



THE BENEFIT OF E-SCOOTERS DURING THE L TRAIN SHUTDOWN

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EXECUTIVE SUMMARY

On June 29, 2017, Governor Cuomo signed an executive order declaring a state of emergency for New York City's subways, triggering \$1 billion to expedite sorely need repairs.¹ Since then, the system has continued to be plagued by more than 1,000 major incidents—defined by the MTA as "incidents that delay 50 or more trains"²—peaking in January at 105. As a result, the MTA is battling a reputation of chronic unreliability. To compound this issue, on April 27, 2019, New York City Transit will suspend service on the L train between Bedford Avenue in Brooklyn and 14th Street/8th Avenue in Manhattan. The shutdown, expected to last 15 months, will impact 125,000 riders³ (equating to 250,000 daily one-way trips) traveling between Manhattan and Brooklyn. Any subway line shutdown is disruptive, but the L train closure will be particularly difficult for riders as it is one of only two lines with exclusive tracks, and one of only three crosstown Manhattan subway lines—what transit experts are calling New York City's greatest transit challenge in a generation. Despite plans by the City and the MTA to mitigate disruption, nearly 95% of surveyed L train riders fear the shutdown will make their commute significantly longer and more stressful.⁴

Meanwhile, 2018 signaled the start of the micromobility revolution on the streets of cities around the world. Micromobility services provide highly-accessible, personalized modes of motorized transit for short distances, alleviating two problems that plague most cities: traffic congestion and first and last mile transit gaps.⁵ In short order, e-scooters have taken off as the micromobility mode of choice, with sharing services gaining rapid acceptance and high market demand because they are affordable, accessible, and easy to use. For cities, e-scooters are an environmentally-friendly, low-cost solution to addressing transit gaps. Altogether, all signs indicate that e-scooters could be particularly helpful to L train riders during the L train shutdown, providing quick, fun, and affordable travel to transit alternatives that might otherwise be just out of reach.

As the nation's leading shared electric scooter ("e-scooter") provider and micromobility industry leader in cities across North America, Bird is uniquely positioned to provide a viable and impactful solution for the L train's impacted ridership. Bird's e-scooters ("Birds") are particularly well-suited to address what transportation planners call "first and last mile" connections, which refer to the travel mode that individuals take to get to and from a transit hub at the beginning or end of their trip. Birds are easier to use than bicycles, and Bird's dock-less equipment gives riders the flexibility to pick-up and drop-off scooters in convenient locations for their first and last mile connections. In fact, Bird's low barrier to entry with regard to both safety and cost

¹ Fitzsimmons, Emma. "Cuomo Declares a State of Emergency for New York City Subways." *The New York Times*, 29 June 2017, www.nytimes.com/2017/06/29/nyregion/cuomo-declares-a-state-of-emergency-for-the-subway.html.

² MTA, 2018, *MTA Dashboard*.

³ MTA New York City Transit, 2018, *Canarsie Tunnel Project: Supplemental Environmental Assessment and Section 4(f) Review*.

⁴ Global Strategy Group, 2018, *L Train Survey*.

⁵ First and last-mile transit gaps refer to the beginnings and ends of transit trips, or the distance between transit and the rider's origin and destination points. Reducing this gap to a quarter-mile—the distance most often accepted as a comfortable walking distance—is often challenging for cities.

make it especially appealing to women and lower income users. Birds are overall an ideal transportation option to help impacted L train riders quickly travel to their nearest alternate subway station, bus stop, or ferry terminal.

Bird engaged HR&A Advisors, Inc. (“HR&A”) to study the potential benefits and impact of a proposal to deploy Bird shared e-scooters to address the urgent and looming problem of the L train shutdown. This study—which analyzes the potential deployment of Bird e-scooters along the L train corridor as part of a broader New York City e-scooter pilot—introduces the concept of e-scooters as an important, innovative transportation mitigation strategy in preparation for the L train shutdown. HR&A is an industry-leading public policy, real estate, and economic development consulting firm that has provided strategic advisory and implementation services for some of the most complex public policy and development projects across North America and abroad. HR&A’s analytic work was supported by Nelson\Nygaard, a nationally-recognized transportation firm that engages in holistic planning for all modes of transportation, with experience that includes improving first/last mile access, planning for shared mobility and analyzing trip data, and updating curb management policies to reflect the changing demands for access.

Proposal

As part of a broader New York City e-scooter pilot, a deployment of e-scooters has the potential to uniquely serve and benefit commuters most impacted by the L train shut down. The deployment would serve an area of approximately five square miles, which encompasses 110,000 residents from neighborhoods including Williamsburg, Bushwick, and Ridgewood. These three initial deployment areas—described as Home Zones in this report—are locations where Birds would be most helpful in getting displaced riders to an alternative subway station, in most cases on the J/M/Z lines. At \$1 to unlock and \$0.15 per minute to ride, with discounts for low-income riders, Bird would provide convenient, quick, and critically-needed first and last mile service.

Benefits by the Numbers

E-scooters will provide an important transportation option for L train riders most impacted by the shutdown, saving riders time and money, reducing congestion, and helping the environment. Benefits likely to accrue to L train commuters within the context of the shutdown, rather than the full suite of benefits the pilot program as a whole may provide, include:

- **Bird will provide a better travel option for 5,500 daily commuters and serve up to 33,000 daily trips.** The L train deployment would attract approximately 11,000 one-way work-related trips and up to 33,000 total daily trips.
- **Riders will spend less time commuting and more time living, working, and playing.** The 5,500 riders would save a combined 1,300 hours per day by taking Bird from their home to an alternative subway line, which translates to an average of 15

minutes per day—enough time for a quick grocery run, or the difference between being late or on-time for daycare pick-up. Altogether this translates into an average 15% reduction in commuting times per Bird user and \$4.6 million⁶ per year in value of time saved.

- **Birds will benefit low-income commuters by providing an affordable and reliable first and last mile connection.** Residents in neighborhoods farther east on the L train line—including East Williamsburg, Bushwick, and Ridgewood—have longer commutes and fewer alternative transit options than commuters in neighborhoods like Williamsburg. In addition, many of these residents are hourly workers who have less flexibility with their work schedule. To ensure Bird is affordable, the OneBird program offers reduced pricing for eligible low-income riders.
- **Bird trips will help keep 1,500 additional cars off the City’s congested roads.** Bird trips could help reduce 9,000 vehicle miles traveled per day—comparable to nearly 1,500 vehicles and 7.25⁷ metric tons of daily Carbon Dioxide Equivalent—compared to the L train shutdown without Bird, reducing congestion and improving air quality.

⁶ Value of time saved is estimated by assigning a \$15 monetary value to each hour saved—reflective of New York City’s minimum wage effective December 31, 2018 for employers of 11 or more staff—multiplied by an assumed 260 working days per year.

