheduled in the recommended circulator concept.

Figure 12 Comparison of Bus Types

Cutaway Bus Typical uses: Demand response and fixed-route Ridership demand: Moderate Length: 25 to 32 ft Seating capacity: 20 to 33 Average cost: $100,000-150,000 Estimated useful life: 5-7 years	 Credit: Nelson\Nygaard
Body-on-Frame Bus Typical uses: Demand response and fixed-route Ridership demand: Moderate Length: 25 to 32 ft Seating capacity: 20 to 33 Average cost: $100,000-150,000 Estimated useful life: 7-10 years	 *Credit: Flickr user "73683441@N07"*
Heavy-Duty Low-Floor Transit Bus *Typical use:* Fixed-route service Ridership demand: Moderate to high *Length:* 29-40 ft *Seating capacity:* 28 to 40 Average cost: $500,000-600,000 Minimum life: 1,000,000 miles plus **Recommended Vehicle Type for Proposed Circulator**	 Credit: Angela Cesere, AnnArbor.com
All-Electric Bus Typical use: Fixed-route Ridership demand: High Length: 35 to 40 ft Seating capacity: 28 to 40 Average cost: $700,000-950,000 Estimated useful life: 12+ years	 Credits: Flickr user "SounderBruce"

Potential for Driverless Vehicles

Given the driverless shuttle service beginning on U-M's North Campus during the fall 2017 semester[24] and the debut of driverless bus service on American public roads in January 2017,[25]

[24] MCity, "*Driverless shuttle service coming to U-M's North Campus*," University of Michigan, 2017. https://mcity.umich.edu/driverless-shuttle-service-coming-u-ms-north-campus/

[25] Griswold, Alison, "*The first driverless bus on America's public roads travels only 1000 feet*," Quartz, 2017. https://qz.com/884564/the-first-driverless-bus-on-americas-public-roads-only-travels-1000-feet/

AVs could be a realistic option for circulator fleet vehicles. This could be as an extension of prototype testing, or as full-market production vehicles. Based on the 15-passenger capacity of the driverless vehicles to be used on North Campus, the variability of passenger capacity among the vehicle fleet might change or be in flux depending on the following:

- AV fleet vehicle service life (Are vehicles long-term members of the fleet roster, or limited term prototype trials?)
- Whether or not the circulator's service fleet is comprised partially or entirely of a particular AV model

Above, the EasyMile EZ10 features a retractable ramp for wheelchair access.
Below, the Navya Arma is pictured moving passengers at MCity. The Arma is the vehicle to be used in the driverless shuttle pilot service on U-M's North Campus beginning in the 2017 fall semester.

Image Sources: National Center for Transit Research, MCity

If the circulator service fleet were to be a mix of buses with drivers and AVs without, one way to reduce the variability of passenger capacity would be to dedicate one or more AVs to the morning or night routes, when less vehicles are needed at once.

Currently, the Navya Arma and EasyMile EZ10 vehicles both use low-floor chassis, which is optimal for ADA-accessibility. EasyMile currently promotes its EZ10 vehicle equipped with a retractable wheelchair ramp that deploys with the press of a button.[26]

Additional considerations regarding the use of AVs in a circulator fleet include the relative capital purchasing and operating costs and staff costs. The use of prototype AVs as extensions of limited-term research and development could reduce capital costs, due to forgone purchasing of permanent fleet vehicle stock. The future market pricing of AV transit vehicles is not yet known, but anticipated to be higher than their current manually-driven counterparts. On the operation side, AVs save on annual expenses for driver and dispatch salary and benefits. However salary and benefits costs remain for vehicle programming and engineering staff. Maintenance costs per vehicle are assumed to be higher than driver-operated vehicles due to the increased programming component.

Total costs

The total costs of operating and capital for the proposed circulator service will vary significantly based on the designated service manager and operator, and their current experience and capacities for service in Ann Arbor. The AAATA and U-M LT&P are public transportation service providers active in the city, with existing vehicle fleets that are ADA-compliant and ideal for estimated ridership, and maintenance and storage facilities in the city. Both also have existing capital and staff capacities for other aspects of service, including service planning, bus stop capital

[26] EasyMile, "EasyMile driverless shuttle at EPFL University in Lausanne, Switzerland," 2015. https://vimeo.com/137217228.

and maintenance, and service funding mechanisms. These traits make them the preferred candidates for management and operation of the circulator.

The low-floor transit bus and all-electric bus are the ideal vehicles for the service. Characteristics such as quickly deployable ramps for ADA-compliant entry, two boarding doors for optimal pick-up and drop-off time, longer service lifespans, and passenger capacity conducive to estimated ridership all make these vehicles preferable to other options. In addition, existing operations and maintenance capacity as well as vehicle stock at local transit service providers lower the barrier to start-up.

AV vehicle options will continue to develop, and may present unique opportunities for financial, marketing, operations, and vendor relationships with the service manager. At this time, a 15-passenger AV is not optimal for adequately serving the estimated level of circulator ridership. In addition, future capital and operating costs for AVs cannot be adequately forecasted at this time, by nature of the vehicle options not yet being in wide market adoption.

FINANCE

Potential Funding Stakeholders

Funding for the circulator service could be provided through sponsorships and strategic partnerships with local organizations and institutions. The Link Circulator was sponsored by the A2DDA, U-M, and AAATA. Potential sponsors or strategic partners for the proposed circulator could include:[27,28]

- City of Ann Arbor
- Washtenaw County
- Ann Arbor Area Transportation Authority (AAATA)
- University of Michigan
- Ann Arbor/Ypsilanti Regional Chamber of Commerce

For example, AAATA currently operates Route 21 Amtrak – Depot, which serves a similar alignment to that of the recommended circulator. A rough approximation of annual costs to operate Route 21, based on current operating characteristics for revenue service, is around $220,000. With a partnership, these costs could contribute to the operation of the recommended circulator instead of Route 21.

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[27] Possible sponsors or strategic partners are not limited to those listed in this section.

[28] This list of potential sponsors or strategic partners is based in part on a combination of those who sponsored the Link circulator and Table 18 in Chapter 3 of TCRP Synthesis 87.

(A) Ann Arbor Area Transportation Authority, "*Proposal to Discontinue the Link Downtown Circulator Route: Summary of Feedback Received During Open Comment Period and Recommendations for Action*," 2009.

(B) Source: Boyle, Dan, "*TCRP Synthesis 87: Practices in the Development and Deployment of Downtown Circulators*," Transportation Research Board, 2011. https://www.nap.edu/download/14499.

AV Research Partnership

Driverless vehicles and AVs are a new and fast growing industry in the Ann Arbor-Ypsilanti area, with several prominent developments putting the region on the map as a global hub for the industry. A funding or operations partnership with these facilities or their investors could present a unique opportunity for mutual marketing, service and even tourism benefits, and an innovative service model.

In July 2015, U-M opened MCity, "the world's first controlled environment specifically designed to test the potential of connected and automated vehicle technologies."[29] The 32-acre test facility is the result of a partnership between U-M and over 50 private companies researching and developing driverless vehicles. One public transportation initiative already stemming from MCity research is the driverless shuttle service on U-M's North Campus, beginning during the Fall 2017 semester.

Early in the summer of 2017, the American Center for Mobility broke ground at the former Willow Run manufacturing site in Ypsilanti Township. Construction of this AV testing facility is planned to be complete before 2018.[30] The facility is a joint venture between the Michigan Department of Transportation, the Michigan Economic Development Corporation, U-M, Business Leaders For Michigan, and Ann Arbor SPARK.[31]

Following the start of construction at the American Center for Mobility, Navya announced its plans to build its first American manufacturing facility in Saline.[32] As an affiliate member of MCity, the vehicle provider for U-M's coming driverless North Campus shuttle, and a future manufacturing employer in the region, Navya has a fast-growing stake in Washtenaw County.

With a confluence of AV research, development, and manufacturing growing quickly in and around Ann Arbor, a partnership with MCity, the American Center for Mobility, or a vehicle manufacturer to support a downtown circulator has significant potential. Support could be in the form of a funding partnership or through the supply, maintenance, and/or operation of fleet vehicles. A circulator featuring AVs for some or all of its vehicle fleet could serve the community with public transportation, publically showcase the latest in AV technology, and promote Ann Arbor as a hub for AV technology. There is also potential for tourism draw, due to the growing global excitement for the progress of the industry. Just as well, a circulator operating traditional buses branded to promote the leaders of the local AV industry could also promote the city as an AV hub, and inspire local pride in the industry.

Fares

It is recommended that the conceptual circulator service be provided at no fare, as requiring payment on board the vehicle would reduce the performance of the service by introducing unpredictable dwell times, and could also hinder opportunities for mode shifts and reductions in

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[29] Carney, Susan, "*U-M opens MCity test environment for connected and driverless vehicles*," Michigan News, University of Michigan, 2015. http://ns.umich.edu/new/multimedia/videos/23020-u-m-opens-mcity-test-environment-for-connected-and-driverless-vehicles

[30] Haynes, Jessica, "*Construction of autonomous vehicle-testing facility underway at old Willow Run site*," MLive, 2017. http://www.mlive.com/business/ann-arbor/index.ssf/2017/06/construction_of_vehicle-testin.html

[31] American Center for Mobility, "*The Team*," 2017. http://www.acmwillowrun.org/the-team/

[32] Navya, "*Navya Set To Open First U.S. Production Plant In Saline, MI*," 2017. http://navya.tech/2017/07/navya-set-open-first-u-s-production-plant-saline-mi/

downtown parking and traffic. In the event that it is determined that fares must be charged, an off-board or mobile payment system would be preferable to maintain the service's efficient times by eliminating the need for passengers to enter and complete a payment transaction with the driver.

