WESTCHESTER COUNTY BEE-LINE SYSTEM

FIRST AND LAST MILE CONNECTIONS

MOBILITY STUDY

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NYMTC
NEW YORK METROPOLITAN
TRANSPORTATION COUNCIL

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Federal Disclaimer

Executive Summary

Overview

Westchester County exhibits a strong multi-modal transportation network, with the County's Bee-Line Bus System providing extensive service, particularly in the southern part of the county where population densities are greatest. Coupled with Metro-North Railroad which services to New York City and points north in Putnam and Dutchess Counties, the region's major transit markets are well served. Yet despite the extensive transit network available, gaps exist, particularly in serving the first and last mile segments of a trip. These first mile/last mile gaps include instances where there is no viable option other than driving to a train station or bus stop, corporate site or any other destination situated outside a corridor that is served by transit.

In recent years, Transportation Network Companies (TNCs) [1] such as Uber and Lyft have emerged as a new transportation modal choice in the United States, and have become key players in addressing issues of first and last mile connections. TNCs offer a customized, flexible, and on-demand service that has proven widely popular among users, who also take advantage of their seamless payment systems and driver rating systems. Typically, passengers download an app on their mobile device to request a ride.

This report reviews several categories of examples of how TNCs have been used by other transit agencies and municipalities throughout the country to address first and last mile challenges, and discusses the issues to consider if such a partnership were to be implemented in Westchester County. The categories include:

- Replacement of Under-Utilized Fixed Route Bus Service
- First-Mile/Last-Mile Connections to Commuter Rail Stations and Bus Stops
- Off Peak Jobs Access
- Market Expansion through Micro-Transit
- Technology Platforms
- Paratransit

Project Goals

The goals of a partnership between Westchester County and a TNC should be to enhance overall mobility, increase cost efficiencies, ensure regulatory compliance, ensure equity among users, and provide opportunities to reinvest savings into core fixed route service. Service should not compete with existing Bee-Line fixed route service but should either complement or replace existing service that is inefficient, or serve new markets. The service should also be designed so as not to result in negative externalities such as an increase in traffic congestion.

Recommendations

Westchester County should initiate a pilot program which would include eliminating one or more of the least efficient routes in the Bee-Line System (listed later in this report), or providing a new service that increases mobility where there is an unmet demand. Possible options include:

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[1] According to the California Public Utilities Commission TNCs are companies that "provide prearranged transportation services for compensation using an online enabled application or platform to connect drivers using their personal vehicles with passengers."

1. Provide first/last mile trips to a train station, with the municipality holding the contract with the TNC.

2. Provide first/last mile trips to corporate parks in the Interstate 287 Corridor.

3. Provide first/last mile trips to Westchester County Community College from areas such as Tarrytown and Ossining.

In addition to defining the type of service to be provided, issues to address in designing a TNC program include:

Americans with Disabilities Act (ADA)
The Bee-Line System currently provides wheelchair accessible vehicles on fixed route buses, as mandated by the ADA. TNCs are not subject to ADA regulations and their vehicles are generally not accessible to those with disabilities.

Equity
TNCs trips are used through apps which require a smartphone. A call-in option or other alternative would be needed for people without a smartphone. TNCs also charge by the length of the trip, demand for the trip at the time it is reserved and the type of ride (either solo or shared), which can make the trip cost prohibitive for those who are sensitive to price. Any partnership with a TNC would also have to consider the per trip subsidy that is appropriate to maintain fare equity with Bee-Line fixed route service.

Labor Union Issues
TNC drivers are generally considered independent contractors, and are not unionized. Transit agencies may find it both legally and politically challenging to substitute a non-unionized workforce for a unionized one. Any partnerships with TNCs may require assurances that there is no net reduction in work performed by union labor used to operate transit services.

Operating Arrangements
Westchester County operates its fixed route service as a public/private partnership. The current agreement with its contractor does not give the county the flexibility to veer from fixed route service using alternative operating arrangements.

Data Sharing
TNCs have displayed reluctance, or have even refused to share data with transit agency partners, claiming the information they compile is proprietary. It may be a challenge to structure a TNC partnership that requires TNCs to provide information for federal reporting purposes.

The research and case studies presented in this report provide insight to how different transit agencies have dealt with these issues in developing unique strategies for addressing first mile/last mile connections in several areas of the United States. Although there are many challenges and barriers that must be overcome, transportation planners and transit agencies have found ways to work around them to meet their specific needs.

Summary of Transportation Network Company Case Studies

Orange County Transportation Authority and City of San Clemente	San Clemente, CA	Lyft	Replaced two underperforming routes	Reported successful, seeking another vendor to provide ADA accessible vehicles
Livermore Amador Valley Transit Authority	Dublin, CA	Uber & Lyft	Replaced one underperforming route	Reported successful
Pinellas Suncoast Transit Authority	Pinellas County, FL	Uber	Replaced one underperforming route	Reported successful, expanded to include Lyft and Wheelchair Transport
Summit, NJ	Summit, NJ	Uber	Trips to train station	Reported successful, extended pilot with Lyft, reduced parking demand at train station
Phoenix, AZ	Phoenix, AZ	Lyft	Trips to bus stops	Reported successful
Centennial, CO and Denver South Transportation Management Assn.	Centennial, CO	Lyft Line	Trips to light rail station	Minimal ridership due to lack of awareness of program
Southeastern Pennsylvania Transit Authority (SEPTA)	Philadelphia	Uber	Trips to 11 train stations	Reported successful, resulted in increase in passengers traveling to train stations
Altamonte Springs, FL	Altamonte Springs, FL	Uber	Trips within Altamonte Springs	Reported successful, expanded to other municipalities
Pinellas Suncoast Transit Authority	Pinellas County, FL	Uber	Late shift program for disadvantaged population	Reported successful
Kansas City Area Transportation Authority	Kansas City, MO	Bridj	New market between underserved downtown neighborhoods	Discontinued due to low ridership and lack of marketing, but reported successful as it helped clarify who uses on-demand transportation
Austin Capital Metro	Austin, TX	Via	Replaced transit route; used Via's technology platform in geo-fenced area	Reported successful, expanded after initial pilot
Cherriots	West Salem, OR	DemandTrans Solutions	Replaced two underperforming bus routes	More expensive to operate and served fewer riders than the routes it replaced
Massachusetts Bay Transportation Authority (MBTA)	Boston, MA	Uber, Lyft & one taxi co.	Supplement to traditional paratransit service	Reported successful, provided many more rides and reduced cost

Introduction

Westchester County, New York is a diverse county that is home to nearly 1 million residents. Bordering New York City to the north, the County has distinct job markets in both urban and suburban settings, and a long history of residents commuting to New York City. Mobility has always been a critical matter for Westchester residents and employees who travel to, from and within the county on a regular basis.

Westchester County exhibits a strong multimodal transportation network, providing diverse mobility options. The Bee-Line System is the second largest bus system in New York State after MTA New York City Transit in terms of ridership. MTA Metro-North Railroad is among the busiest commuter rail system in the United States; it has 43 stations in Westchester along its three rail lines, with an emphasis on north-south travel that connects residents to New York City. There is also a strong roadway network with interstate highways, bucolic parkways and commercial arteries with intense development.

Yet there are clear mobility challenges that do exist, especially among those users of the public transportation system who would benefit from better linkages at either the start or end of their trip. The topography of Westchester includes steep hills and river valleys, making walking to transit stops difficult in some locales. Some neighborhoods have disconnected sidewalk networks or are intersected by wide, busy roadways that aren't always pedestrian-friendly. Safe bicycling infrastructure, such as marked bike lanes, is not present in many instances.

In addition, traditional suburban communities with low density housing and large lots are often disconnected from local transit options, and residents who commute by train typically drive to train stations where parking is limited. And although there are vibrant urban job centers in Westchester located near express train stops and multiple bus lines, there are many suburban corporate office parks disconnected from the broader public transportation system that were intentionally designed to be exclusively accessible by automobile. These are the key characteristics of Westchester County's first mile/last mile transit connection challenges.

Transportation Network Companies (TNCs), such as Uber and Lyft, have been used elsewhere to complement public transit by providing first mile/last mile trips. In some instances, they have even partnered with local public transit agencies. Westchester County may also be able to leverage the arrival of TNCs to address the first mile/last mile connection challenges that many prospective and current Bee-Line users face. For example, TNCs could present an alternative approach to traditional bus service, and may provide mutual benefits to current users and taxpayers who bear the expensive burden of bus routes that typically serve first mile/last mile markets.

This report aims to investigate how other cities and suburban areas, along with their transit agencies/operators, are developing innovative approaches to expanding options for people to overcome first mile/last mile challenges to transit through TNC Partnerships. It identifies partnerships that have been attempted in recent years, and analyzes whether those models may be able to translate into a service that can work for Westchester County. It also investigates the conditions in which formal opportunities to partner with TNCs may be appropriate for Westchester County and its municipalities, and barriers that may act as hurdles.

Although this report is not specifically geared towards actions being undertaken at local levels of government, it is important to note that officials at the municipal level within Westchester also play a role in facilitating first mile/last mile connections, especially those that have jurisdiction of sidewalks and roadways that lead to or

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contain Bee-Line bus stops and train stations. Some communities are actively engaged in developing "complete streets" solutions that make walking and biking safer for residents, and bike sharing programs are being considered in certain communities. But even if these measures can improve access, they don't address the fundamental question of whether there are opportunities to provide existing transit services in a more efficient manner through TNC partnerships, and thus are not going to be addressed in this report.

Existing Conditions

The Bee-Line Bus System Overview

The Bee-Line System is the fixed route transit network for Westchester County, with nearly 60 bus routes. Certain routes operate into New York City and offer free transfers to New York City Transit buses and subways. In 2017, Bee-Line ridership was 28.6 million, with approximately 100,000 daily weekday riders.