⁷ Carbon Dioxide Equivalent is estimated using the mobile GHG emissions calculator of the NYC Environmental Quality Review (CEQR) Technical Manual, which estimates the Carbon Dioxide Equivalent in metric tons based on road type, vehicle type, and borough. For this analysis, it is assumed that half the trips will be made by private vehicles and the other half by taxi, distributed evenly among Manhattan, Brooklyn, and Queens local roads, resulting in an average emissions factor of 0.0008 metric tons of CO₂ per VMT.

WHAT'S A BIRD?

The Rise of Shared E-Scooters

The rapid rise of e-scooters in 2018 has sparked a micromobility revolution on the streets of cities around the world. Micromobility services provide highly-accessible, personalized modes of motorized transit for short distances, alleviating two problems that plague most cities: traffic congestion and first and last mile transit gaps. Micromobility platforms have existed for decades—tracing back to the Segway and appearing more recently in the form of hoverboards, electric unicycles, and electric skateboards. However, these other modes have not seen the same success as e-scooters due to high purchase costs and challenges of operation. E-scooter sharing services have attracted rapid acceptance and high market demand because they are affordable, accessible, and easy to use. E-scooter sharing services operate in a similar way to dock-less bike share, allowing users to rent e-scooters for short rides (typically one to two miles) without searching for docks to park their equipment.

E-scooters are expected to continue growing in ridership because they provide benefits that other modes of transit do not. For cities, e-scooters are an environmentally-friendly, low-cost solution to addressing transit gaps. E-scooters require a small spatial footprint and can reduce vehicle congestion and increase transit ridership, since users have greater access to transit stations that would normally be too far to walk to. For users, e-scooters can be fun to ride, inexpensive, conveniently located, and both faster and easier to use than bicycles.

Bird's Commitment to Safe & Inclusive Mobility

Bird was the first company to enter the shared e-scooter market, introducing equipment to the streets of Santa Monica in September 2017. What was thought to be a West Coast recreational trend has quickly become a reliable mode of transit for urbanites in over 100 cities globally. In its first year, Bird had over 10 million rides—a substantial number for a new mode of transit (compared to Lyft, which took 15 months to reach just 1 million rides).⁸

Through its OneBird program, Bird also offers reduced pricing for eligible low-income riders. Indeed, without upfront purchase or membership costs, e-scooters can serve lower-income residents in neighborhoods that are not well-served by transit. Bird promotes safety for its riders and other users of the road by only allowing customers over 18 to ride, providing free helmets to its members, and encouraging the use of bike lanes. Bird also partners with cities for safety initiatives and bike lane expansions, makes daily pickups of scooters each night to avoid neighborhood clutter, and monitors scooter utilization to match the number of scooters deployed with demand.

⁸ Hawkins, Andrew. "The electric scooter craze is officially one year old — what's next?" *The Verge*, 20 September 2018, www.theverge.com/2018/9/20/17878676/electric-scooter-bird-lime-uber-lyft.

How Bird Works

Equipment



Pricing & Payment

The cost to ride a Bird consists of \$1 upfront to unlock the Bird, followed by a \$0.15 charge for each minute of the ride. Bird offers alternative pricing structures through the One Bird and Red, White and Bird programs as outlined in the Benefits section.

To unlock and pay for use of a Bird, the customer will typically use a smartphone to access the Bird app and form of electronic payment. Accepted forms of payment include a credit card, pre-loaded cash card, or Apple Pay.

Charging

Birds are charged by Bird Chargers, who receive up to \$20 per scooter, per charge, for charging Birds in their homes overnight and placing them in designated areas by the morning. The amount the Chargers earn increases based on the amount of time for which the scooter has gone uncharged.

L TRAIN SHUTDOWN

As the shutdown nears, the public remains concerned about the efficacy of City and MTA mitigation plans. Recent media headlines run the gamut from the cynical, “Is the NYC subway ready for the L train shutdown?”⁹ to the snarky, “What Fresh L Is This?”¹⁰, from the direct, “Other subway lines called inadequate to handle L Train shutdown”¹¹ to the dramatic, “The Nightmare of Brooklyn Commuting, After the L Train.”¹² Even with contingency plans in place, most riders believe the shutdown will have severe impacts. A 2016 survey by the North Brooklyn Chamber of Commerce indicated that most affected businesses—faced with decreased foot traffic and fewer tourists—expect to lose a significant amount of revenue when the L train closes.¹³

Mitigation Plans

In preparation for the L Train shutdown, the City and MTA are making plans to minimize the impact of the shutdown on riders. While extensive, these measures—including subway line and station improvements, bus and ferry enhancements, and roadway measures to prioritize shared modes—will not completely mitigate the negative impacts associated with the line closure.

- SUBWAY**
 - **Additional service** on J/M/Z/G/7 trains, increased off-peak service on A/E lines
 - **Free out-of-system MetroCard transfers** at three stations
 - **Station improvements** to accommodate greater rider volumes
- BUS**
 - **Expanded fleet** (200 new buses, including 15 electric)
 - **Four new bus service routes** across the Williamsburg Bridge
 - **Vehicular restrictions** on the Williamsburg Bridge (HOV 3+), 14th St. (“busway”), and Allen St. (bus lanes) to prioritize shared modes
- FERRY**
 - **New route between North Williamsburg and Stuyvesant Cove**
- BIKE**
 - **New protected bike lanes** on 12th St./13th St., Delancey St. between Allen St. and the Williamsburg Bridge, 20th St, between 1st Ave. and Avenue C (proposed)
 - **Improved bike lane network** around subway stations in Brooklyn
 - **Citi Bike to add 1,250 new bikes** and 2,500 docks, as well as 1,000 pedal-assist bikes

⁹ Gordon, Aaron. “Is the NYC Subway Ready for the L Train Shutdown?” *Curbed NY*, 3 October 2018, www.ny.curbed.com/2018/10/3/17925038/nyc-subway-l-train-shutdown-mitigation-alternatives.

¹⁰ Lampen, Claire. “What Fresh L Is This? MTA Slashes Weeknight L Train Service Until End Of November.” *Gothamist*, 17 October 2018, www.gothamist.com/2018/10/17/lol_train_weeknights_yay.php.

¹¹ Geberer, Raanan. “Other Subway Lines Called Inadequate to Handle L-Train Shutdown.” *Brooklyn Daily Eagle*, 4 October 2018, www.brooklyneagle.com/articles/2018/10/4/other-subway-lines-called-inadequate-handle-l-train-shutdown.

¹² Riccardi, Lucas. “Brooklyn’s ‘L Train Shutdown Nightmare’ Is a Vision of Commuting Hell.” *CityLab*, 31 Oct. 2018, www.citylab.com/life/2018/10/brooklyn-l-train-shutdown-nightmare-halloween-subway-mta/574480/.

¹³ Ehart, Anne, and Abigail Weinberg. “Williamsburg Businesses Brace for L Train Shutdown.” *amNewYork*, 6 Aug. 2018, www.amny.com/news/l-train-shutdown-business-impact-1.20307619.