Public and Private Funding Sources

Figure 13 provides a list of potential federal, state, and public-private partnership funding options that could be used to support a downtown circulator bus service in Ann Arbor. Currently the City of Ann Arbor and the AAATA are the most eligible recipients for federal or state funding mechanisms. If the City of Ann Arbor or AAATA are not the service manager or operator, they may be able to form a partnership with the manger or operator to redirect federal or state funding.

General formula funds, such as the Michigan Comprehensive Transportation Fund (CTF), allocated annually to public transportation agencies for service administration, operations, and capital, are not included in this table. The circulator could be supported by these formula funds if the AAATA is designated as the circulator's service manager.

Figure 13 Federal, State, and Public-Private Funding Resources

Program Name	Description	Eligible Agencies	Eligible Activities
Federal Grants			
FTA 5339 Buses and Bus Facilities Grants Program[33]	▪ Replace, rehabilitate, and purchase transit vehicles and related equipment ▪ Construct transit-related facilities ▪ Federal share is 80%; local match is 20%	▪ Public transportation operators (AAATA via the RTA) ▪ State and local government entities ▪ Entities that are eligible to receive 5307 or 5311	▪ Capital
FTA 5339(c) Low or No Emission Vehicle Program	▪ Purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of necessary supporting facilities	▪ Public transportation operators (AAATA via the RTA) ▪ State and local government entities ▪ Entities that are eligible to receive 5307 or 5311	▪ Capital
State Loan			
Michigan State Infrastructure Bank (SIB)[34]	▪ Statewide revolving loan program that "complements traditional funding techniques and serves as a useful tool to meet urgent project financing demands."	▪ Any Act 51 eligible public entity: – County road commission – City – Village – MDOT	▪ Capital ▪ Planning

[33] Federal Transit Administration, "*Fact Sheet: Grants for Bus and Bus Facilities, Chapter 53 Section 5339, U.S. Department of Transportation*," 2015. https://www.transit.dot.gov/sites/fta.dot.gov/files/5339%20Bus%20and%20Bus%20Facilities%20Fact%20Sheet.pdf

[34] Michigan Department of Transportation, "*State Infrastructure Bank (SIB) Loan Program: Guidelines for Applicants*," 2016. http://www.michigan.gov/documents/mdot/Michigan_SIB_Guidelines-June_2011_474828_7.pdf

Program Name	Description	Eligible Agencies	Eligible Activities
Public and Private Partnerships			
Advertising	▪ Advertisements: Transit providers can display paid advertisements on agency properties, including the inside and outside of fleet vehicles, bus shelters, benches, and at transit stations	▪ Any service manager (public/private)	▪ Operations ▪ Administration ▪ Capital
Naming Rights / Sponsorships	▪ Historically, the selling of naming rights to people or organizations that make a donation for a capital improvement was most common for large organizations, such as universities or hospitals. Selling naming rights has become more common among smaller organizations and some transit agencies sell naming rights to vehicles, stations, or transit corridors	▪ Any service manager (public/private)	▪ Operations ▪ Administration ▪ Capital
Public-Private Partnerships and Joint Development	▪ A public-private partnership is a mutually beneficial agreement between public and private entities that seek to improve the value of an asset. Transit funding from public-private partnerships are most likely to be for capital projects such as a mixed-use development that combined a transit station or center.	▪ Any service manager (public/private)	▪ Operations ▪ Administration ▪ Capital ▪ Equity

ECONOMIC IMPACTS

Introduction and Scope

The purpose of the following economic impacts analysis is to evaluate the potential economic benefits and development potential on downtown Ann Arbor that result from the implementation of the proposed circulator bus system. Critical to this analysis is defining how economic benefits are measured and how the circulator could potentially enhance the overall economic potential of downtown. This analysis is not intended to justify the implementation of the circulator on a cost basis, but to help inform the decision making as to how an investment in a public good such as the circulator could catalyze future economic activity and investment.

There is no single measure to quantify local economic development, impacts, or benefits. On a macro-level, economic development is typically measured by labor market indices such as labor force participation, employment growth, and income as well as gross domestic product (GDP), but locally, economic development can span a wide range of activities such as real estate development, retail spending, and upward economic mobility. Government and local jurisdictions then benefit from economic activity through fiscal impacts such as sales, property, and income tax collection, which in most cases, can be invested back into the community to support public goods and services that can enhance quality of life and further economic expansion. In the case of the present analysis, the focus is more on economic impacts (as related to spending and value), than on economic development (as related to business growth and job creation). It is also recognized that there are other qualitative benefits that could be realized as related to the environmental benefits, downtown marketability, and pedestrian vibrancy.

The implementation of the circulator fits the mold of a public good — it often operates with a subsidy to support its mission, which in turn, can generate new economic activity and support local prosperity. Though operating at a loss, a public good like a circulator, streetscape, or public space, can enhance the overall economic climate, which in many cases, can outweigh the costs.

However, quantifying the potential economic benefits of a public good is challenging given data limitations, the complexities of local economies, and determination of causality.

Despite the intuitive benefits of enhancing pedestrian circulation, mobility, and accessibility, there are no established methodologies to quantify the economic benefits of a bus circulator system. Based on feedback from the communities surveyed for this study's benchmarking memorandum, no community formally tracked specific performance measures related to economic impacts/outcomes of its bus circulator operation. The respondents expressed a general sentiment that the circulator added vibrancy and marketability to the area, but did not track outcomes beyond ridership.

The following analysis aims to quantify economic benefits based on reasonable assumptions, but it should be recognized that there is no "ideal" model to project impacts. The analysis utilizes generally accepted procedures for assessing incremental economic outcomes as used in special district formation such as for a community improvement district (CID), transportation development district (TDD), or tax increment financing district (TIF).[35] This analysis provides some scenario testing for retail spending and property value appreciation, but there is also a broader narrative that should not be ignored when identifying future benefits.

Economic Impacts

Economic impacts manifest themselves in a number of ways, and thus, can be measured using a variety of methods. Typically, economic impact studies analyze the impacts of spending, whether through a business, consumer, or other entity, which, in turn, supports jobs and earnings in the local economy across a multitude of sectors. This spending also stimulates tax revenues for state and local jurisdictions that can be used to further invest in infrastructure, safety, or other public amenities.

In addition to analyzing spending patterns, it has been well-documented that public transportation can have a significant impact on the marketability of a neighborhood or district, resulting in higher demand for real estate, which yields property value appreciation and new investment in housing, retail, office, hospitality, and other uses. The district's marketability and desirability is then enhanced by improving access to retail, jobs, and other amenities for residents, visitors, local workforce, and student population and these market segments are then willing to pay a premium to have better access to these amenities. At the same time, public transportation does not necessarily create jobs—it makes jobs more accessible.[36]

Part of the challenge is that the true measure of economic impacts or benefits of a particular event, program, or capital improvement is measuring the *net new* impacts that would otherwise be unrealized without said event, program, or improvement. Given the complexities of local economies, which are very much influenced by regional, national, and global trends, identifying causality of impacts is oftentimes nuanced and is often supported with assumptions rather than

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[35] There is no governing body or proscribed standards or methodologies for analyzing and projecting incremental economic outcomes. The methodologies used in this analysis were based on best practices. The Government Finance Officers Association provides a general framework and best practices for TIF formation, but there are no proscribed methodologies for analyzing incremental property and sales tax revenue. See reference source: Government Finance Officers Association, "*Creation, Implementation, and Evaluation of Tax Increment Financing*," 2014. http://www.gfoa.org/creation-implementation-and-evaluation-tax-increment-financing

[36] The operational spending of the circulator itself would create some economic impacts, including salaries for staff, although given the scale of the operation, these impacts would be relatively minimal.

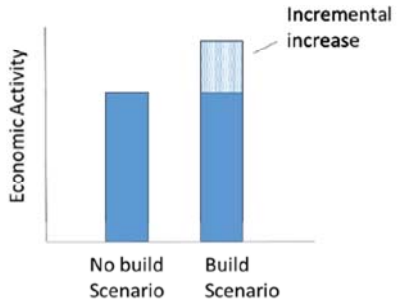
measurable data or outcomes. Additionally, the "true" impacts cannot simply shift economic or fiscal activity from one part of downtown to the other. At the same time, since the goal is to identify the economic benefits of the circulator on downtown, it should be recognized that a portion of increased economic activity downtown may very well be "pulled" from other parts of the region.

In the case of the proposed circulator, it must essentially attract and/or catalyze new activity that would otherwise not occur without it.[37] Therefore, current economic activity is less important than the *incremental* increase in economic activity after implementation. In other words, what are the impacts that can be attributed to circulator implementation (a build scenario) versus not implementing the circulator (a no build scenario)? This concept is visualized in Figure 14.

Given this framework, in the case of the circulator, potential economic outcomes can be primarily measured as a function of potential:

1. Increased retail spending
2. Property value appreciation
3. Catalytic development

Figure 14 Incremental Increase



The following sections aim to address each of these impact categories with modeling that quantifies the potential impacts to the extent possible based on available data, while identifying potential constraints and areas for further study and analysis. Generally, increased retail spending and property value appreciation will return the most tangible benefits, while catalytic development potential is more nuanced given the relatively strong real estate market downtown (based on the 2016 Ann Arbor downtown Market Dashboard) and limited impacts of bus systems on catalyzing new development.

Given the complexities of such a task, it should be recognized that there are a host of additional benefits that should be included as part of the economic benefits "package" but that are discussed herein only on a more qualitative basis. These impacts include, among others, downtown marketability, accessibility and equity, and environmental benefits.

1. Increased Retail Spending

Overview

Research shows that pedestrian activity can generate economic activity and that people prefer to spend more time and money in vital, lively neighborhoods. Placemaking has been shown to attract a greater number of visitors and lengthen the duration of their stay by encouraging them to explore and linger. As the retail industry evolves with increasing competition from online sales, in many cases, successful retail districts must create a unique, and authentic experience to attract customers. This is why the circulator can be an important and supportive placemaking element by servicing downtown with a distinct, branded transportation experience that unifies downtown's destinations, increases street-level vitality, and communicates downtown's boundaries to local and out of town visitors.