The Bee-Line System, including all vehicles, is owned by the Westchester County. All but three of its routes are currently operated by Liberty Lines, Inc. through a contract with Westchester County, utilizing county-owned garages located in Yonkers and Valhalla. The remaining three routes are operated through a separate contract with Peekskill based PTLA Enterprises. The Bee-Line System has 325 vehicles in fixed route service with approximately 143 million annual passenger miles as of 2017.

In addition to the Bee-Line fixed route service, Westchester County also provides Bee-Line paratransit service to accommodate persons physically unable to use fixed-route buses. Bee-Line ParaTransit is operated under a contract with National Express. There are approximately 99 vehicles in the County-owned paratransit fleet, including minivans and cars. The vehicles are located in a facility in White Plains, and the service is operated independently from Bee-Line's fixed route services. (Note: Although this report will not attempt to assess Bee-Line ParaTransit directly, some of the operating practices of Bee-Line ParaTransit will be highlighted as applicable).

Bee Line Fixed Route Services- Local, Limited & Express Routes

The backbone of the Bee-Line System includes three types of fixed route services:

- Bee-Line local services primarily serve the urban cores and suburban corridors across Westchester County, and are designed to provide regular service during peak, off peak, and weekend timeframes. These routes provide transfer opportunities to other Bee-Line routes and in some cases to other transit networks such as New York City Transit subways and buses. Local routes include all of the busiest routes in the Bee-Line System, and generally have bus stops spacing at short distances to allow walkability to almost any point along a route where the pedestrian environment permits safe bus stop placement. Examples include Routes 2, 5, 7, 8, 13, 20, 40, and 60, among many others.
- Bee-Line limited services emulate the routing of existing local routes, but make stops only at key locations outside of urban cores. These routes only operate during peak timeframes. Examples include Routes 21 and 41.
- Bee-Line express services provide long distance peak hour trips connecting certain suburban towns and villages with urban centers and multimodal transfer points in Yonkers, White Plains, New Rochelle and Mount Vernon. Outside of urban centers, express routes operate on limited access highways, and make only selected stops when traveling on arterials or local roads. Examples include Routes 1x, 3, 10, 11, 17,

43, 62, and 77. The Route BxM4c is a premium express service to Manhattan, with fares of $7.50 per trip rather than the $2.75 fare charged on other Bee-Line express routes.

The level of Bee-Line bus service varies significantly from route to route. Certain routes operate seven days a week, while others only on weekdays or on weekdays and Saturday, but not Sundays. The population densities of Westchester County's largest cities and the ensuing demand for frequent service results in peak headways of as little as every 6 minutes on some of the busiest Bee-Line routes, such as those operating along Central Avenue and between downtown Yonkers and the Bronx. During off-peak periods, service is more commonly every 20-30 minutes on the busiest routes, with some routes operating once every hour or two hours. There are also routes that don't operate during off-peak periods, primarily those that are timed to meet arriving and departing trains.

Bee Line Fixed Route Services – First Mile/Last Mile Services

The Bee-Line System has long attempted to provide trips bridging first mile/last mile gaps, which have been designed to address two disparate needs:

- Commuter Routes are specifically designed to facilitate transfers between the Bee-Line System and Metro-North Railroad during weekday peak periods, providing commuters an alternative to driving to and parking at train stations. Schedules have been developed to allow buses to meet specific inbound and outbound trains, with stop locations commonly located alongside or very close to train station platforms. Trips on these routes begin/end at suburban train stations, and follow routes that bring them into residential developments on local and collector roads. Unique among Bee-Line routes, commuter routes allow users to "flag down" an approaching bus, as opposed to other services that require official Bee-Line bus stops to be utilized. Commuter services include Routes 18/31 in Peekskill, 34/38/39 in Hartsdale, the 64/65 in Scarsdale and the 70/71 in Larchmont.

- Shuttle Loops comprise of a set of routes between the White Plains TransCenter and suburban office parks and corporate headquarters located along and just outside the Interstate 287 corridor. These routes operate only in the peak direction during peak weekday timeframes, and similar to commuter routes, the schedules are maintained to allow for timed transfers to Metro-North Railroad service. Unlike the commuter routes, shuttle loop routes only allow boarding and alighting at official Bee-Line bus stops, although they do enter the corporate office park properties and provide stop locations near the front door of offices. Stops are also made throughout downtown White Plains, allowing passengers on other local and express Bee-Line buses to have additional transfer opportunities.

In a sense, the myriad of local services that cross into the Bronx and connect to New York City subway lines also address first mile/last mile needs, but these routes also serve local needs within Westchester County, and are generally among the most productive of Bee-Line routes, as they operate in high density areas.

While commuter and shuttle routes provide first mile/last mile connectivity, they are expensive and inefficient to operate. Both the Bee-Line commuter and shuttle loop services operate only during weekday rush hours, and only in the peak direction (i.e. bringing residents to train stations in the morning and home in the evening, and bringing commuters to corporate office parks in the morning and back to the train station in the evening). These routes also are among the least utilized in the Bee-Line System, and often have excess capacity on the 30-foot

buses and coach buses used on them. In some instances, they also compete with private shuttles funded by commercial complexes and individual companies that provide them as a benefit to their employees, which further limits the potential universe of Bee-Line riders on shuttle services.

The following tables summarize the performance of routes that are specifically geared toward addressing first mile/last mile connections:

Average Daily Ridership

Route	2013	2014	2015	2016	Change - 2013 to 2016
10	126	117	112	100	-21%
18	47	50	38	35	-27%
31	15	13	11	9	-40%
34	54	60	62	59	9%
38	57	60	61	61	6%
39	78	84	81	83	7%
64	135	147	119	108	-20%
65	141	143	148	135	-5%
70	64	64	62	58	-9%
71	37	35	42	36	-2%
Loop A	157	155	138	124	-21%
Loop B	115	104	97	77	-33%
Loop C	60	45	36	31	-47%
Loop D	90	84	80	79	-11%
Loop F	114	110	114	103	-9%
Loop H	173	144	92	82	-53%

Source: Bee-Line Annual Reports – 2013 to 2016.

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Cost Per Passenger Trip

Route	2013	2014	2015	2016	Change: 2013 to 2016
10	$ 14.52	$ 15.89	$ 17.15	$ 19.21	32%
18	$ 46.77	$ 31.28	$ 43.23	$ 46.89	0%
31	$ 32.83	$ 34.91	$ 37.66	$ 47.65	45%
34	$ 12.02	$ 11.46	$ 11.35	$ 8.50	-29%
38	$ 11.39	$ 10.88	$ 11.08	$ 7.84	-31%
39	$ 13.77	$ 12.51	$ 13.12	$ 12.53	-9%
64	$ 6.46	$ 6.00	$ 7.36	$ 6.08	-6%
65	$ 4.18	$ 4.14	$ 4.93	$ 5.78	38%
70	$ 17.45	$ 17.59	$ 18.57	$ 16.75	-4%
71	$ 26.54	$ 28.45	$ 23.01	$ 21.92	-17%
Loop A	$ 16.38	$ 15.76	$ 19.33	$ 18.79	15%
Loop B	$ 28.38	$ 30.00	$ 34.70	$ 28.67	1%
Loop C	$ 23.18	$ 29.92	$ 40.34	$ 35.44	53%
Loop D	$ 32.34	$ 33.29	$ 37.62	$ 26.55	-18%
Loop F	$ 19.42	$ 19.31	$ 20.05	$ 20.68	6%
Loop H	$ 16.04	$ 18.87	$ 32.44	$ 34.60	116%

Source: Bee-Line Annual Reports – 2013 to 2016.

Fare Recovery Ratio

Route	2013	2014	2015	2016	Change - 2013 to 2016
10	9%	9%	9%	7%	-22%
18	3%	4%	4%	3%	0%
31	4%	4%	4%	3%	-25%
34	10%	11%	12%	15%	50%
38	11%	12%	13%	17%	55%
39	9%	10%	11%	10%	11%
64	18%	21%	18%	20%	11%
65	24%	26%	24%	22%	-8%
70	8%	7%	8%	9%	13%
71	5%	5%	6%	7%	40%
Loop A	8%	9%	7%	8%	0%
Loop B	5%	5%	4%	5%	0%
Loop C	6%	5%	4%	4%	-33%
Loop D	4%	4%	4%	6%	50%
Loop F	7%	7%	7%	7%	0%
Loop H	8%	7%	5%	4%	-50%

Source: Bee-Line Annual Reports – 2013 to 2016.

The ridership data above highlights extremely low average daily ridership. Among commuter routes, the most productive routes are those serving the Scarsdale train station, with the Routes 64 and 65 both exceeding 100 passengers per day, but the 64 has seen a 20% drop since 2013. The three routes serving the Hartsdale Train Station (34/38/39) serve about 60 to 80 people each weekday on each route, with ridership that has bucked

trends and remained stable or even increased slightly since 2013. Routes 70 and 71, serving Larchmont Station, average 58 and 36 daily passengers, respectively. And among the two Peekskill Routes, the Route 18 averages 35 passengers daily, while the Route 31 only averages 9 passengers daily.

Commuter routes attract the most passengers when there is high density development within relatively close proximity to a train station. This type of development allows buses to pick up a large volume of passengers within close distance. In low density areas, on the other hand, buses can travel long distances with much less opportunity to pick up passengers, resulting in significantly higher operating costs.