Opportunity

Despite the City and MTA's ambitious mitigation plans, public perception of the shutdown remains pessimistic. Earlier this year, Global Strategy Group—on behalf of Bird—conducted a survey of 1,143 L Train riders to gauge attitudes about the impending L train shutdown and appetite for e-scooters as part of mitigation efforts. More than 60% of respondents take the L train more than ten times per week—36% take the L train between 10-14 times per week, while 26% take the L train 15 or more times per week.

The survey found that more than 70% of L train rider respondents feel they are “not very” or “not at all” prepared for the shutdown.¹⁴ Surveyed riders had grave predictions about their own commutes, with 85% expecting their commute time to double or more, and nearly 95% agreeing that the shutdown would make their commute significantly longer and more stressful.¹⁵ In fact, 17% of respondents anticipate more than 60 minutes in additional one-way travel time following the shutdown, 26% between 45-60 minutes, and another 24% between 30-44 minutes. In place of the L train, the survey identified the three most popular remaining transit options are alternative subway (i.e. J/M/Z, G), bus, or ridesharing options (i.e. Uber, Lyft).

Yet, in the face of these dismal public perceptions, survey respondents were optimistic that alternative forms of transit could ease the burden of the shutdown. More than 60% of surveyed L train users indicated they would support the introduction of e-scooters in their area, and more than 40% of surveyed riders stated they would likely try or use an e-scooter—21% were very likely, while an additional 22% were somewhat likely to try an e-scooter.¹⁶

Given this backdrop, Bird commissioned HR&A to study the potential benefits an e-scooter deployment in the L train corridor could generate, including but not limited to:

- **Provide an additional mobility service option** for impacted L Train riders, prioritizing first and last mile service to alternative transportation options, including subway, bus, and ferry;
- **Reduce reliance on cars**, including personal vehicles, taxis, and ridesharing companies like Uber and Lyft; and
- **Improve equitable transit access** for low income riders, as well as people of color and women.

¹⁴ Global Strategy Group, 2018, *L Train Survey*.

¹⁵ Ibid.

¹⁶ Ibid.

PROPOSAL

L Train Corridor Program Highlights

- Birds would be deployed to serve an estimated **11,000 of the daily impacted commuter trips and up to 33,000 total trips**.
- Birds would be deployed within an approximately **one-mile-wide corridor running north of the L** train route, to provide enhanced connectivity to the closest subway alternative for communities adversely affected by the L shutdown.
- Bird would also provide a limited number of geo-fenced **“nests” in the East Village and 14th Street corridor** to enable commuters to drop off Birds at designated locations in Manhattan and pick them up for their return trip home.

L Train Corridor Program Boundaries

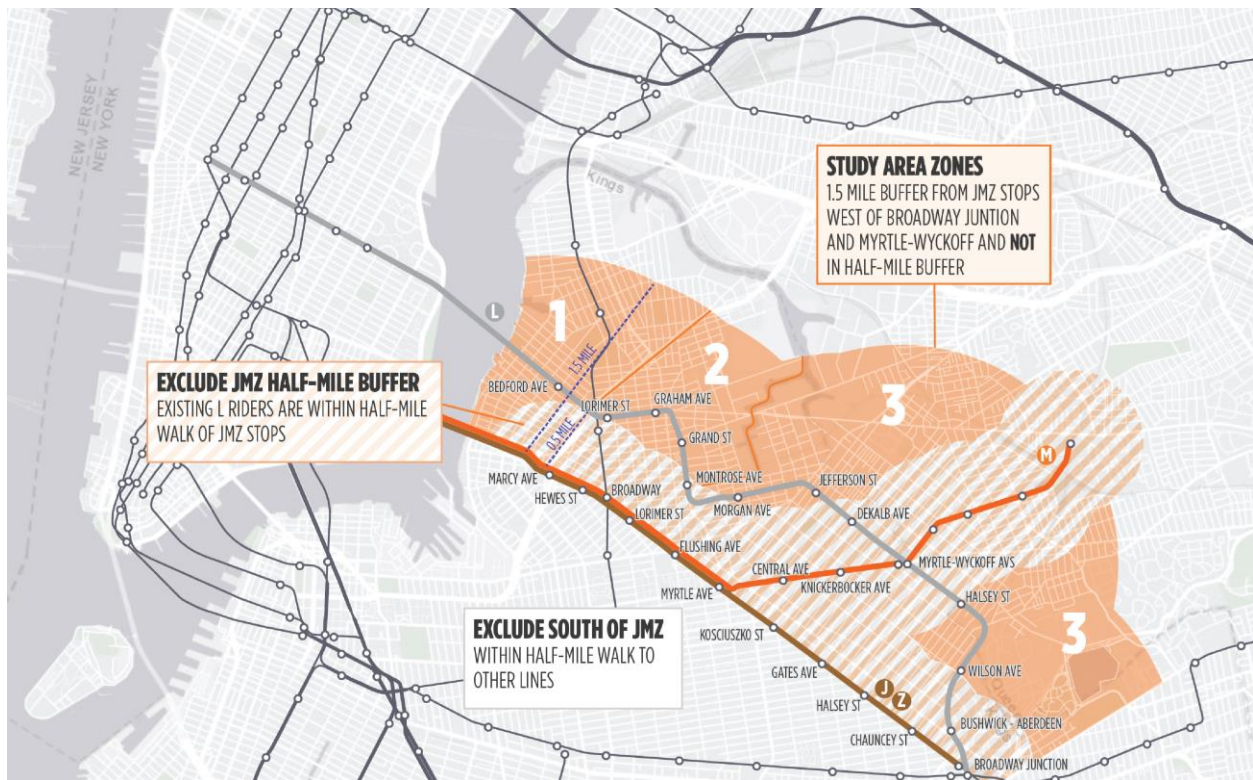
With the understanding that most of the impacted L train rider trips originate in Brooklyn and terminate in Manhattan, boundaries for the program consist of Brooklyn “Home Zones” and Manhattan “Work Zones.” Home Zones are sending areas, drawn to concentrate service in the parts of Brooklyn where impacted riders begin their trips, while Work Zones are receiving areas that reflect broad groupings of common destinations within Manhattan’s traditional business districts.

Home Zones

The proposed program area in Brooklyn’s Home Zones are areas within a 1.5-mile buffer of J/M/Z subway stations. This buffer is based on the average Bird trip length of 1.5 miles. E-scooters within this buffer zone would provide first and last mile access to nearby transit alternatives like the subway (especially J/M/Z and G lines), bus, and ferry. The buffer excludes areas south of the J/M/Z, as residents there are unlikely to have been L train riders, as well as areas within a 0.5-mile buffer north of the J/M/Z, since these riders are likely to walk to their nearest J/M/Z station (a 0.5-mile walk is considered the standard maximum walking distance to transit). By removing the additional 0.5-mile buffer, the deployment area is effectively a one-mile-wide area north of the J/M/Z line.

The Home Zones (as shown in Figure 1) are broken out into three smaller zones—reflective of MTA-designated areas based on available transit alternatives—to enable comparative analysis of demographics (see Figure 2) and time travel savings within the Home Zones.