[37] This is often called the "but for" test, in which a certain economic outcome would not occur "but for" this particular program, development, development district, or other subsidy.

Measuring incremental increases in retail spending in a particular district is typically a function of three fundamental variables:

1. Increase the number of retail patrons
2. Get patrons to stay longer
3. Get visitors to spend more with a larger range and diversity of retail offerings

More patrons, such as residents, workers, students, or visitors simply bring more spending power to support existing and the expansion of new retail. Studies show that by enhancing the overall retail experience with an incorporation of public spaces and other placemaking elements, patrons tend to stay longer and spend more. Diversity of retailors also encourages a broader market-base and multi-stop shopping and dining. Therefore, the potential impacts of the circulator on retail spending were evaluated by asking the following questions: Will it attract more patrons? Will it enable patrons to stay longer? Will it diversify the retail offerings and experience?

Data and Assumptions

Part of the challenge of any economic analysis is identifying and gathering supportive data. Though the A2DDA monitors attendance patterns of special events and parking structure occupancy, there is not one source that can quantify the number of pedestrians on the street at any given time. Additionally, unlike some downtown development districts, the A2DDA does not capture an incremental sales tax, which is often used as a proxy for retail and pedestrian activity. Some pedestrian and visitation patterns are recognizably temporal, such as increased activity on South University during the academic year, or in Kerrytown on Wednesdays and Saturdays when the Ann Arbor Farmers Market is in operation. However, there is no definitive source of data to determine the distribution of pedestrians by segment (resident, worker, student, or visitor), how they navigate downtown, or their spending patterns.[38]

Despite these constraints, there are generally accepted methodologies for testing potential increases in retail spending activity resulting from a public investment. Since this study aims to identify the incremental increase, the baseline spending activity is less of a concern than the future spending after implementation of the circulator. Some level of incremental increase in spending activity could be expected, although limited based on the following assumptions:

- **Based on the configuration and purpose of the circulator routing, it cannot physically bring more people downtown, although it could make visiting downtown more attractive.** Unlike the potential impacts of new parking facilities or significant improvements to regional transportation infrastructure such as bus rapid transit (BRT) or light rail, the circulator cannot physically bring a larger share of new retail patrons downtown. At the same time, some regional visitors may be more attracted to downtown since the circulator would enable greater access to peripheral parking structures and ease of navigating, which would generate an incremental increase in retail spending.
- **Shifting retail spending from one part of downtown to another does not necessarily generate net new impacts, although the circulator could encourage retail patrons to stay downtown longer and spend more.** Given the ease of getting around, regional visitors can park once and then take the circulator to a number of destinations, essentially keeping them in downtown longer. Additionally, retail

[38] Though local businesses may track consumer spending patterns and origin, this data is proprietary and assumed to be unavailable for any future study.

spending by downtown residents, local workforce, and students would be more likely to stay downtown given more efficient circulation, especially during inclement weather. Those businesses along the circulator route will have increased visibility for those riding on the circulator, but also increased pedestrian traffic, which would contribute to net increases in sales. At the same time, simply shifting retail spending from one side of downtown to another will not generate any net new impacts.

- **The circulator would have a minimal impact on retail offerings and diversification within downtown's sub-districts.** There have been local concerns that portions of downtown Ann Arbor are losing their authenticity with the recent loss of long-standing, locally-owned businesses. However, there continues to be considerable market pressure for student housing development, which has altered the retail market conditions in some areas with escalating retail rents. In many cases, only regional or national chains can afford the rents in new or renovated retail spaces. Though the circulator will help retail patrons access parts of downtown more efficiently, will increase marketability of certain spaces, and potentially diversify customer base, increasing retail spending overall, this will have minimal impact on the retailers themselves in terms of types, offerings, and ownership structure (locally-owned, national chains, or franchises).

Based on these assumptions, the circulator will likely have an incremental impact on retail activity along its route; however, specific spending projections cannot be determined without further study. The potential impacts are thus modeled across a number of scenarios based on reasonable assumptions. Though properties within a few blocks of the circulator may also experience incremental retail spending, this analysis assumes that those along the route would have the most prominent impacts.

Methodology

Without data to inform current consumer spending patterns, the incremental increase in retail spending was estimated by using the estimated square footage of retail properties and industry standards for average sales per square foot by retail tenant type. An inventory of businesses fronting the proposed circulator alignment within A2DDA boundaries was created based on parcel data obtained from the A2DDA and a visual survey. Each business was assigned a category, and square footage and retail sales per square foot were estimated for each retail and restaurant property within the study area. This analysis establishes the baseline conditions and projects a hypothetical 1%, 3%, and 5% incremental increase in overall retail spending.

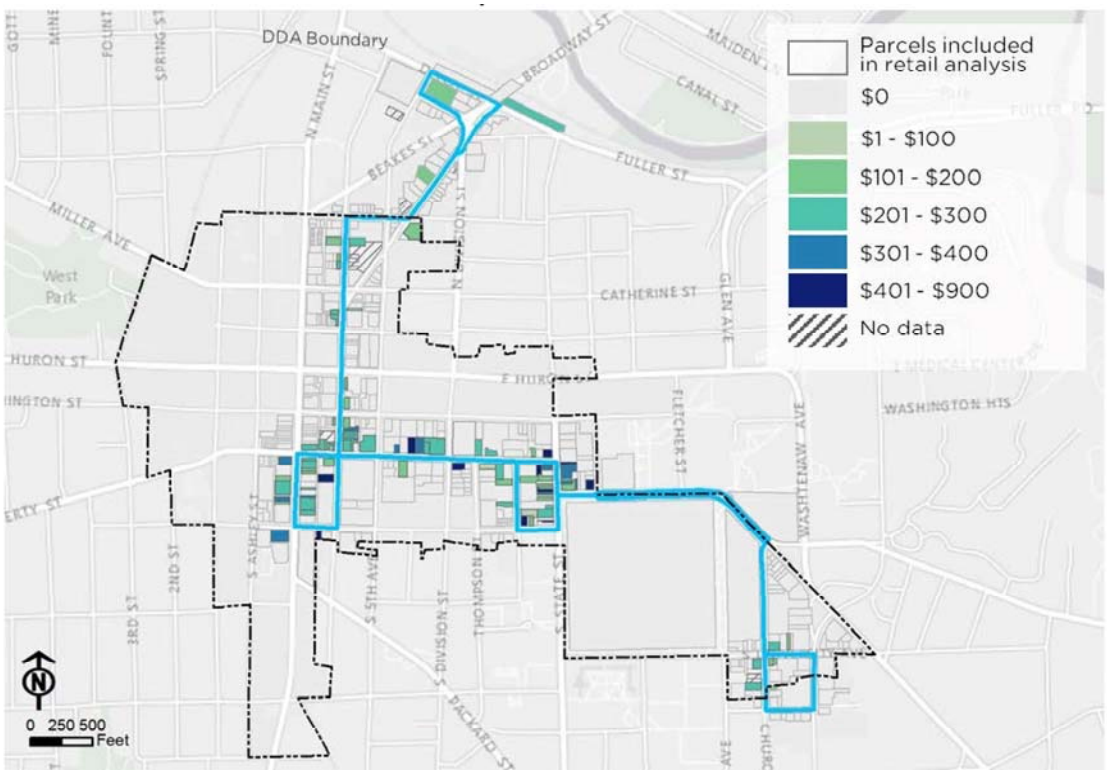
Economic Modeling and Impacts

According to parcel data from the A2DDA, there are 185 retail businesses with frontage on the circulator route, totaling an estimated 431,000 square feet of space. Based on modeling conducted by Development Strategies of the distribution of average sales per square foot by business type and total square footage, the estimated weighted average sales per square foot for the circulator route is $283 per square foot, resulting in total estimated sales of $122.1 million annually (see Appendix for assumptions).

The following map shows the parcels included in the retail sales analysis as well as the average sales per square foot for each included parcel. Some parcels were home to more than one building and/or business establishment, so sales per square foot are depicted as an average of all parcel businesses for the purposes of mapping. Only those properties in the study corridor with retail uses were included in this analysis. The highest concentrations of retail sales along the proposed

circulator route are on Liberty, Main, and State streets. North University Avenue, Church Street, and 4th Avenue have relatively lower concentrations of retail activity.

Figure 15 Average Retail Sales per Square Foot by Parcel



Assuming 1%, 3%, and 5% incremental increases in retail spending results in an estimated increase of $1.2 million, $3.6 million, and $6.1 million in retail spending, respectively. Using data from the U.S. Economic Census, businesses in the Retail Trade sector in Washtenaw County spend, on average, 9.4% of revenues on payroll expenses with payroll expenses per employee of $25,000. Based on these assumptions, the potential increase in retail spending triggered by circulator operations would support an additional 5 to 23 jobs downtown.

Figure 16 Annual Impact Scenarios

Annual Impact Scenarios of Incremental Increases of Retail Spending in Circulator Corridor

Incremental Increase in Retail Spending	*Estimated Increase in Retail Spending*	*Estimated Payroll at Retail Businesses* [1]	*Additional Employees Supported* [2]
1%	$ 1,221,000	$ 113,000	5
3%	$ 3,664,000	$ 338,000	14
5%	$ 6,107,000	$ 563,000	23

[1] *According to the 2012 Economic Census, on average, payroll expenses represent 9.2 percent of total businesses revenue in the Retail Trade sector in Washtinaw County*

[2] *According to the 2012 Economic Census, the average payroll expense per employee in Washtenaw County was approximately $25,000*

[3] *Based on estimated average sales per square foot in the Circulator*

2. Property Value Appreciation

Overview

Economists, developers, and planners have long recognized the reciprocal relationship between transportation and land use. Transportation access influences access to particular parcels, making them more or less valuable as a result. In return, the intensity and types of land use influences the number of users of a transportation network, facilitating or hindering access.