Another contributor to the challenge of providing bus services to train stations has been the trend of the last several years to build and expand train station parking. When the County bus system started operating in the 1970's, as the result of consolidating a myriad of once privately operated bus routes, there were much fewer parking facilities associated with train stations. This created a robust market for bus service to the stations. However, as municipalities and Metro-North continued to expand parking, the market for bus service dwindled and consequently became less and less feasible to operate. The reduction in the demand for bus service resulted in the County reducing the level of service provided. As the bus service was cut back, more rail commuters started to drive and park at the station which increased pressure for municipalities and the railroad to expand parking even more, resulting in fewer and fewer bus riders. This cycle of expanding parking and reducing the market for bus service has not abated.

The poor performances among Bee-Line commuter routes and shuttle loops have been exacerbated by the trend over the last few years, both across the transit industry and within the Bee-Line System, of declining bus ridership. While the Bee-Line has seen a 10% drop in ridership from 2013 to 2016, these commuter routes and shuttle loops have collectively seen a 19% decrease, indicating that these routes are continuing to lag behind the performance of the broader Bee-Line System. In particular, the shuttle loops have seen a 30% drop in ridership since 2013, with the Loop "H" showing the largest decrease, having lost over 52% of its riders; vacancies at the corporate office parks along the Interstate 287 corridor are largely responsible for much of this drop in ridership. Certain commuter routes such as the 18 and 31 have also seen large ridership drops of 26% and 40% over the same period of time.

It is evident that these commuter and shuttle services are very costly to operate. On a systemwide level, they comprise just over 1% of daily Bee-Line ridership, but their operating expenses account for nearly 5% of Bee-Line fixed routes. The entire Bee-Line System covered 37% of its expenses in 2016, with its most productive routes achieving a 60% farebox operating ratio percentage, which compares favorably with New York City Transit.

On the opposite end of the spectrum, Bee-Line's worst performing commuter routes (which include the 10, 18, 31, 70, 71) and the six shuttle loops were covering less than 10% of their expenses; some routes such as the 18 and 31 in Peekskill covered as little as 3% in 2016. On a per-passenger basis, that translates to a cost of about $47 per passenger on the Routes 18 and 31 in 2016; the Larchmont Routes ($16.75 and $22) are also quite high, while the commuter routes serving Scarsdale (in the $8 - $12 per passenger range) Hartsdale (ranging from $4.75 to $6.50) are still expensive but not nearly as extreme as the Peekskill routes. The cost per passenger on the shuttle loops ranges from around $20 for Loops A and F, to closer to $30 on B and D, to about $35 for the C and H.

The above analysis suggests that among the commuter and shuttle routes, the most inefficient and unproductive routes are the Peekskill commuter Routes (18/31), the Larchmont commuter Routes (70/71), and all of the shuttle loops, with Loops B/C/D/F providing the smallest return on investment. It is these routes that potential alternative service approaches should be considered.

Transportation Network Companies - Background

In recent years, TNCs such as Uber and Lyft have emerged as a new transportation modal choice in the United States, and have become key players in urban and suburban mobility. Today, Uber service is available in more than 500 cities around the world and Lyft operates in more than 300 cities across the United States[i]. Simply put, they have had major impacts on both traditional taxi and livery operations, as well as public transit systems which they compete with and, in some instances, may complement.

TNCs offer a customized, flexible, and on-demand service that has proven widely popular among users, who also take advantage of their seamless payment systems, low fares relative to traditional taxis, and driver rating systems. Typically, passengers download an app on their mobile device for the TNC from which they want to request a ride, and input their desired pick-up and drop-off locations. The app will then provide an estimated cost, wait time and pick-up location, allowing the prospective passenger to decide whether to book that trip. Once booked, confirmation will be indicated on the app or via text message, containing instructions such as vehicle make/model or ID and the name of the driver. The vehicle will then arrive at the designated pick-up location and take the passenger to their designated destination.

Billing is normally handled through the app (with tipping recently added as an option), and payment information is provided in advance (some TNCs directly bill the payment method for each trip, while others offer accounts that must be refilled on occasion to cover the cost of a trip). At the conclusion of the trip, some services allow passengers to tip drivers and rate their experience in various categories, including safety and cleanliness, and driver friendliness.

Although on-demand door-to-door rides, such as Uber's X/XL/Select/Black options, Lyft's Standard/Plus/Premier/Lux options, and Juno's Bliss/Lux/SUV services are most commonly used by customers, many TNCs also offer shared rides. Also known as Micro-Transit, shared rides feature multiple pick-ups and drop-offs during the time that a passenger is en-route to their destination. The driver follows the route prescribed by an algorithm, which may not be the fastest or most direct path but optimizes the number of people who can share a trip.

By aggregating people going from different origins to different destinations in an efficient way, prices are lower than single-ride services and are sometimes even comparable to traditional public transit. Also similar to transit, some ridesharing services require passengers to walk to/from the nearest intersection rather than the vehicle traveling to a specific address. Examples of shared ride services include UberPool, Lyft Line, Via, Bridj and Chariot.

The degree of success that TNCs have had has been such that in addition to revolutionizing on-demand transportation, the impacts have been felt by traditional transit operators of buses and trains. Recent trends depict declining transit ridership across the country, and there are strong indications that this is in part attributable to a shift of riders to these TNCs[ii], even though TNCs emphasize that they do not want their services to supplant strong public transportation systems. Lyft has even started a marketing campaign entitled "Friends

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with Transit" that highlights their view of public transportation as a partner, and includes passenger survey data indicating that 25% of Lyft users connect to public transit[iii].

While TNCs have become very popular in New York City, New York State Law did not permit their operation in areas outside New York City prior to June 2017. Before that time, TNCs were only permitted to drop off passengers in Westchester County who began their trips in New York City, or to pick up passengers in Westchester County who were destined for New York City. However, following extensive reviews at both the state and local level, Governor Andrew Cuomo signed a budget bill into law in 2017 that offered cities and counties outside of New York City the opportunity to allow ride hailing by TNCs for intra-County trips.

The infancy of TNC operations in Westchester does not allow for much analysis as of the publication date of this report from a local level. However, a study completed in October 2017 by the University of California at Davis found that there has been much greater use of ride-hailing services in urban neighborhoods than in suburban ones; while 29% of residents of urban neighborhoods reported using them, only 7% of residents in the suburban neighborhoods of major cities regularly used TNCs.[iv] This suggests that the extent of the market for TNCs in places such as Westchester is still not entirely clear.

TNC Issues/Challenges for Public Transit Operator Partnerships

The fundamental difference between TNCs and public transit operators is the private nature of TNCs. TNCs have rapidly become very valuable; Uber and Lyft were considered billion dollar companies at the end of 2017, with Uber's market capitalization exceeding $50 billion by some estimates. Although they have yet to turn profits as companies, they continue to attract investors who see the long-term potential for them to flourish. But they do aim to make a profit, which is their motivation to establish partnerships versus transit operators who seek to leverage the efficiencies of TNCs, and provide alternatives to transit operations that are perceived as inefficient.

It must also be noted that the impacts of the increase in TNC services are just beginning to be understood. New York City may be an extreme example, but studies have indicated that there have been dramatic increases in traffic congestion due to the influx of TNC vehicles into Manhattan operating both with and without passengers[v]. Nor is data available on the amount of time or distance vehicles spend cruising empty between rides, which contributes to congestion[vi].

An increase in traffic congestion is clearly an externality that Westchester County would like to avoid. Studies have also begun to measure the impact that TNCs are having on fixed-route transit, and indications are that they are having an adverse impact on bus ridership.

Since TNC partnerships are still in their infancy, the FTA has limited formal guidance on the various issues facing transit agencies that are interesting in partnering. In December 2016, a "Dear Colleague" letter was sent to transit agencies, which provides a framework for ensuring that equity and accessibility matters are addressed in accordance with Federal policies[vii].

The abundance of case studies demonstrates that public sector transit operators have successfully been able to overcome potential barriers to establishing partnerships with TNCs. The following section summarizes the key challenges that Westchester County must consider in any future potential partnerships.

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Americans with Disabilities Act

One of the clearest challenges that transit agencies face when partnering with TNCs is ensuring that persons with disabilities are provided with equivalent service. Since its passage in 1990, the Americans with Disabilities Act has been critical in assuring equal access to public transit for those with disabilities. Transit agencies must adhere to ADA requirements, including providing wheelchair-accessible vehicles on fixed route bus services; they must also offer paratransit service for those unable to use fixed route services. These services must serve areas within ¾ of a mile from fixed route transit, operate the same hours as fixed route service, and can only charge up to twice the standard transit fare.

Since TNCs are not subject to ADA-regulations, the vehicles used by TNCs are generally not accessible to those with disabilities, or the number of accessible vehicles is limited. In order for certain partnerships between a public transit operator and a TNC to be viable, public transit operators have had to ensure that a TNC was able to provide a sufficient quantity of accessible vehicles; if that is not an option, they alternatively can enter into a separate agreement with a mobility provider that is capable of fulfilling this mandate.

Another way in which agencies have been able to address ADA requirements is by operating on-demand shared ride services for the general public that utilize accessible vehicles that are typically used for paratransit operations. In this scenario, public transit operators have partnered with TNCs to utilize their technology enabling operators to deploy vehicles and drivers to provide the requested rides. However, this operating arrangement requires the agency to be able to swap vehicles and drivers between fixed route and paratransit operations; many transit operators, including Westchester County, do not have the ability to perform this approach.

Equity

A major equity issue regarding TNCs partnering with transit agencies is the comparative cost of using a TNC service. Unlike fixed-route service with its concrete fare structures, and paratransit which is not permitted to charge more than double the standard fare of a fixed-route transit trip, the cost of TNC trips are generally variable. The distance traveled, the type of ride (shared rides are typically less expensive than single rides), and the demand at the time the trip is requested can affect the cost of a trip, making a TNC cost prohibitive for those who are sensitive to price.