Figure 1: Home Zones



Zone 1 is the largest, wealthiest, and most demographically homogenous subarea of the Home Zones, with a population of nearly 50,000 residents, median household income of \$70,000, and non-White population of 18%. Zone 2 is the smallest of the three zones with 21,000 residents. On average, residents earn slightly less (\$64,000) and are more racially diverse (29% identify as non-White) compared to Zone 1. Moving east, Zone 3 is distinctly different. Zone 3 encompasses nearly 40,000 residents, who on average earn less (\$58,000) and have a larger average household size than their counterparts in Zones 1 and 2. Zone 3 residents are also more likely to be non-White (45%) and experience commute times that exceed 45 minutes (40%); in fact, 20% of Zone 3 commuters travel 60 minutes or more to get to work.

"It comes in real, real clutch for transportation," says Abraha [20-year old, Oakland scooter user who works at Sprouts grocery store]. "I don't have to rely on the bus and stuff like that' ... a recent study showed that lower income groups are more likely than high-income groups to approve of shared scooters."

Wirtschafter, Eli. "Inside Oakland's Plan to Make Electric Scooters Affordable for All." KALW, 13 Sept. 2018.

Figure 2: Home Zones by the Numbers¹⁷

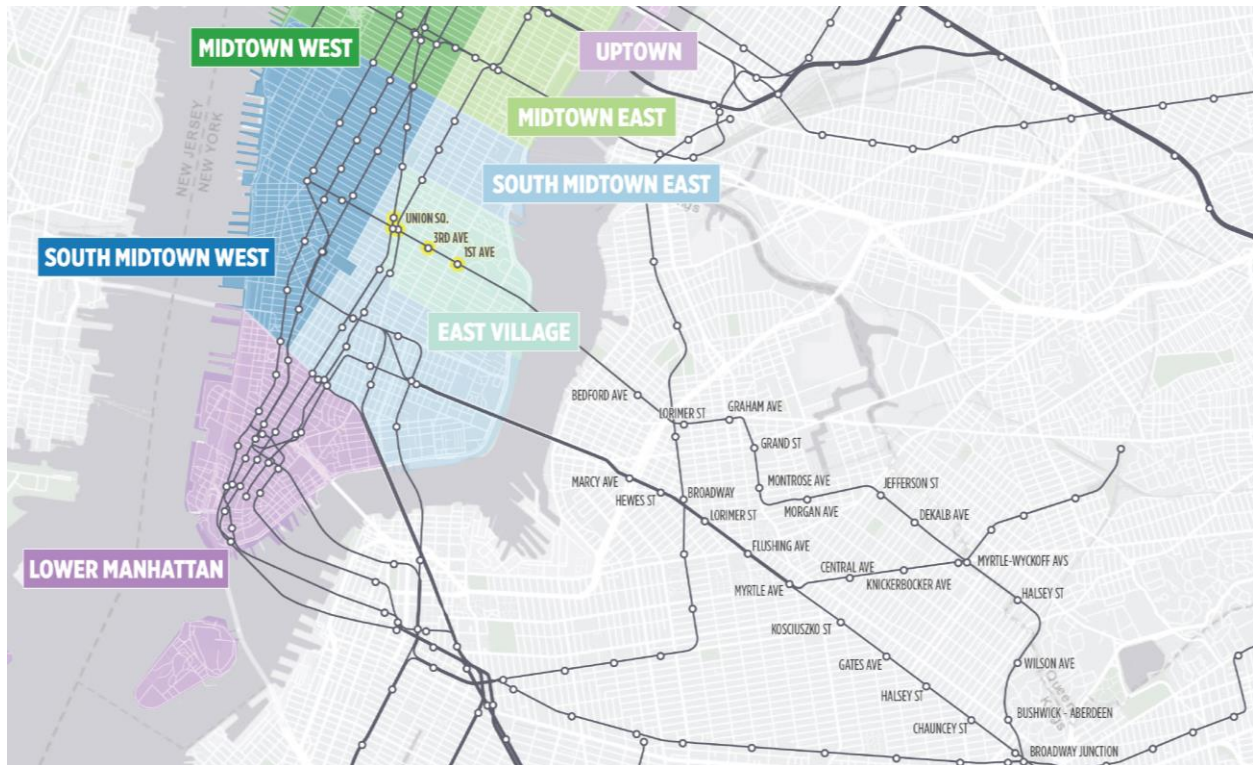
	Zone 1	Zone 2	Zone 3
Population	48,000	21,000	41,000
Income, Household Size, Education			
Median Household Income	\$70,000	\$64,000	\$58,000
Average Household Size	2.10	2.15	2.86
Bachelor's Degree +	65%	54%	25%
Race, Ethnicity			
White Alone	82.0%	70.7%	54.4%
Black Alone	1.6%	7.4%	8.0%
American Indian Alone	0.3%	0.4%	0.8%
Asian Alone	8.2%	9.0%	6.0%
Pacific Islander Alone	0.0%	0.1%	0.0%
Some Other Race Alone	4.8%	8.4%	25.9%
Two or More Races	3.2%	4.1%	4.7%
Hispanic Origin	11.6%	24.1%	52.6%
Brooklyn to Manhattan			
Subway Mode Share	90%	89%	75%
Commute Time 45 Mins +	29%	21%	40%

Work Zones

Six Work Zones represent the destinations of most L train riders traveling from Brooklyn (see Figure 3). Of these Zones, five reflect Manhattan's traditional business districts and one includes the East Village. The East Village is carved out separately as a receiving area for riders who would use Bird as their sole mode of transportation. Three "nests" would be located along 14th Street to enable direct connections to destinations traditionally serviced by the L train.

¹⁷ U.S. Census, 2010 and Esri 2018 Projections; ACS, 2015; CTPP, 2010.

Figure 3: Work Zones



Ridership Estimates

There are an estimated 31,000 daily commuters¹⁸ (defined as those *traveling on any mode* from home to work) residing in a Home Zone and travelling to a Work Zone. Applying an average subway mode share by zone (90% in Zone 1, 89% in Zone 2, and 75% in Zone 3)¹⁹ to these travelers translates to 27,000 daily subway commuters traveling from Brooklyn to Manhattan for work. Since each subway commuter is likely to make at least two trips a day—to and from work—the total number of daily subway commuter trips is expected to be 54,000.

Using the 54,000 subway commuter trips as a daily baseline, a 21% capture rate was applied to these trips based on responses from surveyed L train riders, more than a fifth of whom indicated they would “very likely” try an electric scooter during the shutdown.²⁰ These 11,000 potential daily one-way trips represent the baseline demand for Bird (see Figure 4 for calculation); however, once Birds are deployed, this infrastructure can also support non-commute trips that may increase this demand to 33,000 daily trips based on the findings of the NYC Mobility Report that approximately one-third of all subway trips are commuting trips.²¹

¹⁸ See Appendix A, Figure 8 for commuter number detail.