Thus, within the realm of public transportation, access has the potential to affect the value of nearby parcels, but the magnitude of this effect is highly context-dependent. In communities where driving and parking are more difficult or expensive than taking transit, having easy and convenient access to public transportation is valuable to residents and business owners. This increases competition for transit-proximate real estate and can manifest in a real estate premium for these parcels. In communities where there is less demand for public transportation, there may not be adequate competition for parcels convenient to transit, so land prices may not increase at all. And in both high- and low-demand scenarios, there are also situations where proximity to transit can adversely affect the value of real estate because of noise, unwanted activity, and other nuisance effects generated by public transportation.

The type of public transportation also greatly influences the magnitude of observed effects on proximate real estate. Fixed-route systems, such as subways, heavy rail, light rail, BRT, and streetcars, are perceived as much more permanent than bus routes, which can be rerouted, changed, or eliminated much more easily. Because of this, the implementation of new or enhanced fixed-route alignments is seen as having much greater potential to catalyze new real estate development activity than a new bus route.

Data and Assumptions

Evidence regarding the effect of bus transit on adjacent real estate is still largely anecdotal at best. A scan of academic research found no peer-reviewed before-and-after studies of property values as they relate to new bus routes; therefore, any projected change in real estate values as a result of

bus network improvements in a particular community is largely speculative. A deeper analysis of the potential effects should be rooted in a broader understanding of how the circulator will affect the existing transit network.

However, it is reasonable to assume that the circulator would have a net positive effect on the marketability on downtown and provide a desirable amenity for residents and businesses, which, in turn, should have a positive impact on property values. Without conducting a broader market analysis on real estate trends citywide, it can be assumed that properties along the circulator route and within one block would have an incremental appreciation in property value of between 1% and 5% in the build scenario above current trends. In other words, holding all other factors constant, given the enhanced marketability of the properties along the route and within one block, they will likely experience some incremental levels of appreciation. Similar to the retail analysis, the specific incremental increases cannot be projected without further study, and thus, scenarios of 1%, 3%, and 5% were tested and should be considered reasonable.

Methodology

Property values are influenced by a host of factors and are not necessarily reflected in assessed or taxable values, since true market value of properties fluctuate between reassessment cycles. However, given the scope and scale of this analysis, taxable values are considered a proxy for property values within the circulator corridor. More importantly, understanding incremental increases in assessed values can also inform estimates in potential increases in real estate tax revenues.

To estimate hypothetical property tax increases, the 2017 taxable value for all of the parcels within 300 feet of the proposed circulator route was used as a baseline, and the City of Ann Arbor's most-recently released 2016 millage rate of 16.3003 was applied to the taxable value.[39] A 1%, 3%, and 5% growth rate was used to estimate annual additional property taxes that could be generated under each of the hypothetical growth scenarios.

Economic Modeling and Impacts

It was estimated that the taxable value of all parcels within 300 feet of the proposed route was approximately $319.5 million, which generates about $18.7 million in property taxes for the City of Ann Arbor, Washtenaw County, AATA, and other local entities. At 1% growth in the taxable value of parcels, approximately $187,200 additional property taxes would be generated (Figure 18). Under a 3% growth scenario, the additional amount would be about $561,540, and at 5% growth, $935,900 in additional property taxes would be generated.[40]

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[39] The mileage rate equals $1 of tax per $1,000 of taxable value.

[40] Figure 18 presents real estate potential in absence of Michigan's Headlee Amendment. The Headlee Amendment caps annual real estate tax increases at the rate of inflation, which has averaged around 2% in 2017, according to the Bureau of Labor Statistics. Without change of ownership of properties in the corridor, incremental real estate tax increases would be capped below the 3% and 5% scenarios.

Figure 17 Baseline Taxable Values

Baseline Taxable Values and Real Estate Taxes in Circulator Corridor

	2016 Mileage Rate		*Baseline Taxable Value*		
	Residential	*Commercial*	*Residential*	*Commercial*	*Total*
Circultor Parcels			$ 63,255,000	$ 256,219,000	$ 319,474,000
			Estimated Real Estate Tax		
			Residential	Commercial	Total
City	16.3003	16.3003	$ 1,031,000	$ 4,176,000	$ 5,207,000
Washtenaw County	6.2432	6.2432	$ 395,000	$ 1,600,000	$ 1,995,000
AATA	0.6943	0.6943	$ 44,000	$ 178,000	$ 222,000
Ann Arbor Public Schools	13.7455	27.2379	$ 869,000	$ 6,979,000	$ 7,848,000
Ann Arbor Public Library	1.9000	1.9000	$ 120,000	$ 487,000	$ 607,000
Intermediate School	5.4509	5.4509	$ 345,000	$ 1,397,000	$ 1,742,000
Washtenaw Community College	3.4360	3.4360	$ 217,000	$ 880,000	$ 1,097,000
Total	47.7702	61.2626	$ 3,021,000	$ 15,697,000	$ 18,718,000

Figure 18 Annual Impact Scenarios

Annual Impact Scenarios of Taxable Value Increases in Circulator Corridor

		Incremental Growth Scenarios [2]			*Real estate tax cap at rate of inflation (2.0%)* [3]
	Baseline Real Estate Taxes1	*1%*	*3%*	*5%*	
City	$ 5,207,000	$ 52,000	$ 156,000	$ 260,000	$ 104,000
Washtenaw County	$ 1,995,000	$ 20,000	$ 60,000	$ 100,000	$ 40,000
AATA	$ 222,000	$ 2,000	$ 7,000	$ 11,000	$ 4,000
Ann Arbor Public Schools	$ 7,848,000	$ 78,000	$ 235,000	$ 392,000	$ 157,000
Ann Arbor Public Library	$ 607,000	$ 6,000	$ 18,000	$ 30,000	$ 12,000
Intermediate School	$ 1,742,000	$ 17,000	$ 52,000	$ 87,000	$ 35,000
Washtenaw Community College	$ 1,097,000	$ 11,000	$ 33,000	$ 55,000	$ 22,000
Total	$ 18,718,000	$ 187,000	$ 562,000	$ 936,000	$ 374,000

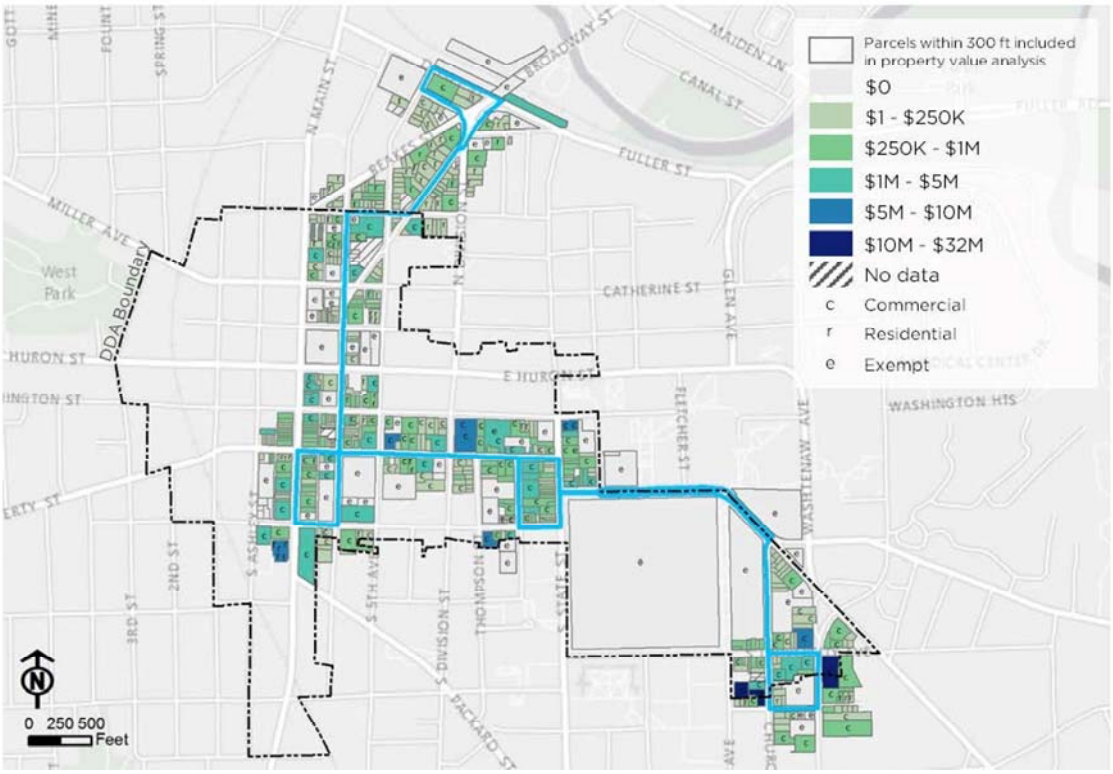
[1] Assumes a baseline taxable value of $63.3 million for residential properties and $256.2 for commercial properties

[2] These scenarios assume the maximum possible real estate tax appreciation for illustrative purposes only

[3] Given the limits to annual property tax increases at the rate of inflation (Headlee Amendment), assuming no change of ownership of existing properties in Circulator Corridor, annual increases in real estate tax would be capped at around 2.0 percent, the estimated average annual rate of inflation for 2017.

The following map shows the parcels included in the property value analysis and their total taxable value. All parcels within 300 feet of the proposed alignment are outlined. Each parcel is labeled by type, whether commercial, residential, or tax exempt. The majority of parcels along the proposed circulator alignment by land area are commercial, although of the total number of parcels, 54% are residential (though these parcels are much smaller or have multiple records within a single parcel, in the case of condominiums), 40% are commercial, and 6% are tax exempt.

