2019
Mechanical Broom Street Cleaning Evaluation

April 2019 to November 2019

City of Philadelphia

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I. Background

The Environmental Protection Agency recommends street sweeping as a best practice for municipal governments to engage in to minimize stormwater pollution run off. Consequently, many municipal governments allocate money to this public service every year. Unfortunately, residential mechanical street cleaning was discontinued in Philadelphia in 2008 primarily due to the recession.[1] Implementing mechanical street cleaning requires immense resources and can be challenging due to the need for residents to comply with alternate-side parking or other disruptive measures in order to allow street cleaning vehicles to operate. However, funding for residential street sweeping services was committed again beginning in 2016 by newly elected Mayor James F. Kenney, who prioritized clean streets in every neighborhood as part of his commitment to the residents of Philadelphia.

In the 2016-2017 Resident Survey,[2] Philadelphia residents rated streets, sanitation, and water as their primary concern. At the same time, residents expressed the most concern with street cleaning out of all public services offered by the City, with 56 percent of residents ranking street cleaning "poor" and 25 percent ranking the service "fair."

As litter and trash debris from city streets can enter Philadelphia's water system causing pollution and health problems, the City of Philadelphia is committed to improving current conditions in residential neighborhoods. The completion of the first publicly released citywide Litter Index Survey in 2017 highlighted the geographical concentration of litter in particular neighborhoods, showing how litter disproportionately impacts certain communities.[3]

Based on these factors, the City of Philadelphia designed a mechanical broom street cleaning pilot program, putting capital funding in place to buy new mechanical brooms, hire and train new crews, and administer the program. The pilot program launched in April 2019.

During the implementation of the pilot, the 2019-2020 Resident Survey[4] was conducted and found the top concern for residents again was streets, sanitation, and water and also quality of streets (including structural conditions and cleanliness). Only 15 percent of residents rated street cleaning as "excellent" or "good" with 78 percent rating street cleaning as "fair" (21 percent) or "poor" (57 percent).

These pilot results will inform how the Kenney Administration can effectively implement a citywide street cleaning program.

[1] Cleaning consisted of a mechanical broom running along the curb line of the street and sweeping up the debris and litter.

[2] City of Philadelphia. (2017). 2016-2017 Resident Survey Report [PDF file]. City of Philadelphia. Retrieved from https://www.phila.gov/media/20171026112614/2017ResidentSurvey-FINAL-v2.pdf

[3] Zero Waste Litter Cabinet. (2017). What Is The Litter Index?. Clean PHL. Retrieved on December 23, 2019 from https://cleanphl.org/what-is-the-litter-index/

[4] City of Philadelphia. (2019). 2019-2020 Resident Survey Report [PDF file]. City of Philadelphia. Retrieved from https://www.phila.gov/media/20200113092058/2019ResidentSurvey-FINAL.pdf

II. Program Overview

The 2019 Mechanical Broom Street Cleaning Pilot was designed and implemented by the Sanitation Division within the Streets Department, and a budget of $2.3 million was allocated by the City's Budget Office in 2019.

The pilot was conducted from April 2019 to November 2019 with the goal of improving litter and trash conditions. The winter months (December through March) were excluded due to the potential interference from snow and ice.

The City used the Philadelphia Litter Index Tool to help identify neighborhoods to include in the pilot. Neighborhoods that had an average litter rating above 2.0 indicated a significant amount of litter, and were included in the pilot.

2019 Mechanical Broom Pilot Neighborhoods:

West Philadelphia
Parkside Ave. to Lancaster Ave. from 52nd St. to Girard Ave.

Southwest Philadelphia
Woodland Ave. to Kingsessing Ave. from 49th St. to Cemetery Ave.

Kensington
2nd St. to Aramingo Ave. from Tioga St. to Lehigh Ave.

Strawberry Mansion
Sedgley St. to Lehigh Ave. from 29th St. to 33rd St.

Logan
Godfrey Ave. to Roosevelt Blvd. from Broad St. to 5th St.

South Philadelphia
McKean St. to Oregon Ave. from 4th St. to 8th St.