¹⁹ CTPP, 2010.

²⁰ Global Strategy Group, 2018, *L Train Survey*.

²¹ NYC DOT, 2018, *NYC Mobility Report*. Calculated as 11,000 (potential riders) divided by 33% (share of subway riders commuting—traveling from home to work).

For context, in September 2018, the Citi Bike system averaged 35,000 daily trips city-wide, with a month-high of 70,000 daily trips and month-low of just under 20,000 daily trips.²² Therefore, the potential for Bird to capture up to 33,000 daily trips demonstrates the magnitude of the opportunity given the relative size of the proposed Home Zones.

Figure 4: Ridership Estimate Calculation²³

	Zone 1	Zone 2	Zone 3	Rounded Total
Commuters from HZ to WZ	15,800	7,200	8,000	31,000
Subway Mode Share	90%	89%	75%	-
Subway Commuters from HZ to WZ	14,400	6,500	6,000	27,000
Subway Commuter Trips from HZ to WZ	28,800	13,000	12,000	54,000
Potential Scooter Mode Share	21%	21%	21%	-
Scooter Commuter Trip Demand	6,000	2,700	2,500	11,000

Rebalancing

To best serve the impacted rider population, Birds would be released in waves at key pick-up points each morning ensure that users would have continuous and reliable access to Birds. Bird removes scooters from circulation starting each night at 9PM, with the goal of picking up all equipment by midnight. Scooters are then redeployed for the morning rush by 6AM.

²² Citi Bike Trip Data, 2018, www.citibikenyc.com/system-data.

²³ Note, numbers may not sum due to rounding, see Appendix A, Figure 10 for detail.

BENEFITS

Bird will provide an attractive and efficient mobility alternative for L train riders living in Brooklyn and traveling into Manhattan for work or other purposes. For riders living in neighborhoods east of Bushwick Avenue, who experience longer commutes into Manhattan and have fewer transit options than their Williamsburg counterparts, Bird can provide a critical first and last mile travel connection to alternative subway stations. For residents living closer to Manhattan, L train riders may even choose to ride a Bird over the Williamsburg Bridge to the East Village/Lower East Side. Birds would make a measurable difference in improving commuters’ travel times—and translated into direct cost savings—during the 15-month L train shut down.

Travel Time Savings

Depending on their point of origin in Brooklyn and work destination in Manhattan, L train riders currently spend an average of 15 to 60 minutes commuting to and from work each day. The L train shutdown would create a significant disruption to these commuters, adding between 30 to 45 minutes of travel time to their usual commutes.²⁴

To evaluate travel time savings enabled by Bird, subway commuter travel times with the L train shutdown were evaluated by comparing walking to the next closest station with using an e-scooter to travel to the station. Using journey to work data, commuters located within the Home Zones were paired with an employment destination in the Work Zone. For this analysis, the average Bird speed is assumed at 7.5 mph, while the average walking speed is assumed at 2.9 mph.²⁵ Travel time savings were estimated by comparing walk travel times to scooter travel times, applying average speeds, from points in each of the commute origin zones to the nearest subway station (J/M/Z/G) (see Figure 5).

Figure 5: Travel Time Savings Enabled by Bird by Zone²⁶

Home Zone	Average Subway Commute Time Post L Shutdown		Time Savings
	Without Bird	With Bird	
Zone 1	35 mins	29 mins	6-8 mins
Zone 2	43 mins	38 mins	4-6 mins
Zone 3	55 mins	47 mins	7-9 mins

Overall, Bird would provide a faster way to access nearby subway stations, as compared to walking. Due to the shutdown, some commuters in Zone 3 would need to walk as far as 1.7 miles, a 30-minute walk, to get to the subway. A scooter would allow them to complete a similar trip in roughly 15 minutes. On an annual basis, Bird would collectively save the 5,500

²⁴ Nelson \ Nygaard calculation, see Appendix B for methodology.
²⁵ NYC DCP, 2006, *New York City Pedestrian Level of Service Study Phase I, Chapter 5: Data Summary and Analysis*.
²⁶ Nelson \ Nygaard calculation, see Appendix B, Figure 11 for detailed results.

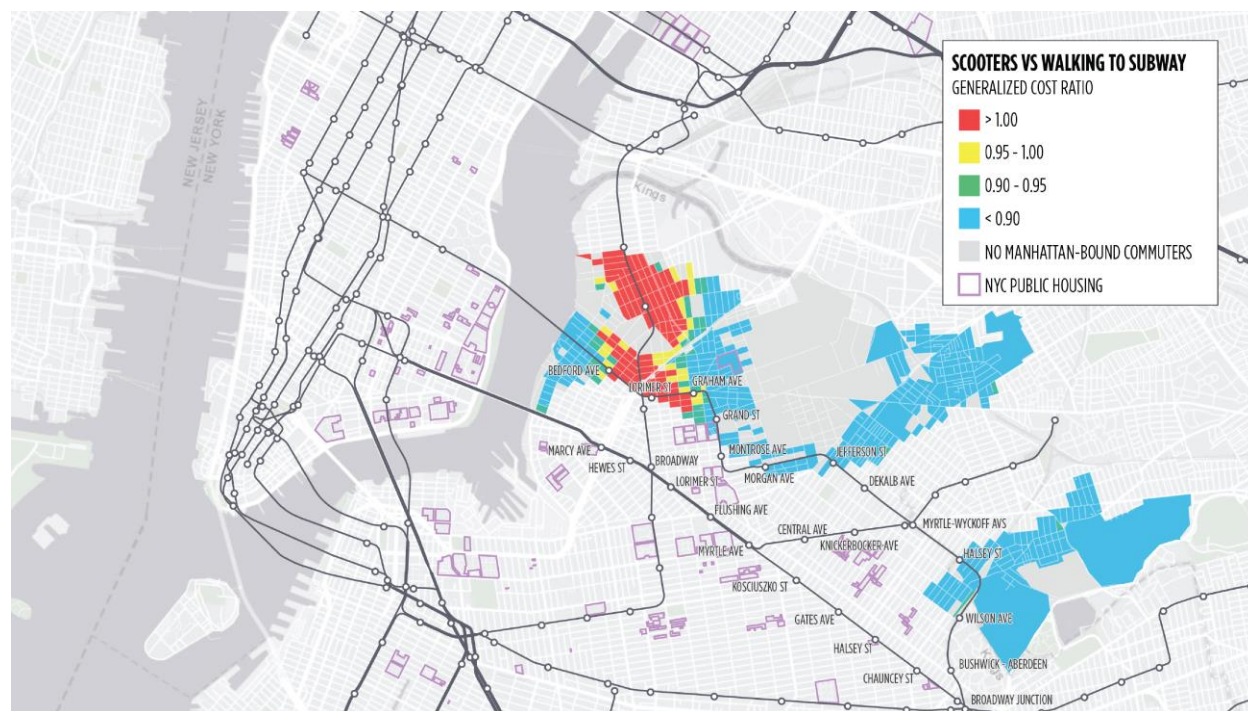
identified potential daily Bird users located in the Home Zones approximately 340,000 hours²⁷ (180,000 hours in Zone 1, 80,000 hours in Zone 2, and 80,000 hours in Zone 3).