Figure 19 Parcels by Taxable Value and Type in circulator Corridor



3. Catalytic Development

Overview

The Downtown Development Authority generates operating and capital improvement revenue through the incremental real estate tax from new real estate development and major improvements, so the potential catalytic impacts of the circulator are especially crucial for future program and service expansion. From an economic development perspective, one of the key roles of the public sector is to invest in public goods, services, and infrastructure that can then catalyze new private investment and development opportunities. In recent years, increasing demand for walkable and accessible communities with less reliance on automobiles has encouraged more public investments to support TOD. In many communities, targeted investment in public infrastructure and transportation has catalyzed new development to create thriving mixed-use downtowns, districts, and nodes.

There are, however, limitations to expected economic outcomes. In most cases, the attractiveness of TOD is enhanced when the transportation service and other public improvements such as streetscaping and public spaces are more or less permanent, indicating a longer-term commitment from the public sector. For example, in many communities with recent light rail or trolley implementation such as in Kansas City and Minneapolis, there has been considerable new

investment along these corridors that would have otherwise not occurred.[41] In addition to a host of other regional market and economic factors, developers are attracted to the permanence of this infrastructure, which minimizes risk. On the other hand, though bus lines are more cost effective and adaptable from a public investment perspective, there is less incentive for private investment since the buses can, at any time, go out of service or be rerouted.

Data and Assumptions

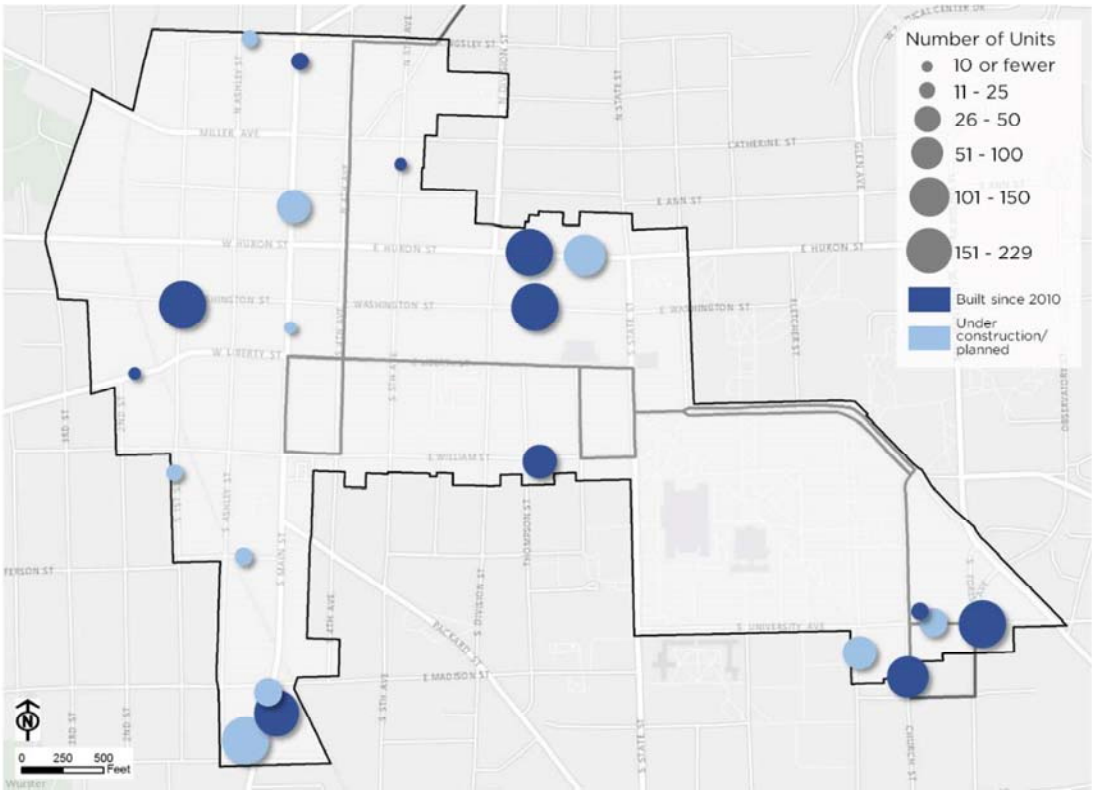
The proposed circulator will undoubtedly provide an attractive amenity for downtown workers, residents, students, and visitors, which will likely have an impact on retail activity and property values (as presented previously); however, it will likely not have a catalytic impact on new real estate development that could be attributed to circulator operations. Given the pace of new development downtown and residential population with growth rates outpacing regional averages, development will continue downtown with or without the circulator. The proposed circulator routing strategically touches many of the new residential development clusters, such as around the South University Avenue corridor and near the intersection of East Huron Street and South Division Street. This is ideal for ridership, but these recent and proposed developments did not require the circulator to unlock their potential.

Economic Modeling and Impacts

Given the limited influence of the circulator to catalyze new real estate development, modeling was not developed to quantify potential impacts. However, Figure 20 shows the new and planned residential developments within the A2DDA area.

[41] At least not in these particular corridors. Development dollars generally flow to areas with the greatest opportunity and new investment may have otherwise occurred in other parts of the region. At the same time, regions with strong public transportation systems are often more competitive in attracting and retaining talent, which, in turn, would have a greater net positive economic impact.

Figure 20 New and Planned Residential Developments within A2DDA



Other Potential Benefits

There are a number of benefits that a circulator could bring to downtown Ann Arbor, but given the scope of this analysis and data limitations, these impacts are non-quantifiable without further study. However, these potential impacts could have a lasting impact on the marketability and vibrancy of downtown Ann Arbor as a whole.

- **The circulator would contribute to the marketing, promotion, and visibility of downtown as a whole:** In addition to enhancing downtown accessibility, the circulator can also help with the branding and identity of downtown Ann Arbor as well as promotion of local events and culture, which in turn, should increase retail spending activity. In order to support operational costs, there are also opportunities for marketing and advertising on the bus exterior.
- **Circulator operations will have additional economic impacts:** Not included in this analysis are the direct and indirect impacts of circulator operations, which will include hiring drivers and other staff to support operations. The purchase and servicing of vehicles and development of bus stops will generate additional spending in the region and support new jobs, although any job creation from circulator operations would not have a significant impact on the local economy.
- **The circulation of daily workforce will be improved:** According to data from the U.S. Census, approximately 98% of workers in the greater downtown area live outside of

downtown.[42] The circulator would offer opportunities for more efficient daytime circulation of the workforce encouraging increased retail spending and offer park and ride opportunities with some of downtown's peripheral parking structures.

- **The circulator could create more efficient park-and-ride opportunities within downtown:** Though the circulator will not necessarily limit the number of automobiles downtown at any given moment, it can alleviate congestion in certain parts of downtown and promote the use of some of the peripheral parking structures. The circulator would also provide a great benefit for staff at U-M and throughout downtown to park once and then have efficient access to and from their places of work.
- **The circulator would expand ADA accessibility:** Though downtown Ann Arbor is widely recognized for its walkability, not every resident and visitor is able to experience downtown Ann Arbor on foot. High quality public transportation plays a large role in bridging the accessibility gap for residents and visitors with limitations in their physical abilities. For residents and visitors with limited walking and/or driving abilities, the circulator provides a high quality alternate mode of traveling from destination to destination and increases the city's accessibility in general.
- **Affordable public transportation promotes equity and accessibility:** Though the majority of Americans drive, a very significant portion of the population does not drive for reasons of age, ability, cost, or other factors. High quality public transportation promotes inclusive cities where all residents enjoy equal access to destinations regardless of income or ability to drive. As a high-frequency bus service serving some of Ann Arbor's greatest concentrations of population, employment, and commercial activity, the circulator has the potential to increase equity and accessibility for all Ann Arbor residents.
- **The circulator will enhance perceptions of safety in evening hours:** The perception of safety is an important determinant of pedestrian activity. While downtown Ann Arbor is very safe, the perception of safety can drop off sharply at night when streets are less active. For vulnerable or concerned residents, the circulator can provide an alternative to walking alone at night that may encourage them to make trips within downtown during evening hours.
- **The circulator will encourage more pedestrian circulation in inclement weather:** downtown Ann Arbor is an attractive, pedestrian-friendly setting, but its Midwestern climate means that the weather on some days is less pedestrian-friendly than others. The circulator provides an alternative means of traversing downtown even when the weather is very hot, very cold, rainy, or snowy, which will encourage pedestrians to make trips they may otherwise avoid because of inclement weather.
- **The potential displacement of automobiles will have environmental benefits:** Replacing car trips with bus trips reduces greenhouse gas emissions, improving air quality. Improved air quality benefits the environment as well as the cardiovascular health of the people within the environment. This effect is especially pronounced for single-occupant car trips and for well-utilized public transit routes. In some cases, a reduction in car trips significantly eases congestion, which in turn reduces greenhouse gas emissions as well by reducing trip length and vehicle idling. By replacing vehicle trips and reducing congestion, the circulator can have a positive impact on air quality within downtown Ann Arbor.

[42] Based on the commuting patterns in downtown Ann Arbor, and the surrounding areas generally bounded by the Huron River to the north, rail tracks to the west, Hill Street to the south, and Washtenaw and Observatory Street to the east.

General Limitations, Constraints, and Risks

Despite the potential economic benefits of a circulator on downtown Ann Arbor as outlined in this chapter, there are some general limitations and constraints.