Cost sensitivity is especially important for Westchester County bus passengers. The 2016 on-board Bee-Line Passenger Survey indicated that 49% of Bee-Line users reported household incomes of less than $25,000. According to the UC Davis report referenced earlier, only 15% of Americans living in households with annual incomes below $35,000 have used a ride-sharing service; in contrast, 33% of Americans living in households with annual incomes exceeding $150,000 who have used such services[viii]. For this reason, some TNC partnerships have included per trip subsidies to keep the cost per passenger in check; in some instances, the transit agency will pay up to a $10 per TNC trip to subsidize the total cost of the trip.

Additionally, transit agencies have an obligation under Title VI to ensure equity when contracting with any mobility provider. TNC services typically rely almost exclusively on the use of a smartphone linked to a credit card or a debit card to arrange for service. This creates a significant barrier to lower income and limited English proficiency individuals who may not own a smartphone and/or who do not have a credit card or bank account.

Labor Union Issues

A key element to the structure of TNCs is the manner in which their drivers are not employees but are considered independent contractors. As contractors, they may not be subject to background checks. Taxi drivers and advocates for traditional taxi and chauffer services have argued that ride sharing services are essentially taxi services and should be regulated as such. Advocates for ridesharing services have argued that ridesharing services are part of a sharing economy and should not be subject to the same regulations as taxi services. Uber and Lyft have made this legal argument, and claim their drivers are not entitled to minimum wage guarantees, workers compensation and unemployment coverage, or protection under the National Labor Relations Act. This issue is the subject of pending litigation in many states, and is not currently resolved.

Unlike TNCs, many transit operators including Westchester County's contracted service providers, employ a unionized labor force. There is a question as to whether labor unions can prohibit agencies from forming agreements with TNCs and other emerging mobility providers. Many transit agencies are seeking to increase operational flexibility, but find it both legally and politically difficult to substitute a non-unionized workforce for a unionized one. Changes to rules in collective bargaining agreements must be negotiated.

Transit agencies will have to determine what is legally and politically feasible given their labor-management relationships and local jurisdictional laws. There are avenues that can and have been taken to circumvent this issue. Some TNC partnerships have been forged in a manner where existing unionized workforces perform the work on behalf of the TNCs; in other instances, there have been reallocations of labor resources that allowed a TNC service to operate while existing staff was shifted to other existing services and routes and thus was not adversely impacted by the TNC service.

Data Sharing

Transit agencies, even with newer technologies such as automatic passenger counters and automatic vehicle location, do not have the equivalent data capabilities as TNCs. Since TNCs are operating on-demand services requiring customers to input both start and end points, they can build many layers of data that can identify origins and destinations in a variety of ways; fixed route buses can count passengers boarding and alighting, but can't identify origin/destination pairs to the same degree of specificity. Therefore, any data that a TNC can make available to planners and transit providers can be extremely valuable.

As transit agencies embrace new mobility concepts, it is crucial that they are provided with enough data to meaningfully evaluate service provision. The absence of data can make it hard to observe first and last mile behavior, especially with limited information on origin and destinations. Additionally, transit agencies must consider their federal reporting requirements, and how any data a TNC doesn't make available may impact their ability to comply.

If a TNC/Transit Agency partnership is entered into, transit agencies ideally should determine what data will help inform policy decision-making, and attempt to include language regarding access to meaningful data in TNC service agreements. The case studies describe various levels of data that have been made available, but do not discern whether they have been sufficient for analysis or planning purposes. It is noteworthy to consider the GoDublin example described later in this report, where there were partnerships with 3 different companies that provided vastly different levels of data, making it difficult to compare how each company's partnership was truly faring.

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TNC Partnership Case Studies

As TNCs have expanded and became more popular, various examples of partnerships have been initiated, starting in 2016 when Uber entered into its first public/private partnership with the Pinellas Suncoast Transit Authority (PSTA)[ix].

Transportation experts are increasingly acknowledging the likelihood that TNCs will play a major role going forward. Planning organizations are starting to include these partnerships in their long-range planning documents, such as Regional Plan Association's Fourth Regional Plan that specifically recommends that Westchester County and other suburban counties consider partnering with TNCs[x]. Public transportation advocacy groups, such as the American Public Transit Association and New York Public Transportation Association (NYPTA), have also been introducing the topic and working with their members to prepare and potentially implement these partnerships[xi].

As of late 2017, there were numerous examples of partnerships that could be analyzed to identify potential concepts that may be appropriate for the operating environment of Westchester County. Research has been performed to better understand these service models and pilot programs across the country between TNCs and transit agencies or local governments. For the purposes of this report, these efforts have been organized into the following categories:

- Replacement of Under-Utilized Fixed Route Bus Service
- First-Mile/Last-Mile Connections to Commuter Rail Stations and Bus Stops
- Off Peak Jobs Access
- Market Expansion through Micro-Transit
- Technology Platforms
- Paratransit

Replacement of Under-Utilized Fixed Route Bus Service

A common issue among bus operators is that there are certain types of routes that are not particularly productive from the standpoint of ridership or cost. However, these routes are often well established as part of a broader network and difficult to eliminate, whether it is due to community concerns, political realities, or regulatory requirements such as Title VI. Yet, there are examples of innovative approaches to eliminating traditional bus service and replacing it with alternative service models, including utilizing TNCs to provide similar service that can be operated more efficiently and provide passengers with more flexibility than they previously had on routes that operated infrequently or only during peak periods.

Case Study - Orange County Transportation Authority (OCTA) – San Clemente + Lyft Partnership

Transit Agency	Orange County Transportation Authority (OCTA)
Mode	Commuter Bus, Demand Response - Taxi, Bus
Total Population	3,041,754
Area Square Miles	464
Population Density	3,940 Persons Per Square Mile
Ridership Per Year	15,783,367
# of bus routes	65

| # of passenger miles | 183,484.60 |
| # of vehicles | 317 |

Agency data reflects 2014 information reported to the FTA.

Like many bus operators across the country, the Orange County Transportation Authority in Orange County, California has witnessed a large ridership decline in recent years, but their losses have been particularly extreme. Between 2008 and 2015, the OCTA bus system ridership declined by 30%, the largest of any system in California [xii]. This resulted in significant cuts in service across the system, and led to a re-envisioning of the entire bus system in 2016. One element of this effort included the elimination of two routes in San Clemente, a city of 63,000 at the southern end of the OCTA service area. These routes included the following:

- Route 191, a local bus route serving residential and retail corridors across San Clemente and neighboring cities. The Route 191 operated 7 days a week; peak headways on weekdays were approximately every 30 minutes; headways at other times were approximately every 60 minutes. The span of service on both weekdays and weekends was between 6:00AM and 8:00PM; ridership averaged approximately 550 people per weekday the entire route, with an operating cost of $1.26 million generating a 13.7% farebox recovery.
- Route 193 was a commuter route serving the San Clemente Train Station, where passengers connected to MetroLink commuter rail service to Los Angeles. There were 3 daily peak directional trips each weekday morning and afternoon, which attracted about 100 daily passengers. The route cost $258,000 to operate in 2015, and had a farebox recovery percentage of 12.5%.

In response to these route eliminations, San Clemente officials approached OCTA with a conceptual proposal for a TNC partnership to replace the routes that were eliminated. OCTA provided the City of San Clemente with a $900,000 grant funded by a local sales tax to design a new local rideshare service to assist former riders of the discontinued routes. The product of this collaboration was a partnership between the City of San Clemente and Lyft[xiii], which began in October 2016. The program requires riders to be picked-up and dropped-off along the corridors of the discontinued 191 and 193 bus routes, at safe locations within 250 feet of the existing bus stops. These zones were created through Lyft's geo-fencing[2] technology[xiv]. Bus stop signs were replaced with municipal signs designed by and funded by San Clemente featuring the Lyft brand logo.

The fare for passengers was set at a minimum of $2, which was equivalent to the fare on the discontinued OCTA routes. The additional cost for the ride was paid for by the project funds up to a maximum subsidy of $9 per boarding, as long as passengers used the provided discount code when booking the trip through the Lyft app. Any incremental cost beyond the $9 subsidy was charged to the rider in addition to the initial $2 minimum; thus, a $15 ride would cost the passenger $6.

Since the partnership between San Clemente and Lyft was done using local funds, and due to the fact that it was administered by the City of San Clemente, the Lyft Partnership was not considered a replacement of transit service, and thus did not require a complementary ADA element to be provided. However, in order to meet other ADA requirements regarding accessible vehicles, passengers were directed to use OCTA's ACCESS paratransit program, which offered same-day accessible taxi trips; users would be reimbursed for ACCESS trip costs for trips up to 5 miles, with passengers paying for additional costs incurred beyond the 5 miles permitted. Lyft also intended to place additional wheelchair vehicles on the road to serve customers.

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[2] Geo-fencing is a technology that defines a service boundary or area where trips must occur to be eligible for a subsidy.

San Clemente is satisfied with results of the program. As of November 2017, the service was averaging about 70 rides per day[xv]. While the ridership was significantly less than that of the Routes 191 and 193, the Lyft partnership was not intended to serve the same market and obtain the same ridership levels. From San Clemente's perspective, Lyft has been a very cooperative corporate partner. However, OCTA reports that Lyft has been unable to meet their goals for accessible vehicles, and the data being provided is not as robust as originally anticipated. San Clemente is also currently seeking another vendor to provide ADA-accessible vehicles as part of its program. From a financial standpoint, OCTA has been able to shed unproductive routes, and even with the grant reimbursements they are saving money by not operating the routes 191 and 193.