Value of Time

In making transportation decisions, people often consider cost, travel time, and the quality of the travel experience. The analysis of these factors into a combined metric is called the “generalized cost” in transportation economics. To calculate the generalized cost of a trip, this analysis accounts for the monetary costs associated with travel, like transit or taxi fare, as well as the non-monetary costs linked to the time spent travelling from origin to destination.

Using a value of time of \$15 per hour,²⁸ travel time is converted into a dollar value that can be added to the actual monetary cost associated with the specific route and selected mode. Areas with a lower generalized cost ratio are likely to have the highest capture rates of Bird users (highlighted in yellow, green and blue in Figure 6). However, it should be noted that despite a higher generalized cost ratio, in situations where Bird may be more expensive than walking or another alternative transportation mode, people may still choose Bird for factors such as convenience, independence, and fun.

Figure 6: Generalized Cost Ratio Comparing Cost of Walking vs. Bird²⁹



²⁷ This assumes a daily time savings of 1,300 hours multiplied by 260 annual working days and does not account for travel time savings that would be experienced by non-commute subway riders who would benefit from Bird.

²⁸ MTA New York City Transit, 2010, *Second Avenue Subway FEIS: Appendix D.1, Transportation – Ridership Modeling*. Value of time is defined as the willingness to pay for a reduction in travel time and is not intended to be a proxy for hourly earnings. This value is determined through combined revealed-stated preference survey on a representative sample of population.

²⁹ Nelson \ Nygaard calculation, see Appendix C for methodology.

Equity

Riders living in Zones 2 and 3 are more likely to be people of color and have a lower income than riders in Zone 1. Riders from Zone 3 also face the longest travel times into Manhattan's business districts, with an average travel time of 50 minutes, yet have the fewest options to access alternative subway and bus service. Many lower-income commuters may also be employed in hourly positions that allow limited flexibility to adjust work schedules—where too many late arrivals could jeopardize employment. With Bird's One Bird program, that either reduces or waives the upfront \$1 to begin each ride, low-income riders have greater access to the equipment.³⁰ Altogether, this cohort of riders would benefit from a combined daily travel time savings of 1,000 hours and \$800 in generalized costs, affording riders with an enjoyable, cost-effective, and reliable mode of travel.

Increased Transit Access

For commuters who live in Zone 3, Bird would provide an attractive first and last mile transit solution. Residents in these neighborhoods are less likely to commute by transit—15% currently commute by private vehicle—given the area's limited subway access. Bird would provide the 6,000 daily commuters in this area a convenient option to take an electric scooter to subway stations like Halsey Street (J/Z) and Seneca Avenue (M).

VMT Reduction & Congestion

According to the Global Strategy Group L Train Survey, 40%³¹ of surveyed L train riders stated that they are likely to take use ridesharing or a personal car as a transportation mode alternative following the L train closure.

There are an estimated 31,000 daily commuters (defined as those traveling by any mode from home to work) residing in a Home Zone and travelling to a Work Zone. The proportion of these commute trips made by subway was estimated by applying an average subway mode share by zone (90% in Zone 1, 89% in Zone 2, and 75% in Zone 3) which translates into 27,000 daily subway commuters from these Home Zones traveling from Brooklyn to Manhattan for work. As noted above, 40% of surveyed L train riders stated that they would use a private vehicle or ridesharing company after the L train closure. Applying this 40% share to the 27,000 subway commuters results in nearly 11,000 impacted L train commuters switching to a car-based mode.

Then, by assuming a vehicle occupancy of 3 and that each commuter will make two trips per day—to and from work—the total number of additional vehicles on the street is expected to be 7,000. Multiplying those vehicles by the average commute distance of each Home Zone to Work Zone results in 43,000 new vehicle miles traveled following the L train shutdown (see Figure 7 for calculation).

³⁰ In addition to discounted programs like One Bird, Bird provides a range of options to make scooter usage more accessible. For riders without a credit card, Bird accepts pre-loaded cash cards as a form of payment to use in the Bird app.

³¹ Global Strategy Group, 2018, *L Train Survey*.

Figure 7: VMT Estimate Calculation

	Zone 1	Zone 2	Zone 3	Rounded Total
Commuters from HZ to WZ	15,800	7,200	8,000	31,000
Subway Mode Share	90%	89%	75%	-
Subway Commuters from HZ to WZ	14,200	6,400	6,000	27,000
Potential Auto Mode Share	40%	40%	40%	-
Auto Commuter Demand	5,700	2,600	2,400	11,000
Auto Commuter Trips	11,400	5,200	4,800	21,000
Vehicle Occupancy	3	3	3	-
New Autos Without L Train	3,800	1,700	1,600	7,000
Average Trip Length	5.4 miles	5.8 miles	8.1 miles	-
New VMT	20,500 miles	9,800 miles	12,900 miles	43,000 miles
Potential Scooter Mode Share	21%	21%	21%	-
Scooter Commuter Trip Demand	4,300 miles	2,000 miles	2,700 miles	9,000 miles

Then, to estimate the VMT reduction enabled by Bird, a 21% capture rate was applied to these total car-miles reflective of surveyed L train riders that indicated they were “very likely” try an electric scooter during the shutdown—resulting in a total VMT savings of 9,000 miles and 7.25 metric tons of daily Carbon Dioxide Equivalent.³² Note that these benefits are focused on potential mode shift and VMT reduction for L train commuters, but the potential impact of e-scooters in the L train corridor and for a wider outer borough pilot is much greater. These additional benefits would include mode shift for other residents and workers in the L train corridor and outer boroughs who might take a personal car, taxi or car service to other locations within Brooklyn and Queens, and who would find e-scooters a more competitive, reliable and enjoyable alternative.

³² NYC Mayor’s Office of Environmental Coordination, 2014, *CEQR Technical Manual: Chapter 18 - Greenhouse Gas Emissions and Climate Change*.

USER PROFILES



**JOSÉ, 25
EAST
WILLIAMSBURG**

José is a nurse living in East Williamsburg (Zone 2). He lives near Grand Street Station with two roommates and usually takes the L to Union Square, where he transfers to the 4/5/6 downtown to Brooklyn Bridge-City Hall Station for shifts at NY- Presbyterian / Lower Manhattan Hospital. With the L, his current commute is 28 minutes. Without the L and without Bird, his commute is likely to become roughly 43 minutes either by walking to the G and switching to the C or walking, biking, or taking the Q54 bus to the J/M/Z at Lorimer Station.

Alternatively, José could take the express bus across the Williamsburg Bridge and transfer to the subway at Delancey Street Station, which would take 56 minutes. A Citi Bike ride would be faster (30 minutes door-to-door). For an approximately \$15 fare, José could take a rideshare service for a 30-minute ride depending on traffic.