- **Economic benefits to downtown bus circulators have not been well-studied or documented:** Though there is a general sentiment that circulators have had an impact on vibrancy and accessibility in comparable downtowns, very few communities have documented, or even attempted to analyze, their economic impacts. In other words, their implementation and operating costs are not evaluated based on other economic outcomes, and circulators in general, are considered a public amenity rather than economic driver.
- **Ann Arbor circulator would not directly improve accessibility to and from downtown or increase downtown visitation:** The circulator will not relieve total parking occupancy in downtown, although it could lead to more efficient distribution of parking, especially in peripheral parking structures. Since the circulator will only operate within downtown, it will not encourage more out-of-town visitors staying in the cluster of hotels at the I-94 and South State Street interchange, or regional residents who avoid downtown due to parking concerns. It will also have minimal impacts on the regional workforce getting in and out of downtown.
- **Ann Arbor circulator cannot directly address the general retail needs of the sub-districts within downtown:** As presented in the retail analysis, the circulator will provide an amenity to downtown pedestrians, but it will not address other market-based issues related to student housing development or retail diversification in the South University Avenue corridor. Given the pace and density of development in this area, the retail offerings will likely continue to cater towards students and drawing more non-students to the area will have limited impacts.
- **Increasing the value of real estate is a double-edged sword:** There is a general concern with retailors that increasing rents could potentially drive out long-standing, locally-owned businesses. Though retail vacancy rates remain very low (some could even say impressive based on Midwestern downtown standards), the increasing marketability of downtown through new development and amenities such as the circulator will increase real estate values, which will inevitably price out some retailers. At the same time, the circulator could help balance real estate value increases with increased retail spending activity.
- **Downtown is configured in a way that most of the core retail areas and points of interest are within a 15-minute walk**: Most of downtown Ann Arbor is accessible within a 15-minute walk. The retail corridors of South University Avenue, South State Street, East Liberty Street, and South Main Street have minimal vacancy. In addition, there are few “gaps” in the pedestrian experience downtown, which enhances vibrancy and safety on public walkways. These factors limit the need or appeal for a circulator.
- **The circulator would have a limited impact on new development:** Compared to many of its peers, downtown Ann Arbor is relatively healthy economically and the future pace of development will be the most impacted by regional economic development, housing, and transportation trends. The circulator will provide an amenity that will enhance marketability and value in some areas of downtown, but it will not operate at a scale that is likely to accelerate or catalyze development with the same potential as significant regional transportation infrastructure such as light rail or BRT.

- **Proliferation of on-demand transportation will compete for ridership with the proposed circulator service:** Though circulators continue to be successful in comparable downtown areas, the proliferation of TNC services have changed the way people navigate urban areas. Those with higher consumer spending thresholds will opt for TNC services since they can be more time efficient and reliable than finding cabs or waiting for buses. TNC services would likely not have an impact on routine users of the circulator, but certainly would for visitors and those unfamiliar with downtown. Additionally, some local hotels offer their own on-demand shuttle service, which also minimizes the demand for a circulator.

Summary of Costs and Benefits

The net impact of the proposed circulator service is comprised of the economic and social benefits realized by the downtown community, and the capital and operations costs required to field the service. From an economic development perspective, a key role of the public sector is to invest in public goods, services, and infrastructure that can then spur new private investment and development opportunities.

The most quantifiable and predictable benefits of the circulator are increased retail spending and property values, which are estimated to garner $300 thousand to $7 million in new annual economic activity. Many other benefits are likely to result, but less quantifiable in economic forecasting, including:

- Improved distribution of downtown parking, through enhanced park-and-ride opportunities
- Improved circulation of daily workforce, downtown
- Expanded downtown ADA accessibility
- Enhanced perceptions of downtown safety in evening hours
- Increased pedestrian circulation in inclement weather
- Potential environmental benefits from automobile displacement

As described in the Operations and Organization chapter, the primary quantifiable costs of the circulator are the combination of initial capital costs – estimated to be between $2.0 and $3.8 million – and annual service operating costs – estimated to be between $1.5 and $1.8 million. These costs will vary depending on who the managing and operating organization(s) is and what type of fleet vehicles are used. In addition, the following constraints to the circulator are known, but less quantifiable in forecasts:

- The circulator would have a limited impact on new development
- Downtown is configured in a way that most of the core retail areas and points of interest are within a 15-minute walk from each other
- Proliferation of TNC services will compete for ridership with the proposed circulator service

These estimates of costs and benefits do not account for the possible use of AVs, as the market for commercial AVs is not yet well established.

IMPLEMENTATION

Timeline

The timeline of implementation will be dependent largely on who the agency (or agencies) that takes responsibility for management and operations is, and what capacities it has in the following factors:

- Bus capital fleet and/or bus procurement staff capacity
- Service planning staff capacity
- Service operations staff capacity
- Maintenance staff and facilities capacity
- Financial resources / eligibility for state, federal, and local financial resources
- Funding partners

The AAATA is eligible to receive both federal and state capital and operations funding resources as pass-through from the RTA, and has local taxing authority. In addition, the AAATA has existing service planning staff, operations staff, maintenance staff and facilities, and vehicle stock that could be shifted to provide the service. With this, the AAATA could begin service within a year of being designated as the service manager and operator.

U-M is not eligible for federal and state transportation funding resources, nor does it have the power to levy a local tax. It does, however, have existing service planning staff, operations staff, maintenance staff and facilities, and vehicle stock that could be shifted to operate the circulator service. These traits are conducive for a service launch within a year's time as well.

Other service managers would take longer to align resources for service launch. In particular, alternate managers will need to contract a separate provider in addition to lining up financial resources. In addition, the maintenance facilities of all potential local contract providers are outside the city of Ann Arbor; this would necessitate vehicle and vehicle operator deadhead time greater than that of the AAATA and U-M LT&P.

Capital

The AAATA and U-M LT&P use a combination of bus stop signs, benches, and shelters at their bus stops throughout the greater Ann Arbor-Ypsilanti area. In addition, U-M has real-time arrival clock and map displays at its Central Campus Transit Center (CCTC). Proposed circulator stop locations that are not existing AAATA or U-M bus stops will require, at minimum, bus stop signage. Improving stop amenities at existing bus stops would also improve the passenger experience for existing AAATA and U-M riders, and potentially attract new riders to any of these services. Figure 21 presents estimated costs of some bus stop amenities.

Figure 21 Bus Stop Amenities with Estimated Costs

Bus Stop Amenities	Estimated Cost Per Unit
Landing Pad and Related Sidewalk Work at Each Stop (includes bus stop sign)	$7,000 - $11,500
Shelter and Foundation	$15,000 - $20,000
Bus Stop Sign	$150 - $200

Bus Stop Amenities	Estimated Cost Per Unit
Bench	$750 - $4,000
Lighting	$3,000
Static Information Display (Maps, Schedules, etc.)	$750
Real-time Information Display	$8,000-$10,000

Source: Estimated costs adapted from Brown University South Street Landing Shuttle Study (2016) and Memphis MPO/Memphis Area Transit Authority Bus Stop Design Accessibility Guidelines (2017)

Infrastructure Improvements

Much of the proposed route is shared by pre-existing AAATA and U-M LT&P bus services, which suggests that the street network is adequate to accommodate a new bus service. However, there are a select number of locations of the route which should be altered to expedite service. Figure 22 shows a list of priority improvements to the streets network.

Figure 22 Priority Street Improvements

Location	Action
South Forest Avenue at South University Avenue	Pull back stop bar on South Forest Avenue for right turn from South University Avenue.
Willard Street and South Forest Avenue	Pull back stop bar on Willard for right turn. The bus will need to make right turn onto Willard Street from the regular travel lane on Forest Avenue rather than the curb.

While all stop locations – including those with preexisting bus stop infrastructure – may benefit from some level of infrastructure installation or improvement, several of them currently contain little to no stop infrastructure and would require more immediate attention. Locations that would be new bus stop locations will also require immediate attention. In particular, some stop locations are currently designated loading zones; due to the low amount of time in a given day when a loading zone is occupied, these zones would need to be alternately designated for both transit boarding and deboarding, and loading. Some locations would also need to relocate meters and metered parking spaces to provide adequate space for the shuttle to safely access the stops. Figure 23 shows a list of priority infrastructure improvements to select stop locations.

Figure 23 Priority Stop Location Improvements

Direction	Route	Name	Stop Maneuver	Block Location	Parking Changes	Traffic Markings/Signals	AAATA / UM Bus Stop
Eastbound / Southbound – Base							
EB/SB	Base	Kingsley @ 5th Avenue	In-lane	Near-side	None	None	No
EB/SB	Base	4th Avenue @ Concert House	In-lane	Mid-block	None	None	No
EB/SB	Base	4th Avenue @ Ann	Pull-out	Near-side	Remove 1-2 spots	Potential visibility/site line issues.	No
EB/SB	Base	4th Avenue @ Washington	Pull-out	Far-side	None?	Loading zone	No
EB/SB	Base	Liberty @ 4th Avenue	Pull-out	Far-side	None	None	No
EB/SB	Base	Liberty @ Division	Pull-out	Mid-block	None	Loading zone	No
EB/SB	Base	Liberty @ Thompson	Pull-out	Far-side	None	Loading zone	No
EB/SB	Base	State	Pull-out	Mid-block	Remove 1 spot, move handicap spot north	None	No
EB/SB	Base	South University	Pull-out	Mid-block	Remove 1-2 spots, remove 15-minute parking spot	None	No
Westbound / Northbound – Base							
WB/NB	Base	Church @ South University	Pull-out	Near-side	None	Loading zone	No
WB/NB	Base	Liberty @ State	Pull-out	Far-side	Remove 1 spot	Potential visibility/site line issues. Possible changes to signal timing for left-turn onto Liberty Street from State Street; make State Street to Liberty Street a “no right turn on red”.	No

Direction	Route	Name	Stop Maneuver	Block Location	Parking Changes	Traffic Markings/Signals	AAATA / UM Bus Stop
WB/NB	Base	Liberty @ Division	In-lane	Near-side	None	None	No
WB/NB	Base	Liberty @ 5th Avenue	Pull-out	Near-side	None	Loading zone	No
WB/NB	Base	4th Avenue @ Liberty	Pull-out	Far-side	None	Loading zone	No
WB/NB	Base	4th Avenue @ Catherine	Pull-out	Near-side	Remove 15-minute parking spot	None	No
WB/NB	Base	4th Avenue @ Hollander's	Pull-out	Mid-block	None	Loading zone	No
WB/NB	Base	Kingsley @ 5th NB	Pull-out	Far-side	Remove 2 spots	None	No
Morning / Night							
WB/NB	Morning	Maynard @ Parking Structure	Pull-out	Mid-block	Remove 5-minute parking spot	None	No
EB/SB	Night	Main @ Mid-block Crosswalk	In-lane	Mid-block	None	None	No

Branding & Marketing Communications

An effective marketing and branding strategy provides customers with the information they need to make informed transportation choices while creating a dynamic and captivating public image that helps retain existing ridership, attract new riders, and when done well, cultivates support and enthusiasm within the community. As the conceptual shuttle circulator is a new service that is intended to supplement existing services, its marketing and branding strategy must distinguish it as a convenient, efficient, or comfortable option, while disassociating it from the existing services.