The City of Philadelphia Litter Index is a map-based survey of the litter conditions of the City's streets, parks and recreation sites, public school sites, green stormwater infrastructure, river ways, and vacant lots. The index is digitized using cloud-based surveys taken on tablets using GPS coordinates to ensure accuracy. Along with an estimated litter count on an asset or property, field surveyors also give a 1-4 litter rating based on metrics from Keep America Beautiful, with a rating of 1 being little to no litter, 2 being litter in the amount that can be picked up by one person, 3 being litter in the amount that would need a team to clean up, and 4 being litter that would require a large cleanup effort and/or heavy machinery to remove debris.

**Learn more at
https://cleanphl.org/what-is-the-litter-index/**

Map of 2019 Mechanical Broom Pilot Neighborhoods

Pilot Areas
Neighboring Areas
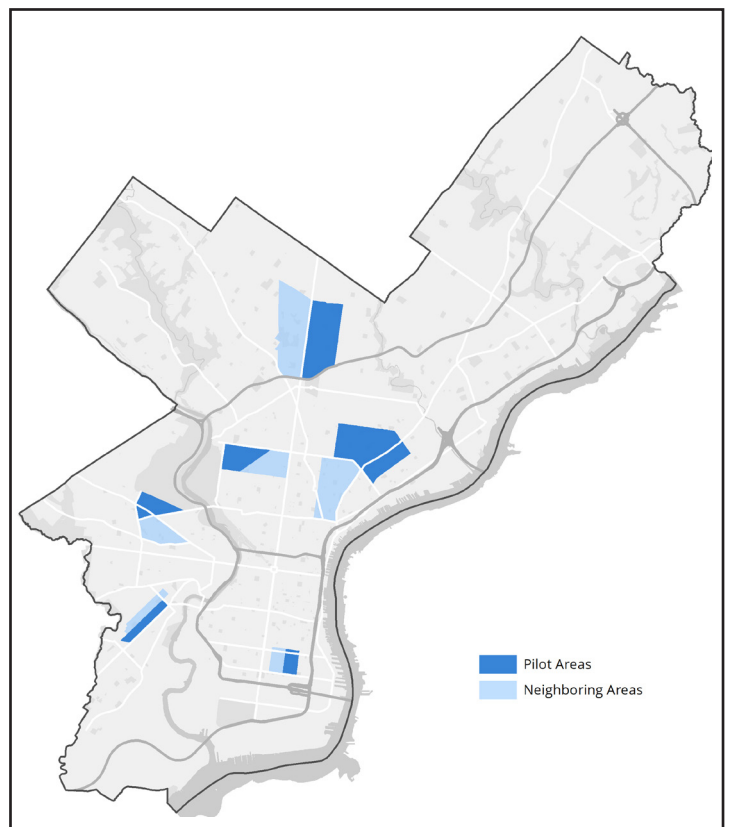
The Sanitation Division within the Streets Department hired new full-time laborers and purchased equipment to develop six pilot cleaning crews, one for each neighborhood. Six mechanical street cleaning crews worked each weekday, Monday to Friday, during normal business hours, 7am to 3pm, to clean their designated routes. The following sequence was planned for the mechanical broom pilot in each neighborhood:

1. Trash and recycling was collected on the regular pick-up schedule, and only changed for regularly scheduled holidays.

2. Mechanical broom street cleaning intentionally occurred one day after the regularly scheduled trash collection day in each pilot area, which allowed the mechanical brooms to pick up leftover debris.

3. Streets Department laborers equipped with backpack blowers and hand brooms cleaned each pilot route the day after trash collection.

4. Mechanical brooms followed each cleaning crew once debris was blown off sidewalks and curb lines into the street. Residents were encouraged, but not required to move their vehicles for the 2019 pilot.

5. Existing Streets & Walkways Education and Enforcement Program (SWEEP) officers were deployed simultaneously to patrol the pilot neighborhoods and address code violations related to litter.

Each pilot area was assigned to a cleaning crew, and each cleaning crew consisted of six laborers. Five laborers operated the backpack blowers and hand brooms and one laborer served as an equipment operator to follow the cleaning crew and drive the mechanical broom.

An additional two crew chiefs were added to oversee the full mechanical street sweeping operation, while another five laborers were reserved for unexpected staff shortages.

In addition to operations, the Streets Department expanded their existing data collection infrastructure to routinely record the tonnage of trash collected, and document the mileage on mechanical brooms during the pilot.