However, by taking Bird to Marcy Avenue Station and riding the J directly to Fulton Station, José could save 6 minutes toward his subway commute, reducing his travel time to 37 minutes.



**PAULINA, 42
BUSHWICK**

Paulina is a working mom living in Bushwick (Zone 3). She normally travels via the L from Wilson Avenue Station to 14th Street Station and transfers to the M/F to reach her administrative assistant job at Rockefeller Center. Her typical commute using the L takes about 41 minutes, which involves transferring to the E or F at 14th Street Station. Without the L and without Bird, her commute will increase to 55 minutes, requiring her to walk to Chauncey Street Station to catch the J/Z and switch to the M at Myrtle Avenue Station or walk to the M at Myrtle-Wyckoff Avenues Station.

She could, alternatively, combine bus and subway by taking the B30 bus and M train, or take a \$27, 55-minute ridesharing ride to reach Rockefeller Center.

With Bird, Paulina could scooter to Chauncey Street Station and get to work in 47 minutes, reducing her subway commute time by 8 minutes.



TINA, 31
WILLIAMSBURG

Tina is a young attorney living in Williamsburg (Zone 1) who works at a community service provider in the East Village. She normally takes the L from Bedford Avenue Station to First Avenue Station, a quick 4-minute ride plus 15-minute walk resulting in a 19-minute door-to-door commute. Without the L train and without Bird, she would need to walk about a mile to Marcy Avenue Station, resulting in a 11 minute longer subway ride on the M to reach First Avenue Station. Her overall trip time would increase by 35 minutes.

Alternatively, Tina could make the complete trek by Citi Bike, which would take nearly 20 minutes, order a car via ridesharing app for nearly 40 minutes, take one of the new shutdown-specific special bus services for nearly 45 minutes, or the ferry from North Williamsburg to Stuyvesant Cove taking nearly an hour.

With Bird, she could reach the J at Marcy Avenue Station in 8 minutes and arrive at work in 35 minutes, or she could even take Bird straight from home to work, taking a mere 20 minutes—just like Citi Bike, but without breaking a sweat.

While these user profiles illustrate the potential experience and benefits associated with Bird for those commuting between the identified Home Zones and Work Zones following the L train shutdown, it is likely that these benefits would accrue similarly in many areas within New York City's outer boroughs. In particular, commuters living in neighborhoods with an existing connectivity need—such as those located beyond a 10-minute walk and up to 1.5 miles from a subway station or those that might more easily and quickly access a one-seat ride to their destination with the help of Bird—are likely to benefit from a more expansive outer borough Bird deployment.

APPENDIX A: RIDERSHIP ESTIMATE

Commuter Estimate: Home Zones to Work Zones

To estimate the total number of commuters travelling from a Home Zone to a Work Zone, extracted journey to work data³³ for all census blocks within or touching the Home Zone boundaries. The Longitudinal Employer-Household Dynamics (“LEHD”) dataset is created by the U.S. Census Bureau and provides detail on the work locations of commuters, along with demographic characteristics such as age and income of the commuter. For each census block in the Home Zones, calculated the total number of commute trips ending in a Work Zone.

Figure 8: Commuters from Home Zones to Work Zones (One-Way)³⁴

		Work Zones							Total
		Lower Man.	East Village	S. Midtown E.	S. Midtown W.	Midtown E.	Midtown W.	Uptown	
Home Zones	1	2,000	600	2,400	3,100	2,500	3,500	1,800	15,900
	2	1,000	300	1,200	1,500	1,000	1,500	800	7,200
	3	1,400	300	900	1,300	1,200	1,600	1,400	8,000
	Total	4,300	1,200	4,400	6,000	4,600	6,700	3,900	31,100

Commuter Estimate: Home Zones to Work Zones via Subway

Then, to estimate the number of commuters from Home Zones to Work Zones that use the subway as their primary mode of transportation, multiplied the average subway mode share by each Home Zone-Work Zone pair (Figure 9) by the total number of commuters (Figure 8), to result in an estimate (Figure 10).

³³ LEHD, 2015.

³⁴ Ibid. Note, numbers may not sum due to rounding.

Figure 9: Commuter Mode Share – Subway³⁵

		Work Zones						
		Lower Man.	East Village	S. Midtown E.	S. Midtown W.	Midtown E.	Midtown W.	Uptown
Home Zones	1	89%	87%	90%	93%	92%	93%	88%
	2	85%	98%	86%	97%	93%	97%	82%
	3	71%	82%	83%	74%	73%	74%	68%

Figure 10: Commuters Using Subway from Home Zones to Work Zones (One-Way)³⁶

		Work Zones							Rounded Total
		Lower Man.	East Village	S. Midtown E.	S. Midtown W.	Midtown E.	Midtown W.	Uptown	
Home Zones	1	1,800	500	2,100	2,900	2,300	3,300	1,500	14,400
	2	800	300	1,000	1,400	900	1,500	600	6,500
	3	1,000	200	700	1,000	900	1,200	900	6,000
	Total	3,600	1,000	3,900	5,300	4,000	5,900	3,100	26,900

Estimate: Scooters Trips

To estimate scooter trips, potential mode share is based on the L Train Survey completed by Global Survey Group on behalf of Bird in October 2018. The survey showed that 21%³⁷ of respondents were “very likely” to try or use an electric scooter. This percentage was then applied to the subway commute trips, resulting in approximately 5,500 daily commuter round trips or 11,000 one-way commuter trips that could be served by e-scooters for either the journey to the subway station or potentially the complete trip.

³⁵ CTPP, 2010.

³⁶ Note, numbers may not sum due to rounding.

³⁷ Global Strategy Group, 2018, *L Train Survey*.

APPENDIX B: COMPARISON OF TRAVEL TIMES BY MODE

Following the L train shutdown, Bird will be a powerful mitigation tool to support impacted riders in commuting to Manhattan in a timely manner. Bird will be a viable option for single mode trips from Zones 1 and 2 to the East Village, Lower Manhattan or South Midtown, or can help shorten travel time from rider's homes to the nearest alternative subway station in all three zones. To calculate travel times from Home Zones to the Work Zones following the L train shutdown, these methodological assumptions were made:

From All Zones

- Walking and biking travel times were estimated using Google Maps.
- Subway travel times were calculated using the MTA trip planning website.
- Bird speed is assumed as equal to biking speed.
- Vehicle speeds are 5 mph in the Midtown core from 34th St. to 59th St., and 7.1 mph elsewhere. Vehicle travel time estimates are presented as a range based on calculations whereby an entire trip is made at the low or high speed.
- Bus travel times were estimated as reflective of lower Google Maps drive travel time estimates. These estimates rely on the assumption that expected bus priority measures will lead to reliable, and relatively quick bus operations.
- A ferry trip from North Williamsburg to Stuyvesant Cove is assumed to take 7 minutes, based on current NYC Ferry travel times.