Case Study –Livermore Amador Valley Transit Authority/Uber & Lyft- Dublin, California – GoDublin

Transit Agency	Livermore Amador Valley Transit Authority
Mode	Local/Express Bus, Paratransit
Total Population	Approximately 200,000
Area's square miles	40
Population Density	Approximately 5,000 Per Square Mile
Ridership Per Year	1.65 million passengers
# of bus routes	16 fixed routes, 15 school trips, 1 regional
# of passenger miles	1.81 million
# vehicles	71 buses, 18 paratransit

Source: Wheels Facts and Figures 2015

The Livermore Amador Valley Transit Authority's Wheels Bus system is one of a multitude of transit systems in the San Francisco area. Wheels covers a suburban area about 40 miles east of San Francisco known as the Tri-Valley which includes the cities of Dublin, Livermore and Pleasanton. The area is served by BART, the San Francisco area's commuter rail/rapid transit system.

Following the completion of a comprehensive operational analysis of the LAVTA system, it was determined that there were certain routes that were costly to operate and considered unproductive, with per ride subsidies exceeding $15 in one instance[xvi]. This was the case in Dublin, which exhibited a low-density land use environment and contained a BART station that is a key destination for Wheels users.

As an alternative to providing fixed route service on one particular route in Dublin that averaged only about 5 passengers per hour, LAVTA considered various models including partnering with TNCs and using mini-buses. The outcome of this process was the GoDublin program. GoDublin is a partnership between LAVTA and Uber, Lyft and the local taxi company DeSoto Cab, which allows users to travel within the City of Dublin using the provider of their choice. Although not the exclusive purpose, the program especially hoped to attract passengers who commute to/from the Dublin BART station[xvii].

GoDublin enabled passengers to receive a 50% discount on their shared ride fare (UberPool, Lyft Line or DeSoto Share) upon entering a promotion code, with a maximum discount of $5 per trip. The discount was applicable as long as the trip began and ended within the City of Dublin and utilized UberPool, Lyft Line or DeSoto Share; if the trip were to go beyond Dublin City Limits or were done using a single-ride Uber, Lyft or DeSoto Cab, the discount would not be applied.

The program was designed to be used by passengers with various needs. For passengers requiring an accessible vehicle, they could decide to use either UberPool or DeSoto Share; if a passenger did not have access to a mobile device or a credit card, they could call DeSoto share and request a ride by phone.   In all instances, vehicles were expected to arrive within 15 minutes of making a reservation.

GoDublin began as a six month demonstration program with a $100,000 grant from Alameda County; LAVTA contributed an additional $100,000 to the program. The program launched in January 2017, was extended in June to continue through the end of 2017, and extended again in December 2017 to continue through June 2018[xviii].

Though it is too early to fully assess the program, preliminary reports by LAVTA staff are generally positive from an operations perspective. The service is averaging 1,500 riders per month as of January 2018, and the cost to LAVTA to operate GoDublin is approximately $3 per trip, compared to $15 per trip for the fixed route service that was eliminated; anecdotal evidence suggests passengers are satisfied, and system ridership across LAVTA has increased as cost savings from GoDublin were reinvested into other routes[xix].

However, LAVTA has had struggles with the GoDublin program from an administration perspective. There is limited and inconsistent information being reported by the partners, and as a result it is hard to discern details such as wait times, ride matching potential, and customer feedback[xx]. There are open questions regarding the type of information that will need to be reported for FTA and National Transit Database purposes, and whether each vendor will ultimately provide that information. Passenger wait times for the ADA accessible service also have not met expectations.

LAVTA officials noted the importance of working with Federal partners throughout the process of developing the GoDublin program. Since the FTA had not established clear rules pertaining to issues such as ADA, Title VI and drug/alcohol testing, LAVTA's communicative approach enabled them to proceed without concerns that they would be later told they were not complying with the spirit of existing FTA requirements.

Potential Applications for Westchester County

Given the current Bee-Line routes noted earlier in this report that perform poorly from a ridership and financial standpoint, there are clearly opportunities for Westchester County to pursue replacement of routes with TNC partnerships. In order to sidestep labor concerns, any action by Westchester County to replace routes through a TNC partnership should coincide with proposals to reallocate any operations savings elsewhere into the Bee-Line fixed route network.

The LAVTA GoDublin model in particular has some attributes that may translate well to Westchester in terms of how they addressed labor concerns and managed to clearly define the operating boundaries of their service. LAVTA's labor unions were not on-board with the TNC partnership, but were reassured that any savings from elimination of service LAVTA previously provided would be reinvested in other LAVTA services, thus assuring that no work reductions occurred. One element of LAVTA's approach that is particularly noteworthy is how they partnered with a separate provider to address ADA requirements. A question that must be considered for Westchester is, depending on the type of potential arrangement that is developed with a TNC, whether an on-demand accessible service would be required, or if current contractors serving Westchester County would meet on-demand wait time requirements to maintain equity among services and pass muster with the FTA.

First-Mile/Last-Mile Connections to Commuter Rail Stations and Bus Stops

First and last mile transit partnerships are those that seek to address the challenges of accessing public transportation due to lack of access from one's point of origin or destination to the nearest bus/train stop. While walking to and from a transit stop is often thought of as the most effective means of travel to a fixed-route stop, riders aren't always within a "comfortable" walking distance, generally considered to be within ¼ of a mile of their nearest transit stop[xxi]. In these cases, transit and municipal agencies are partnering with TNCs to provide the first and last-mile of a trip. Generally, these arrangements consist of a TNC providing a subsidized ride to or from one or more designated transit stops within a geo-fenced zone. These partnerships are credited for bridging inefficiencies or distances for users by providing quick and easy connections to public transportation.

At capacity rail parking lots present challenges for daily commuters and occasional users alike, as certain stations lack available spaces by the end of the AM peak period, leaving no spaces for those who use the train during midday timeframes. Although some communities and transit agencies offer commuter bus shuttles that are timed to meet trains, service is generally only operated generally during peak periods, and they follow designated routes that aren't necessarily convenient to those who live outside of those route corridors. Westchester's Bee-Line commuter shuttles in Hartsdale, Larchmont and Scarsdale are examples of this approach.

Recently, partnership opportunities with TNCs have emerged as another approach for communities that are faced with parking shortages at train stations. These partnerships provide opportunities for relief from overcrowding, as is often experienced in suburbs outside of New York City. If TNCs become successful, they could lead to opening up land currently used for parking, for other purposes that don't require dedicating valuable property in town centers to be used exclusively for cars to be parked.

Case Study: Pinellas Suncoast Transit Authority (PSTA) – Direct Connect Program

Transit Agency	Pinellas Suncoast Transit Authority (PSTA) – Direct Connect Program
Location	Pinellas County, Florida (St. Petersburg/Clearwater)
Mode	Commuter Bus, Demand Response, Taxi, Bus
Total Population	850,758
Area Square Miles	348
Population Density	3,347 Persons Per Square Mile
Ridership Per Year	14,503,728
# of bus routes	42
# of passenger miles	70,933,094
# of vehicles	167

Agency data reflects 2014 information reported to the FTA.

In 2016, executives from the Pinellas Suncoast Transit Authority (PSTA) paved the way for what would become the first subsidized first/last mile TNC Partnership in the United States[xxii]. Known as the Direct Connect Program, customers within designated zones were provided the opportunity to take subsidized trips to/from select bus stops operated by PTSA using Uber.

Direct Connect emanated from savings achieved from the elimination of PTSA's East Lake Connector service, which was a curb to curb service that deviated up to ¾ of a mile from a regular route that used 14 person minibuses[xxiii]. The Connector was a poor performing route, having averaged only 26 riders per day and costing $160,000 to operate. Direct Connect began with a $40,000 investment for an initial six month pilot program[xxiv].

During the first 6-months of the pilot, PSTA offered a 50 percent subsidy, up to a maximum of $3, to customers who used Uber, United Taxi (a local taxi operator), or Care Ride (an ADA accessible transportation provider). Trips had to begin or end at a designated transit stop within two designated zones between 7AM and 7PM, Monday through Saturday. Any incremental cost exceeding the maximum discount of $3 was charged to the customer.

Uber trips could be requested through the standard Uber application available on iOS and Android devices. A "PSTA" option had been added to the app locally within the designated zones. Once customers opened the Uber application they had to slide to the "PSTA" option to access the discount. The other option was to either call United Taxi or Care Ride[xxv].

Outreach was an essential component of the program, as riders initially didn't know where and how to access Direct Connect, nor were they knowledgeable of the geographic region in which the subsidy was applied. Through the help of Uber's program marketing team, efforts to educate the public of the program's benefits were taken which, in turn, helped boost ridership[xxvi].

The first experiment with ridesharing through the Direct Connect program was deemed a success; Direct Connect also received a "Future of the Region Award" for transportation and mobility by trying to solve the first-mile/last-mile within the St. Petersburg region[xxvii], and the program was unanimously approved for a second pilot with an expanded service area throughout Pinellas County. The expansion involves an increase in the subsidy to $5 per ride and includes six additional zones (for a total of eight) that together cover all of Pinellas County. Each zone is roughly 10 square miles in area, and one bus stop within each zone is served by Direct Connect. The eight stops served by the Direct Connect pilot were chosen because they are centrally located within each zone and serve a bus route that provides frequent service[xxviii]. In addition to Uber, United Taxi and Care Ride, two other service providers were added to the program: Lyft and Wheelchair Transport.

By the end of 2017, daily ridership was approaching 1,000 passengers per month, after having initially attracted 200-400 monthly riders from February to April 2017. However, PSTA officials do recognize that the current cost structure is a barrier for some potential passengers, and is perhaps inhibiting ridership growth. As the program evolves in 2018 and is slated to expand further into other communities, PSTA is looking to revisit the $5 subsidy cap and cover additional costs. Although there is no true measure that PSTA can use to demonstrate they as an agency are currently saving money in operating costs compared to when they operated the East Lake Connector, the Connector's $54 average passenger trip cost was extremely high and the assumption is that PSTA is in a better financial position as a result of Direct Connect by only having to pay out $5 per trip as a subsidy.