Branding

Stations and stops are the basic marketing assets of all fixed-route services, and typically serve as the primary medium of informing residents, commuters, and visitors about a new service. Transit websites, social media, and smartphone applications on the other hand, have become the preferred sources of information about a service. Traditional media outlets and strategic partners, meanwhile, still often serve an important role in publicizing a new service, particularly prior to launch.

A distinguishable branded identity allows each of these media to promote and provide information about the new service in a way that is easily recognizable, easy to understand, and attractive. A strong branded identity should contain the following basic components:

- Name – The name should be catchy, easy to remember, and, if possible, convey a message of the purpose or strength of the particular service.
- Logo – A good logo is immediately identifiable and distinguishable from other services. If possible, the logo will further convey the message of the purpose or strength of the service.
- Color Scheme – The color scheme will be used for the logo as well as all signage, printed or online materials, buses, stops, etc.

Route and Schedule Information

Buses, Trains, Stops, and Stations

Stations, stops, and on board of transit vehicles are all significant locations to deliver information about the service. As transit customers are navigating the system it is important that they understand all of their transportation options, and are provided with the information they need to get where they want to go. The following features make transit systems user friendly:

- Printed media and information such as posters, maps, brochures, and schedules at key stops and stations
- Where needed, use wayfinding signage or “area maps” to show riders where they are in relation to stops and key destinations
- Digital displays showing real-time arrival information at selected high-demand stops
- Paper schedules and other information for the route, as well as connections at stops and the station, on board the buses

- On-board stop announcements when the next stop is approaching[43]

Online and Social Media

The types of information that typically are provided on websites or through social media outlets include:

- Route map and schedule information (interactive or PDF format)
- Service alerts
- Fare information
- Information on how to ride if in a wheelchair or loading a bicycle

Additional website features that improve customer convenience include:

- Real-time information displaying vehicle locations and predicted arrivals
- A simple, stand-alone web address that is easy to remember
- A mobile-responsive website for smartphones and tablets, which can display real-time information for all stop locations
- A stand-alone application for smartphones and tablets
- Trip planning capability, either directly on the website or through integration with third-party sites such as Google Maps
- Customizable e-mail or text alerts for service disruptions, agency news, etc.
- Integration with social media such as Twitter and Facebook to provide service alerts and updates on transit initiatives
- Availability in multiple languages to make information accessible for the entire community

Real-Time Services

Real Time Customer Information Strategies

The selection of a service operator should include a specification for a public-facing Automatic Vehicle Location (AVL) system. An AVL system can be used both for supervision and dispatching, and passenger-facing real-time tracking and arrival prediction. On the customer facing side, vehicle location output can be displayed online, in a mobile app, on station video monitors, and on variable message signs on both private and public property.

Both U-M and the AAATA offer public facing real-time map displays of their respective fixed-route services for convenient passenger planning, which could incorporate the recommended circulator service. Integration with an existing AVL system is optimal for user-experience and maximizing operations costs.

[43] Note that ADA requires verbal or automated stop announcements at transfer points, major intersections, major destinations, stops requested by riders with disabilities, and at frequent enough intervals that blind persons or persons with partial vision can orient themselves.

SUCCESS CRITERIA AND EXPANSION

Monitoring Success

Monitoring performance over time by tracking indicators relative to internal targets and goals can foster an accountable, continually improving, and progressively more useful service. Indicators may be directly related to monitoring transit success, or be more broad in monitoring the influence of the service on the economy or quality of life downtown.

Transit

The following are transit performance metrics that are recommended to be tracked, analyzed, and used to create internal targets:

- Total ridership
- Ridership per hour
- Ridership per mile
- Ridership per revenue mile (i.e., miles buses are in service), or "service effectiveness"
- Ridership per revenue hour
- Operating expense per passenger, "cost effectiveness"
- Operating expense per revenue hour, "cost efficiency"
- Operating expensive per revenue mile, "service efficiency"
- On-time performance
- Accident/collisions per 100,000 revenue miles or incident/accident rate
- Revenue miles (distance) between incidents
- Circulation runtime
- Percent change in all of these indicators by month and year

The Florida Department of Transportation notes that measuring indicators related to sustainability and energy conservation, such as those in Figure 24, can additionally help to increase efficiency.[44]

[44] Florida Department of Transportation, "Best Practices in Evaluating Transit Performance," 2014. http://www.fdot.gov/transit/Pages/BestPracticesinEvaluatingTransitPerformanceFinalReport.pdf

Figure 24 FDOT Service Efficiency Metrics

Sample Goals	Criteria	Measure	Data Data Elements Needed
Increase service while enhancing fiscal stability	Service Efficiency	Revenue miles per square mile	Revenue miles
			Service area size
Ensure the long-term viability and stability of the service		Farebox recovery ratio	Fare revenue
			Total operating expenses
		Operating expense per capita	Total Operating expenses (Operating budget)
			Service area population
		Operating expense per passenger mile	Total operating expenses
			Passenger miles
		Operating expense per passenger trip	Total operating expenses
			Passenger trips
		Operating expense per revenue hour	Total operating expenses
			Revenue hours
		Operating expense per revenue mile	Total operating expenses
			Revenue miles
Preserve environment and promote energy conservation		Energy consumption per vehicle mile	Consumption of electricity (for electric or hybrid electric vehicles)
			Vehicle miles
		Tons of emission per 100,000 vehicle miles	Emission factor
			Vehicle miles
		Vehicle miles per gallon	Vehicle miles
			Fuel consumption

Source: Florida Department of Transportation

Economic Development

Possible indicators to track the relationship between economic development within downtown Ann Arbor and the new circulator may include collecting the following data:

- New commercial developments along the circulator routes

- New small and local businesses
- Retail sales[45]
- Business expansion
- Business retention
- Number of new job listings
- Increased average/median incomes
- Increased land value directly on route

The economic development analysis presented earlier primarily focuses on the potential impacts of increased retail spending and property value appreciation using reasonable assumptions. Part of the reason why the economic impacts of circulation bus systems are rarely tracked, if at all, is the limited availability of reliable data, which is a function of the lack of data collection resources of most transit services. In most cases, total ridership is the only measure of success; however, the future study of the Ann Arbor circulator's performance and impact on downtown could be further enhanced with the following performance measures:

Property assessment: To support the economic analysis, the parcels along the circulator route and within 300 feet ("Circulator Corridor") were identified and the latest assessed/taxable values were aggregated by use to determine an estimated total value and real estate taxes paid. The analysis of these parcels should continue after each property assessment cycle.

Storefront vacancy: Maintain an on-the-ground monitoring of storefront vacancy of parcels in the Circulator Corridor and compare vacancy rates to overall retail vacancy rates Downtown and citywide.

- **Real estate market indicators:** Monitor property sales, residential rents, and retail rents in the circulator corridor and compare to downtown and citywide averages.
- **Pedestrian Counts:** Data is available to determine total number of jobs, residents, and students living or working in or around downtown, but there is limited data pertaining to the total number of pedestrians navigating downtown at any given time. Track and maintain total pedestrian counts seasonably and during various times of the day and continue monitoring and pursing technology that can automate and maintain visitation data.
- **Customer/ridership surveys:** The only way to truly measure customer behaviors and perceptions is through surveys of both riders and non-riders. It is important to not only understand why people use public transportation, but more importantly, why not.
- **Zip code analysis:** The A2DDA should continue leveraging any available zip code data to help understand where downtown visitors live and how they get to and from downtown. It is critical to understand the proportional "users" of downtown and how their experiences getting to, from, and around downtown could be enhanced.
- **Parking analysis:** As with many downtowns, the lack of parking (perceived or actual) tends to limit retailer's ability to attract customers. A deeper analysis of parking capacity by time of day and season should be conducted to understand how the circulator could

[45] A local sales tax is typically used as a basis for tracking retail sales. Without one in Ann Arbor, there are limited publically available data sources that can inform decision makers on retail activity. Data providers such as Nielsen or Esri offer some data sets to help inform aggregate retail sales trends. Beyond proprietary data though, the A2DDA would need to conduct surveys of local businesses and/or customers to track retail-spending patterns.

help relieve parking congestion in certain areas and how this can be communicated to the broader public.

Future Expansion Potential

There are a few possible expansion efforts that could be deployed in the future, based on performance indicators. However, it is worth noting that the circulator route does not have a massive physical expansion potential. This is because of the ultimate goal of increasing the health of the business district of downtown Ann Arbor within the A2DDA boundary. As recommended, the circulator configurations would serve the majority of the A2DDA area, and any expansion of the route itself would most likely not act as a further economic benefit within the boundary.

Potential expansion efforts related to frequency are more realistic. It is recommended that the service manager/operator acquire low-floor buses that can hold about 30 passengers seated, or 45 with standees. After running the service for a period of time, if ridership is at maximum capacity during peak hours, it would be useful to increase the frequency of the bus route by a few minutes. Additionally, the base route can be expanded to replace the morning and night route hours in order to serve more people during those hours if necessary.