From Home Zone 1

- A precise origin point at N 10th St @ Bedford Ave. was chosen due to its central location within the Home Zone and equal distance from nearby alternative subway stations.
- With L train service, riders would use the Bedford Ave. Station.
- Without L train service, subway riders would walk to Nassau Ave. Station on the G.
- Without L train service, bus riders would walk to the future L3 bus stop at N 5th St. @ Roebling St.
- With Bird service, subway riders would travel by Bird to Nassau Ave. Station on the G. Ferry riders would travel by Bird to the North Williamsburg ferry dock. Bird riders travelling directly to Manhattan would travel via the Williamsburg or Queensborough Bridges, depending on their destination.

From Home Zone 2

- A precise origin point at Judge St. @ Devoe St. was chosen, due to its central location within the home zone and equal distance from nearby alternative subway stations.
- With L train service, riders would walk to Graham Ave. Station.
- Without L train service, riders would walk to the Metropolitan Ave. Station on the G.
- Without L train service, riders would walk to the future L2 bus stop at Grand St. @ Bushwick Ave.

- With Bird service, subway riders would travel by Bird to the Metropolitan Ave. Station on the G.

From Home Zone 3

- Origin points at Hart St. @ Onderdonk Ave. (Zone 3 West) and Irving Ave. @ Decatur St. (Zone 3 East) were chosen due to their locations at either end of the zone, and their distance from nearby alternative subway stations.
- With L train service, riders at the western origin would walk to Jefferson St. Station. Riders at the east origin would walk to Halsey St. Station.
- Without L train service, riders at the west origin would walk to the Seneca Ave. Station on the M. Riders at the east origin would walk to Chauncey Str. Station on the J/Z.
- With Bird service, subway riders at the west origin would travel by Bird to the Seneca Ave. Station on the M. Riders at the east origin would travel by Bird to the Chauncey St. Station on the J/Z.

Figure 11: Average Travel Time Between Home and Work Zones by Transportation Alternative (Minutes)

	Transportation Alternative	East Village (8th @ 1st)	Lower Manhattan (Zucotti Park)	S. Midtown E. (14th @ 8th)	S. Midtown W. (B'way @ Houst.)	Midtown E. (Grand Central)	Midtown W. (42nd @ 7th)	Uptown (79th @ Lex.)
Zone 1 (N 11th St @ Bedford)	Walk-Subway	36	36	40	28	27	31	49
	Walk-Bus-Subway	44	50	39	34	44	56	53
	Walk-Ferry-Other	54	56	39	43	49	49	56
	Bike-Subway	31	31	34	23	22	26	44
	Bike	17	24	28	23	29	33	37
	Drive (Taxi-Rideshare)	27-38	44-62	55	46	34-48	39-55	42-66
	Scooter-Subway	29	29	34	23	21	24	42
	Scooter-Ferry-Other	44	49	32	60	42	42	49
Scooter	26	35	28	23	42	47	47	
Zone 2 (Judge St @ Devoe)	Walk-Subway	42	42	57	42	29	34	44
	Walk-Bus-Subway	48	55	49	38	49	52	58
	Subway-Walk-Ferry-Other	41	56	63	48	51	48	58
	Bike-Subway	37	37	45	30	24	29	39
	Bike	23	30	34	24	-	-	-
	Taxi/Rideshare	30-42	44-62	57	48	38-54	43-61	49-70
	Scooter-Subway	37	38	45	30	25	30	40
	Scooter	23	30	34	24	-	-	-
Zone 3 West (Hart St @ Onderdonk)	Walk-Subway	55	54	66	54	66	62	65
	Subway-Walk-Ferry-Other	57	72	60	62	67	64	74
	Bike-Subway	45	44	50	38	50	46	55
	Taxi/Rideshare	49-70	52-73	71	68	54-77	59-84	62-88
	Scooter-Subway	46	45	50	38	50	46	56
Zone 3 East (Irving Ave @ Decatur)	Walk-Subway	49	40	48	39	54	54	66
	Subway-Walk-Ferry-Other	60	75	63	65	70	67	77
	Bike-Subway	41	32	40	31	46	46	58
	Taxi/Rideshare	63-84	58-80	69	60	70-101	78-108	70-100
	Scooter-Subway	42	33	40	31	47	47	59

APPENDIX C: VALUE OF TIME

Generalized Cost of Travel

66% of commuters that travel from a Home Zone to a Work Zone are estimated to have a lower generalized cost of travel if they use Bird compared to if they were to walk. Generalized cost of travel is a transportation economics metric which monetizes the non-monetary components of travel, including time, ease, and enjoyment and adds it to the traditional costs of travel, such as fare, gas, or Citi Bike membership.

To calculate the generalized cost of travel, first estimated access time using ArcGIS and a central point within each Home Zone census block. Using the shortest distance within the street network to the nearest subway station (J/M/Z, G). The average speed for walking and taking a Bird is 2.9 mph and 7.5 mph, respectively. Then, a value of time of \$15 per hour was taken from the Transit Demand Forecasting Model developed by New York City Transit. This model assumes a standard value of time across New York City, and therefore does not distinguish between income levels within the Home Zones.³⁸ Note, however, for commuters with an annual income lower than \$15,000, the One Bird program will waive the \$1 Bird unlock fee.

$$GC = TT * VOT + F$$

Where

GC: Generalized cost

TT: Access time

VOT: Value of time (\$15/hour)

F: Fare (\$)

Subway fare: \$2.75/ride

Scooter fare: \$1+\$0.15/minute/ride

³⁸ MTA New York City Transit, 2010, *Second Avenue Subway FEIS: Appendix D.1, Transportation – Ridership Modeling*.

APPENDIX D: USER PROFILE TRAVEL TIMES & FARES

Figure 12: Zone 1 Commute Times & Fares (Tina)

Mode(s)	Travel Time	Fare
Scooter	19 mins	\$3.85
Bike	19 mins	\$0.33 ³⁹
Scooter & Subway	31 mins	\$4.30
Walk & Subway (J/M/Z)	36 mins	\$2.75
Rideshare	38 mins	\$15.00
Express Bus	44 mins	\$2.75
Ferry	54 mins	\$2.75

Figure 13: Zone 2 Commute Times & Fares (José)

Mode(s)	Travel Time	Fare
Rideshare	29 mins	\$15.00
Bike	30 mins	\$0.33 ⁴⁰
Scooter & Subway	37 mins	\$4.50
Walk & Subway (J/M/Z)	43 mins	\$2.75
Express Bus & Subway	55 mins	\$2.75

Figure 14: Zone 3 Commute Times & Fares (Paulina)

Mode(s)	Travel Time	Fare
Scooter & Subway	47 mins	\$4.75
Walk & Subway (J/M/Z)	54 mins	\$2.75
Rideshare	55 mins	\$27.00

³⁹ Estimated by dividing the Citi Bike annual membership cost (\$169 per year) by annual commute trips (assumed at two per day, 260 working days per year)

⁴⁰ Estimated by dividing the Citi Bike annual membership cost (\$169 per year) by annual commute trips (assumed at two per day, 260 working days per year)