Case Study – Summit, New Jersey – Commuter Ridesharing Program

Municipality	Summit NJ - Dynamic Ridesharing Program
Mode	N/A
Total Population	21,869
Area Square Miles	6.046

Population Density	3,646 Persons Per Square Mile
Ridership Per Year	N/A
# of bus routes	N/A
# of passenger miles	N/A
# of vehicles	N/A

Source: US Census.

Summit, New Jersey, small suburban city 20 miles from Manhattan, sought to develop an alternative, reliable means for their resident commuters to get to and from the Summit Train Station to access New Jersey Transit rail service. Summit officials were also interested in determining if a dynamic ridesharing service could serve as an affordable cost alternative to creating traditional parking infrastructure, such as their city-owned surface lots and structured garages. In October 2016, Summit launched the Resident Commuter Ridesharing Program, a partnership with Uber that provides subsidized TNC trips to and from the Summit train station during morning and evening commuting hours.

As this was a pilot program, it was initially very limited, open to a maximum of 100 Summit resident long-term commuters. In order for a trip to be eligible, it was restricted to participant rides originating or terminating in Summit going to or from the Summit train station. Rides were capped at two per weekday and all trips were scheduled on-demand. Commuters who had purchased a monthly parking pass for $80 were not charged for their Uber rides to and from the station. Commuters who had purchased a $4 daily parking pass were charged a $2 flat rate per ride through his/her Uber account. These parking user fees subsidized the commuter's trips to the station. Participants could access the benefit via a standard Uber application on iOS or Android device.

There was no data collection on user demographics as part of the pilot program, nor has there been any collection of origin or destination data. As part of the service agreement, Uber agreed to provide anonymized aggregate data on a monthly basis for all trips taking place within the pilot, including the total monthly trip count, fare price, duration, distance and actual arrival time[xxix].

The City of Summit hoped that the program would save $5 million in taxpayer dollars over 20 years by averaging 200 rides per week, which would open up 100 parking spaces at the Summit Station that were previously being used. Over the first six months, 30 parking spaces were freed[xxx], enabling more people to park in town to shop or do business. From a consumer perspective, customer satisfaction was very high, with about 70% of participants saying they were very satisfied with the program[xxxi]. As a result, Summit decided to extend the program an additional six months.

Additional Examples of First-Mile/Last-Mile Connections to Commuter Rail Stations and Bus Stops

- Phoenix, Arizona - In October 2017, the City of Phoenix, AZ announced a partnership with Lyft to address first mile/last mile gaps in areas on the periphery of the city's bus network. Passengers who lived within the pilot project area were eligible for a 20% discount on their Lyft trip to a "transit transfer area" where passengers could transfer to Valley Metro bus routes. Other than the defined service areas and the use of geofencing, these trips were standard Lyft trips, and did not offer additional options to those without smartphone access or for passengers requiring accessible vehicles.
- Centennial, Colorado - In August 2016, the City of Centennial, CO initiated a six-month pilot program providing commuters with free Lyft Line rides to its Dry Creek light rail station weekdays between

5:30AM and 7:00PM. The $400,000 program was funded equally by the City of Centennial and Denver South Transportation Management Association[xxxii]. The program replaced a prior city owned demand responsive vanpool service. RTD, the operator of Denver's light rail and bus system, contracted with a separate operator to provide ADA rides[xxxiii]. The program averaged 11 rides per day at an average cost of $4.75 per passenger for Centennial, compared to 50 passengers daily who used the previous vanpool service at a cost of $21 per passenger. The lack of ridership was attributed to lack of awareness of the program[xxxiv]. Light rail ridership at the Dry Creek Station increased by less than 1%[xxxv].

- Southeastern Pennsylvania Transit Authority (SEPTA) – During the summer of 2016, SEPTA partnered with Uber to provide trips to 11 suburban train stations. Passengers using the service were eligible for a 40% discount, with a maximum discount of $10. The brief pilot program resulted in an increase in the number of passengers traveling to these train stations[xxxvi].

- Altamonte Springs, Florida – Located about 10 miles from Orlando, Altamonte Springs partnered with Uber in 2016 to provide discounts to passengers whose origin and destination were in Altamonte Springs. Using geofencing, any ride that was between points in Altamonte Springs was discounted by 20%; any trips going to the local commuter rail station received an additional 5% discount. The project was locally funded and cost $500,000 [xxxvii]. In 2017, the project expanded to include four other neighboring municipalities[xxxviii].

Potential Applications for Westchester County

Partnering with TNCs to provide access to train stations could have potential in Westchester County as a way to reduce demand on local parking facilities and provide more options for accessing the stations. The use of TNCs could become part of an overall parking management strategy for a municipality. One approach would be to follow the Summit model, with a municipality being responsible for administering the program, instead of County government.

The model of providing trips to train stations as a replacement for Bee-Line routes with low ridership could be appropriate. As in the Summit model, eligible riders could pay a monthly fee, possibly less than the monthly parking fee, as an incentive to use the service, and be allowed a certain number of trips per month via a TNC. Many issues would need to be worked out, such as maintaining a Uniticket option with Metro-North. So as not to have a negative impact on traffic congestion, shared rides should be required to the extent possible. There would also need to be an arrangement for occasional riders.

If the service were designed to provide trips to train stations, as a supplement to existing Bee-Line service, it would be necessary to ensure that the TNC operated services would not adversely impact existing Bee-Line ridership. Complex geofencing would also be required, which may not suit the interests of potential local municipal partners.

While the Phoenix example provides a noteworthy attempt to use TNCs to bring people to bus stops, the applicability to Westchester County is limited at best. The Phoenix program was implemented to serve areas with high population densities that were not in close proximity to transit, and the connections were offered to hubs where multiple bus routes provided passengers access to the broader transit network. Unlike Phoenix, most areas in Westchester County without close proximity to Bee-Line routes are in the northern portion of the county; in these areas, the few bus routes operate with limited frequency due to low-density land use.

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Off Peak Jobs Access

Off peak job access been a long-standing challenge for transit agencies, as many transit operators provide little or no service during pre-dawn, late night, and even midday timeframes. However, workers still need to access their place of employment during these timeframes, especially those who don't have access to a personal vehicle. Thus, efforts involving the subsidizing of TNC rides to accommodate work shift times outside normal transit system hours have recently begun, with the intended purpose of helping the low-income population overcome transportation barriers to employment.

Case Study: Pinellas Suncoast Transit Authority (PSTA) – TD Late Shift Program

In addition to their previously discussed Direct Connect Program, PSTA also initiated a partnership with Uber called TD Late Shift. The TD Late Shift Program complements fixed route service, as it is in operation during overnight hours when there is no bus service available. Its goal was to provide service to economically disadvantaged riders, especially second/third shift workers who have no access to personal vehicles. The program is Uber's first ever partnership with a public agency that utilizes technology allowing riders to access the program without a smartphone or a credit card[xxxix]. The program was funded through a $300,000 state grant[xl].

In order to qualify for the benefit, Late Shift Program participants must be enrolled in PSTA's Transportation Disadvantaged (TD) program, and purchase a discounted bus pass every month (good for 31 days at a cost of $11 per month). Participants must meet certain income qualifications – annual incomes for customers may not exceed $18,900 annually as a single person, or $36,900 for a family of four.

The $11 monthly discounted bus pass enables participants to schedule on-demand trips between the hours of 9PM and 6AM at no additional cost. Eligible customers may take up to 23 on-demand trips per month. In addition, participants have the option to take one daytime Uber trip per month (for qualifying circumstances) for $3.

Participants use the standard Uber application on iOS or Android devices and use coupon code "PSTA" to access the benefit. For riders who do not have smartphone access, both Uber and United Taxi are available through a telephone dispatch, allowing PSTA customers to call Uber to book a ride with the cost billed through PTSA.

PSTA is very satisfied with the results of the program, and secured an additional $500,500 grant to expand it for 2017-2018[xli]. Late Shift generated nearly 50,000 rides between August 2016 and December 2017, and was averaging about 4,000 rides a month at the end of this timeframe. PSTA's ability to remove significant barriers for low-income individuals in accessing services was also a significant achievement, as Uber's call-in dispatch enabled PSTA to live up to their obligations under Title VI to ensure that alternative methods of payment and reservations were available.

The cost benefit to PSTA is not entirely clear due to complex policies in place in Florida stipulating maximum reimbursement rates for taxi companies, TNCs and ADA services. However, PSTA staff indicated that they are incurring a cost to operate this program, and they are considering an additional co-pay for passengers purchasing the discounted bus pass to support the program in 2018[xlii].

Potential Applications for Westchester County

A major attribute of the PTSA program was its link to eligibility for an income restricted bus pass, which is not available in Westchester County. However, there are operational elements to the PSTA Late Shift program that may be applicable to Bee-Line, as certain routes operate trips with very low passenger volumes during late evening, mid-day or evening timeframes. The PSTA Late Shift program model could potentially be used to fill in such gaps in service. If Westchester County were interested in pursuing a similar approach, policy decisions regarding how such a service would be structured to ensure such trips are priced comparably to Bee-Line would have to be determined, as would the model to be used to best satisfy ADA requirements.

Market Expansion through Micro-Transit

Market expansion can be a challenge for transit operators. With the vast majority of funding for transit directed toward the operation of current services and the maintenance of transit assets in a state of good repair, little room in the budget is typically left for systems to expand service. Some agencies require any service expansion to be entirely paid for through existing budgets, meaning that the addition of service on one route would necessitate a cut elsewhere. Yet, cutting service is also a very difficult process, even if entirely justifiable based on ridership patterns.