Downtown Circulator in the Era of New Shared Mobility

AVs and shared-mobility services, such as transportation network companies (TNCs) and carshare services, are changing the way people move about their communities, and have important implications for the shape of public space. Carsharing services have operated in Ann Arbor for 11 years now, with ZipCar establishing its local fleet in 2006, and Maven launching in 2016.[46] More recently TNCs, Uber and Lyft, have been operating ridesourcing services similar to taxis in the Ann Arbor-Ypsilanti area, and worldwide. While AVs are not yet in widespread market adoption, TNC service providers including Uber and Lyft are investing in the research and development of AV technology that could eventually replace drivers in their services.[47] Whether AVs operate as private vehicles for individuals, part of privately-operated shared-mobility services, or the fleets of public transit providers, there will be significant impacts on the shape of roads, sidewalks, parking, and all other facets of public right-of-way.

In the AAATA's 2015 onboard survey, 12% of all riders surveyed reported having recently used a TNC service for a trip they would have made by public transit before the existence of TNC services.[48] In 2017, the City of Innisfil, Ontario, took the approach of subsidizing local Uber trips

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[46] Durr, Matt. *Maven Versus Zipcar: Compare Ann Arbor's Two Car-Sharing Services*. The Ann Arbor News: Ann Arbor. 2016. http://www.mlive.com/business/ann-arbor/index.ssf/2016/03/car-sharing_services_in_ann_ar.html

[47] Isaac, Mike, "*Lyft to Develop Self-Driving Car Technology in New Silicon Valley Facility*," The New York Times, 2017. https://www.nytimes.com/2017/07/21/technology/lyft-self-driving-car-technology.html?mcubz=0

[48] Ann Arbor Area Transportation Authority, "*A Survey of Users of TheRide, A Service of The Ann Arbor Area Transportation Authority*," 2015. http://www.theride.org/Portals/0/Documents/5AboutUs/Surveys/AATA%20Onboard%20report%20-%202015%20Ver%205.pdf?ver=2016-08-30-173250-693

instead of developing a public transit service.[49] Each of these examples marks different impacts TNCs are having on the shape of public transportation. However, a crucial factor at play in Ann Arbor and any other urban city is that "space is the ultimate currency."[50]

AVs and shared-mobility services will continue to grow and morph in the ways they interact with or participate in the provision of public transit. Ultimately though, shared-mobility services cannot replace public transportation without exceeding the space constraints of downtown Ann Arbor streets. In the 2015 service year, the AAATA and U-M LT&P provided over 13.8 million fixed-route bus trips in the Ann Arbor-Ypsilanti area. Over 50% of those trips were on U-M buses within the City of Ann Arbor.[51,52] Ann Arbor streets could not handle the vehicle space capacity for those trips to be served by TNC service providers, instead of public mass transit systems. A downtown circulator bus service can improve mobility between the four districts of downtown Ann Arbor, and is an optimal service model given the space constraints of downtown streets.

CIRCULATOR RECOMMENDATION

The following points summarize conclusions and recommendations from throughout this study, pertaining to the optimal configuration of a new downtown circulator for Ann Arbor:

- It is reasonable to assume that a downtown circulator service would have a net positive effect on downtown marketability, and a positive impact on property values.
- A recommended circulator concept includes three route configurations, shifting based on the time of day. Figure 3 and Figure 4 display the recommended service operating configuration and route alignments for all three route configurations. These route configurations tie together the South University, State Street, Main Street, and Kerrytown districts of downtown, with U-M's Central Campus.
- All three configurations of the circulator should run throughout the year, and the schedule should not vary based on seasons.
- It is recommended that the AAATA manage and operate the circulator service if it is financially feasible to do so.
  - If U-M LT&P is willing to manage and operate the service as part of its local fixed-route bus system, this is considered an optimal alternative.
  - If neither the AAATA or LT&P is able to operate the circulator service, a private operator, could be contracted by a service manager to provide this service.

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[49] Smith, Craig, "*A Canadian Town Wanted a Transit System. It Hired Uber*," The New York Times, 2017. https://www.nytimes.com/2017/05/16/world/canada/a-canadian-town-wanted-a-transit-system-it-hired-uber.html?mcubz=0

[50] Walker, Jarrett, "*the photo that explains almost everything (updated!)*," Human Transit, 2012. http://humantransit.org/2012/09/the-photo-that-explains-almost-everything.html

[51] Michigan Department of Transportation, "*Michigan Public Transit Facts: Ridership Report, 2015*," 2016. https://www.michigan.gov/documents/mdot/2015_Ridership_Report_527051_7.pdf

[52] Planet Blue, "*University Of Michigan – Ann Arbor, Sustainability Goal Reporting Guidelines, Goal #2: Decrease Carbon Intensity Of Passenger Trips On U-M Transportation Options By 30%*," University of Michigan, 2016. http://sustainability.umich.edu/media/files/goal%202%20reporting%20guideline%202015.pdf

- The recommended vehicle type for the circulator is a low-floor transit bus with capacity for at least 30 passengers.
- It is recommended that the conceptual circulator service be provided at no fare, to maintain predictable dwell times.
  - In the event that it is determined that fares must be charged, an off-board or mobile payment system is preferred, over on-board transactions facilitated by the driver.
- Potential sponsors or strategic partners for funding the proposed circulator could include:
  - City of Ann Arbor
  - Washtenaw County
  - Ann Arbor Area Transportation Authority (AAATA)
  - University of Michigan
  - Ann Arbor/Ypsilanti Regional Chamber of Commerce
- Potential public and private funding sources are outlined in Figure 13.
- The service should include a public-facing Automatic Vehicle Location (AVL) system.
- The following transit performance metrics are recommended to be tracked, analyzed, and used to create internal targets for service development:
  - Total ridership
  - Ridership per hour
  - Ridership per mile
  - Ridership per revenue mile (i.e. miles buses are in service), or “service effectiveness”
  - Ridership per revenue hour
  - Operating expense per passenger, “cost effectiveness”
  - Operating expense per revenue hour, “cost efficiency”
  - Operating expensive per revenue mile, “service efficiency”
  - On-time performance
  - Accident/collisions per 100,000 revenue miles or incident/accident rate
  - Revenue miles (distance) between incidents
  - Circulation runtime
  - Percent change in all of these indicators by month and year

APPENDIX

The following table lists the assumptions used in the economic modeling for this study.

Assumptions for Estimating Baseline Retail Spending Activity in Circulator Corridor

Use Type	*Total Retail Businesses*	*Total Square Footage*	*Estimated Sales per Square Foot*	*Total Estimated Annual Sales*
Lodging - BNB	1	3,000	$ 200	$ 600,000
Lodging - Hotel	1	6,800	$ 200	$ 1,360,000
Restaurant - Full Service (Independent)	34	99,450	$ 250	$ 24,862,500
Restaurant - Limited Service (Independent)	17	28,300	$ 200	$ 5,660,000
Restaurant - Bar	16	61,350	$ 200	$ 12,270,000
Restaurant - Coffee Shop	9	13,650	$ 200	$ 2,730,000
Restaurant - Ice Cream/Frozen Yogurt	4	5,200	$ 400	$ 2,080,000
Restaurant - Chipotle	1	2,000	$ 900	$ 1,800,000
Restaurant - Noodles & Company	1	1,500	$ 400	$ 600,000
Restaurant - Potbelly Sandwich Shop	1	2,500	$ 400	$ 1,000,000
Restaurant - Ruth's Chris Steak House	1	6,500	$ 500	$ 3,250,000
Restaurant - Starbucks	3	5,700	$ 775	$ 4,417,500
Restaurant - Pieology Pizzeria	1	2,600	$ 500	$ 1,300,000
Restaurant - Bruegger's Bagels	1	1,200	$ 400	$ 480,000
Restaurant - Panera Bread	1	4,000	$ 575	$ 2,300,000
Restaurant - Jimmy John's	2	2,200	$ 400	$ 880,000
Restaurant - Which Wich	1	2,000	$ 400	$ 800,000
Restaurant - Bar Louie	1	5,700	$ 300	$ 1,710,000
Retail - Apparel (General)	6	22,200	$ 325	$ 7,215,000
Retail - Apparel (Men's)	2	3,200	$ 300	$ 960,000
Retail - Apparel (Women's)	8	11,690	$ 350	$ 4,091,500
Retail - Bookstore	4	10,000	$ 200	$ 2,000,000
Retail - Convenience Store	3	4,600	$ 550	$ 2,530,000
Retail - Craft Shops	2	15,250	$ 300	$ 4,575,000
Retail - Dispensary	3	5,200	$ 900	$ 4,680,000
Retail - FedEx	1	1,000	$ 300	$ 300,000
Retail - Florist	2	1,400	$ 275	$ 385,000
Retail - Gas Station	1	1,500	$ 550	$ 825,000
Retail - Gifts & Housewares	12	18,700	$ 325	$ 6,077,500
Retail - Grocery	2	4,450	$ 150	$ 667,500
Retail - Jewelry	5	6,150	$ 300	$ 1,845,000
Retail - Misc	4	6,800	$ 200	$ 1,360,000
Retail - Pharmacy (Franchise)	1	12,000	$ 200	$ 2,400,000
Retail - Shoes	2	2,000	$ 300	$ 600,000
Retail - Smoke Shop	4	5,200	$ 300	$ 1,560,000
Retail - Specialty Food	8	2,000	$ 250	$ 500,000
Retail - Sporting Goods	9	20,620	$ 300	$ 6,186,000
Retail - Urban Outfitters	1	10,000	$ 375	$ 3,750,000
Retail - Wireless Service	1	1,000	$ 300	$ 300,000
Service Commercial - Salon	10	9,350	$ 100	$ 935,000
Service Commercial - Spa	2	3,000	$ 100	$ 300,000
Total/Average	189	430,960	$ 283	$ 122,142,500

Use, number of business, and square footage based on parcel file obtained from Ann Arbor DDA; Estimated sales per square foot represent Development Stratagies' estimates based on indsutry standards and other sources