The inherent challenge of a fixed route system is that once a route is established and passengers incorporate the service into their daily lives, it is very hard to take it away. Doing so not only disenfranchises existing riders, but is politically difficult, as politicians will work to protect the services already in place for their constituents. Furthermore, when service on a bus route is reduced, existing riders from the trips that are cut do not necessarily take other trips on the bus route. Instead, the service is perceived as less convenient and riders abandon the system.

One innovative approach that has been attempted to expand service is a different type of partnership between a TNC and transit operator, in which the TNC provides a micro-transit service that provides flexibility beyond an existing route structure. This arrangement can incorporate a flexible service within an area with established routes, allowing new transit markets to theoretically develop organically.

Case Study - Kansas City Area Transportation Authority - *Ride KC: Bridj Pilot Program*

Transit Agency	Kansas City Area Transportation Authority (KCATA)
Mode	Demand Response, Demand Response - Taxi, Bus, Bus Rapid Transit, Vanpool
Total Population	748,415
Area Square Miles	332
Population Density	1,472 Persons Per Square Mile
Ridership Per Year	16,313,457
# of bus routes	89
# of passenger miles	61,905,009
# of vehicles	223

Agency data reflects 2014 information reported to the FTA.

In March 2016, the Kansas City Area Transportation Authority (KCATA) launched a demand-responsive micro-transit service partnership with Ford and Bridj, a TNC that had previously begun operating in Washington, D.C.

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and Boston. The partnership featured Ford transit passenger vans built locally in Kansas City, and a technology platform developed by Bridj that was used by customers to schedule trips.

Ride KC: Bridj aimed to provide a new mobility option to numerous neighborhoods in and near Midtown Kansas City, and to improve connectivity between the Midtown area and Kansas University's Medical Center neighborhood; these two areas were not previously connected by one-seat transit trips. Unlike the Bridj service in Washington, D.C. and Boston, where Bridj was operating between areas where there was no direct transit service in an independent fashion (and charging higher fares than those offered by public transportation), Ride KC was subsidized by KCATA and had fares set at the same $1.50 as the fare for a single bus trip. To promote the service, riders were offered their first 10 rides for free.

The year-long pilot began in March 2016. Service was provided during AM and PM peak timeframes – 6:30 to 9:30AM and 3:30 and 6:30PM. Once riders access the Bridj application via their iOS or Android device, they would input location/destination, choose from a list of prearranged pick-up times, and receive walking directions to a nearby "pop-up" shuttle stop where a 14 passenger van would arrive. Trips could either be scheduled on-demand with an average wait time of 5-10 minutes, or they could be reserved up to 24 hours in advance. The cost to KCATA was $25 per revenue hour per vehicle; the service was fully operated by KCATA employees and union members, and utilized ADA accessible vehicles[xliii].

The Ride KC: Bridj program, did not meet ridership expectations. In comparison to the 200 daily rides KCATA projected would occur during the first six months of the pilot program, Ride KC: Bridj provided 597 total rides, which amounted to just under 5 per day[xliv]. Ridership increased slightly over the next six months to 783 rides, or about 6 rides per day. In total, the service provided 1,480 rides[xlv], equating to just under 6 passengers each day. At the conclusion of the pilot, Ride KC: Bridj ceased operations. Although the service did not prove to be sustainable from a ridership perspective, it was widely praised for its innovation. KCATA officials considered the pilot a success, stating that their top priority for the project was not strong ridership; it was to learn who uses on-demand transportation services[xlvi].

As part of the program agreement, Bridj shared all data with KCATA, including user demographics, origins/destinations, average response times, total trips per month and total invoiced. In addition to performance data, KCATA partnered with the Transportation Sustainability Research Center (TSRC) at the University of California at Berkeley to produce a survey of Bridj users and interested customers who signed up for the Bridj app. The survey was performed during the course of the first six months of the pilot.

The survey indicated that Bridj users were demographically distinct from the average KCATA passenger, as users of Bridj where younger, wealthier, and Caucasian. However, the report also indicated that the needs of riders were not being met, with 31% saying it did not operate when they needed to travel and 76% saying it did not operate where passengers needed to go. This was also reflected in the relatively low customer satisfaction reported, as the percentage of people reporting being satisfied was 39%, which was the same percentage reporting dissatisfaction.

Insufficient marketing was also an issue for Bridj, as the report indicated that passengers learned through sources other than KCATA, such as local media about the existence of the program[xlvii]. Another possible reason for the lack of ridership is rooted in the underlying commuting trends that are present in the Kansas City area. Not only do just about 1% of Kansas City residents use public transportation to get to work, but the Kansas City

region has the fastest commute times (about 23 minutes) out of the country's 50 largest metropolitan areas[xlviii]. The relative ease of commuting by car in certain locations generates a limited market for transit and highlights the challenges faced in attracting users to a shared ride system.

Although not sustainable over the long term, the Ride KC program did display how labor unions could be successfully integrated with a transit/TNC partnership. KCATA engaged with labor unions early in the service exploration phase and budgeted for a longer timeline to provide for labor negotiations. Ultimately, KCATA was able to strike a deal with the Amalgamated Transit Union (ATU), and the service utilized union drivers[xlix].

Potential Applications for Westchester County

Bridj's attempts to create new direct connections have potential applications in Westchester County, especially in instances where there is a single major trip generator that is attracting passengers from more isolated locales without one-seat commuting options. One example is Westchester Community College, which has expressed interest in improved public transportation from locations such as Tarrytown, Ossining and New Rochelle that require long trips on Bee-Line with transfers that can be arduous, particularly during timeframes with limited service. But much like access to train stations, such an arrangement would likely need to be between a TNC and Westchester Community College, and be geofenced in a way to avoid pillaging current Bee-Line passengers.

Although Bridj demonstrated how a new service can incorporate existing labor, current operating arrangements in Westchester County would need to be revised if the operator of Bee-Line service were to incorporate smaller vehicles such as those Bridj used, and provide a demand responsive service in addition to the fixed route service.

Technology Platforms

Beyond partnering with TNCs to provide mobility services, transit agencies have also begun to recognize that the technology platforms offered by TNCs and trip planning software companies can also be valuable tools and present partnership opportunities. There are a few general approaches to TNC/Transit Partnerships that are technology based:

- TNCs provide their service, but passengers can use the transit provider's app to connect to the TNC service, which often is geared to first mile/last mile connections. Examples include Dallas Area Rapid Transit, which allows passengers to access Uber and Lyft through DART's mobile ticketing and trip planning application; also, Atlanta's MARTA system cross promotes with Uber and Lyft, and offers discounts for first time users and in association with certain special events.
- Transit software companies such as Trapeze and RouteMatch have begun to roll out apps with integrated platforms that allow riders to book public transit service with a first mile/last mile connection using Uber and Lyft with the convenience of a single payment.
- Transit operators can also partner with technology companies or even TNCs to develop their own unique approach to operations that allows transit providers to operate services in manners similar to micro-transit using their own vehicles:

Case Study – Austin Capital Metro – Pickup

Transit Agency	Austin Capital Metro- Pickup/Via Partnership
Mode	Light Rail, Bus, Bus Rapid Transit, Paratransit
Total Population	1,163,204
Area's square miles	535
Population Density	3,358 Persons Per Square Mile (metropolitan area)
Ridership Per Year	30.5 million
# of bus routes	82
# of passenger miles	144.8 million (2015)
# vehicles	404 buses, 171 paratransit

Source: Capital Metro Fast Facts.

Capital Metro in Austin, Texas has recently begun a pilot partnership with Via, a New York City based ridesharing company that offers a technology platform that allowed Capital Metro to test a new service model. In this partnership, Via developed a mobile app allowing for trips to be requested, utilizing their proprietary technology to allow passengers to be matched and for rides to be shared.

Prior to the Via Partnership in 2016, Capital Metro introduced a new flexible pilot service called MetroFlex, which served its Upper East Side neighborhoods as a replacement to a previous on-demand, subsidized taxi program that was closed out due to its inability to guarantee equivalent service for ADA eligible customers. The route, which was open to all, was a spin on traditional shuttle bus which allowed for deviations off of its regular routing to pick up and drop off passengers who lived outside of the defined route[l]. MetroFlex was a six month pilot program, and operated only on Thursdays and Saturdays using rebranded shuttle vehicles; passengers could either board at traditional bus stops along the route, or call Capital Metro by phone to request a pick up in the off-route service area. The program was not successful, as they only averaged 40 passengers a day on the route, and only 1 passenger daily calling to request a flexible pick-up, compared to expectations of 4 flexible pickups or drop offs per hour[li].

Following the completion of the MetroFlex pilot, Capital Metro began a new service called Pickup, which utilized Via's technology platform and enabled Capital Metro to provide on-demand trips to any location within a defined geo-fenced area covering much of the service area of the defunct MetroFlex service. As part of the agreement, passengers without smartphones could call Capital Metro to request Pickup rides[lii]. The service was to utilize 9 passenger minibuses owned by Capital Metro, and assign drivers who were already contracted by Capital Metro for paratransit operations[liii]. The agreement with Via was intended to test the program and the use of Via's platform as a pilot to demonstrate its possible applications for transit agencies, it thus was provided to Capital Metro for no cost[liv].

Pickup service started in June 2017, and was to last 12 months. Passengers requesting a Pickup trip were to expect vehicles to arrive within 15 minutes of the request. During the pilot period, service was available on Tuesdays, Thursdays and Saturdays between 9AM and 6PM, and was free to passengers; the program has since expanded to 6 days a week (no Sunday service), with expanded hours of 7AM to 7PM on weekdays and 10AM to

5PM on Saturdays, and an expansion of the service area to include one Light Rail train station to test whether Pickup can provide an effective first mile/last mile solution[lv].

According to Capital Metro Staff, the Pickup program initially attracted 400 passengers upon starting up in June 2017. During October 2017, that figure grew to 1,100 passengers, when the program expanded to six days per week. By December 2017, ridership amounted to 2,000 passengers for the month, serving an average of 3 passengers per hour. Although Pickup serves the general population, 14% of users are eligible for Austin's paratransit program; the cost per passenger trip is $28, and that produces a savings for would-be paratransit users, as those trips are about $50 per passenger. The cost of the program to Capital Metro as of December 2017 was about $50,000; as of the publication date of this report, it was too early to evaluate other financial performance metrics[lvi].

Case Study – Cherriots West Salem Connector - West Salem, Oregon

Transit Agency	Salem Area Mass Transit District (Cherriots)
Mode	Bus, Demand Response
Total Population	236,632
Area's square miles	43
Population Density	3,114 Persons Per Square Mile
Ridership Per Year	3,927,117
# of bus routes	29
# of passenger miles	121,910,607
# vehicles	54 buses

Agency data reflects 2014 information reported to the FTA.

Cherriots, the transit agency serving the Salem, Oregon region, launched the West Salem Connector pilot project in June 2015. The project was developed to replace two bus routes that were underperforming and hard for passengers to access, with a new West Salem Connector shared-ride service. One of the key components of the program was the partnership with the technology company, DemandTrans Solutions to provide software for customer trip planning and service deployment, allowing Cherriots to operate a system using an approach commonly used for paratransit to serve the general public.

West Salem Connector users reserved trips online, with an option for passengers to make reservations by phone. The reservations were input into the DemandTrans software, which devised trips and provided drivers with their routes via mobile data terminals.   Passengers would walk to a designated pick-up point, and pay their fare on-board.

The West Salem Connector was operated by Cherriots, utilizing 14 passenger vehicles that had been retired after being used for paratransit operations. Trips were designed to operate up to three times hourly based on demand. If no reservations were made, the bus would not make a trip. The service was designed for vehicles to layover hourly at a transit center where transfers to the fixed-route system would take place. An exception was made for passengers transferring to the Connector at the transit center, who could board without needing to book their trip in advance.

The software cost about $15,000 per year. From a technology standpoint, the pilot program was a successful demonstration. There were growing pains, including the need to replace the on-board tablets recommended by

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DemandTrans after they did not work as anticipated and needed to be replaced. Riders also indicated their preference for a dedicated app, which DemandTrans did not offer. There were also challenges with limited opportunities for some passengers requesting trips far in advance of their preferred trip times. However, the software worked well enough to enable it to be extended through the end of 2017. Riders also appeared to have reported other benefits, including reduced wait times for trips and pick up/drop off locations closer to their homes[lvii]. Customer satisfaction was also generally positive.

Through its first 21 months of operation, the Connector cost about $234,000 to operate, which was about $130,000 less than it cost to operate the fixed routes that were eliminated. However, the Connector was not efficient to operate, as the cost of the Connector was $17.65 per trip compared to $9.40 for the previous fixed route service. Higher costs were attributed in part to overly burdensome maintenance costs for the older vehicles that averaged 5 times the normal cost.

From a ridership perspective, the service was also viewed as unsustainable, even though the ridership targets originally set by Cherriots were met. The Connector averaged only 3.5 passengers per hour and 52 daily boardings, compared to 10.4 passengers on the fixed route trips with 86 daily boardings[lviii].

Ultimately, the service was discontinued due to poor financial performance. It was replaced at the beginning of 2018 as part of a system makeover of the Cherriots fixed route bus network that included new routes in areas that had been served by the Connector.

Potential Applications for Westchester County

A technology platform partnership presents interesting possibilities for Westchester, similar to the market expansion allowed using a micro-transit approach. But the barriers are if they require flexibility in the use of a vehicles and labor.

One potential path forward for Westchester County could involve integration with TNC apps that allows Bee-Line to cross promote their services and provide discounts during certain hours of day. Such discounts could be specifically targeted to areas where gaps in transit service have been identified, or geared towards times of day when Bee-Line routes in an area are not operating. Such an approach would have to be structured in a manner that does not adversely affect Bee-Line ridership. Equity issues with routes that provide more robust service would need to be addressed as well.

Paratransit

Transit systems are also partnering with TNCs to provide paratransit trips as an additional service. As ambulatory paratransit services often incur high per-passenger trip costs, transit agencies have begun to partner with TNCs in an effort to realize operational savings. These programs can offer customers same day scheduling as opposed to the 24-hour reservation most paratransit service providers require. Furthermore, agencies that have been utilizing TNCs to augment their paratransit programs are finding that they have improved the customer experience and provided more broad and convenient access to jobs, education and other points of interest[lix].

Case Study - Massachusetts Bay Transportation Authority (MBTA) + Uber/Lyft

Transit Agency	Massachusetts Bay Transportation Authority (MBTA) - The Ride - Uber/Lyft Partnership
Mode	Heavy Rail, Light Rail, Bus, Bus Rapid Transit, Trolleybus
Total Population	4,181,019
Area's square miles	3,244
Population Density	5,000+ Persons Per Square Mile
Ridership Per Year	409,248,438
# of bus routes	177
# of passenger miles	1,847,714,947
# vehicles	1,286

In October 2016, the Massachusetts Bay Transportation Authority (MBTA) launched a pilot program with Uber, Lyft and other Boston-area Taxi companies to provide customers of The Ride, MBTA's paratransit program, options to use on-demand service. The program made wheelchair accessible vehicles available upon request and enabled registered users to book same-day reservations, as opposed to a 24-hour reservation. The goal of the pilot was to reduce operational costs and to provide customers with on-demand service.

For MBTA, every time a customer decided not to use a traditional paratransit vehicle and instead opt for a ride with a TNC, the agency was compensated for the difference. For all eligible trips, customers paid the first $2.00 of the trip and the MBTA covered the remainder of the fare up to $15. After the first $15 for each ride, riders were responsible for any additional charges. The public subsidy to the TNC was up to $13 a trip.

Participants book rides through Uber and Lyft's smartphone applications. For customers not using smartphones, MBTA worked with Lyft to create Lyft Concierge, which allowed customers to contact a call center via phone to book the Lyft trip. Uber took a different approach by providing a limited number of free smartphones[lx].

The agreement with Uber/Lyft requires that they provide anonymized aggregate data on a monthly basis for all trips taken within the pilot, including the total monthly trip count, fare price, duration, distance and actual arrival time. MBTA collected demographic data through The Ride database, as well as origin and destination data at the zip-code level[lxi].

The MBTA was very satisfied with the results of the program, as they were able to provide more rides, save money as an agency, and save their customers time and money. Over the first five months, customers took a total of 10,000 rides, with an average time savings amounting to 34 minutes per trip. MBTA reported a 28% increase in the total number of trips taken while achieving an overall cost reduction of 80% on the cost of each trip and a total savings to The Ride program of 6%[lxii]. Additionally, MBTA has launched a second 6-month pilot that resulted in the doubling of its ridership to 20,000 in 2-months[lxiii].

Potential Applications for Westchester County

The MBTA model provides a promising framework for TNC partnerships with agencies providing paratransit, and is similar to the ParaTaxi program launched by Westchester County in 2011, which allows eligible paratransit users to take a taxi if they are ambulatory. Such a model wouldn't be directly translated to fixed route operations for Westchester County, as doing so would directly siphon passengers from the fixed-route system. Yet, MBTA does demonstrate how a TNC partnership model can achieve the concurrent goals of increased ridership, time and cost savings. MBTA also seems to have successfully found approaches to addressing equity issues for their users, allowing them to make reservations by phone and using traditional apps.

Conclusion

The research and case studies presented in this report clearly demonstrate that innovative and creative approaches to addressing first mile/last mile connections have been implemented across the United States through the use of TNCs. Although there are many challenges and barriers that must be overcome, transportation planners and transit agencies have found ways to work around them to meet their unique needs.

A successful TNC partnership model for Westchester County should lead to more users being served while concurrently achieving cost efficiencies. Most likely, the appropriate model would involve specific elements from several of the examples discussed above. Questions to address include: Which elements of TNC partnerships elsewhere can be applied to a program that Westchester County may look to develop? How can savings achieved from such partnerships be best reinvested into the existing system? How can partnerships with TNCs be structured to ensure that they complement rather than compete with fixed route services not intended to be included in such partnerships? What levels of subsidy, if any, would be necessary to keep costs reasonable to passengers? How would Westchester County fund such subsidies or pay for any new expenses that they would potentially incur?

Based on the performance review of Bee-Lines routes discussed earlier, it appears that the most appropriate market to be served with TNCs should be those presently served by the Bee-Line shuttle and loop networks, as well as certain markets for transit service which are currently underserved.

An unknown factor is whether any particular model or approach is sustainable over the longer-term, as it is impossible to predict how the TNC industry will continue to evolve, given how fast the evolution has been in the five years since Uber launched service in San Francisco in 2011.

As stated earlier, issues to be addressed include ADA compliance, equity, labor union and other regulatory and contracting issues. Furthermore, the examples provided in this report highlight the correlation between operational flexibility and the ability to be innovative in designing TNC partnerships. Agencies that have staff or fleet that can be shifted among services have an advantage in working with TNCs; those that don't have to consider more complex issues and perhaps even additional contracts to satisfy regulatory requirements such as ADA needs. Westchester County, as it moves forward, should investigate whether it can achieve any additional flexibility that may pave the way to supplementary partnership opportunities.

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