Survey of Resident Experiences

The Streets Department further added departmental resources to canvas each pilot neighborhood using door-to-door outreach to collect feedback from residents about the mechanical broom pilot, and their perceptions of litter in their neighborhood before and during the pilot. The Mechanical Sweeping Pilot Survey was conducted over the course of four weeks, from October 15, 2019 to November 15, 2019. The outreach team consisted of SWEEP and Philadelphia More Beautiful Committee (PMBC) officers for a total of 15 employees. The team surveyed residences (no businesses) in all six of the pilot areas between the hours of 8am to 3:30pm from Monday through Friday.

III. Prior Research and Relevant Literature

GovLabPHL* conducted an analysis of the 30 most populous U.S. cities and Pittsburgh, PA[5] to see how other major City governments manage street litter and trash. From the analysis, it was found that all cities had a street sweeping program although one city only had a pilot program (Jacksonville, FL).

In some cities, private contractors managed the services instead of the government. Coverage was citywide for most cities (where more than 90 percent of city streets were swept at least once a year), while some cities only limited the scope of the services to downtown, business, and commercial or residential areas. In all cases, commercial areas were cleaned more often, ranging from daily to quarterly, while residential areas were only cleaned weekly to yearly. Many of the northern cities stopped operations in the winter due to the unpredictability of snow and ice.

About half of the cities enforced parking restrictions in all or certain areas to ensure mechanical brooms were not hindered, while a small number of cities asked residents to voluntarily move their vehicles. Commercial districts tended to be swept at night to minimize disruptions to businesses and traffic. In a quarter of the cities, cleaning services also included sweeping before and after special events, bike lanes, trails, or public transit with varying frequency.

*GovLabPHL is an initiative led out of the Mayor's Policy Office to advance the practical use of data and evidence across local government.
[5] Pittsburgh, PA was added to include another Pennsylvania city for comparison, even though it was not one of the 30 most populous U.S. cities.
[6] Sweeping frequency of commercial and residential streets varied. Some programs only swept residential areas once to twice a year.
[7] Commercial area sweeping was unknown in Jacksonville, FL.
[8] Sweeping areas were unknown in Fort Worth, TX.
[9] The more frequent timing was listed if a range of frequency that overlapped two categories was provided.
[10] The more frequent timing was listed if a range of frequency that overlapped two categories was provided.
[11] In two cities, it was unclear if parking restrictions were enforced.

Summary Table of Mechanical Street Sweeping Programs
(see Appendix for full data table)

Management Type

City government	24
Private contractors	5
Mixed programs	2

City Coverage

Citywide[6]	26
Limited to downtown/business/ commercial areas	3
Limited to residential areas[7]	1
Areas unknown or unclear[8]	1

Commercial Sweeping Frequency[9]

More than twice a week	8
Once a week or more but less than thrice a week	8
Once a month or more but less than once a week	5
Once a quarter or more but less than once a month	3
Unknown or unclear	7

Residential Sweeping Frequency[10]

Once a week or more but less than once a day	6
Once a month or more but less than once a week	11
Once a quarter or more but less than once a month	5
Once a year or more but less than once a quarter	3
Unknown or unclear	3
Not swept	3

Parking Restrictions

In all or some areas[11]	12
Voluntary removal	6
Unknown or unclear	13

Special Cleaning Services

Events, bike lanes, trails, or public transit	8

GovLabPHL also looked at previous academic research on mechanical street sweeping programs. There is a limited body of academic literature with only a few studies addressing or demonstrating evidence of the effectiveness of municipal street sweeping programs on reducing litter.

While programs may reduce pollution and trash, there were some environmental concerns in the implementation of programs such as fuel consumption and air quality when brushes raise dust.[12]

There were also health studies completed on the sweepers, although they were less applicable since workers in the studies did not have proper protection gear.[13] (The Philadelphia Streets Department issues uniform jumpsuits, eye protection, dust masks, puncture resistant gloves, and work boots to all their laborers.)

The type of equipment and parking restrictions, such as gutter brushes[14] and illegally parked cars,[15] have been studied to determine the effectiveness of sweeping programs.

There were not enough studies to summarize conclusive overall findings and trends. Therefore, this pilot study's aim is to broaden the evidence that exists concerning mechanical street sweeping programs and effective methods to address litter.

[12] Amato, F., Querol, X., Johansson, C., Nagl, C., Alastueya, A. (2010). A review on the effectiveness of street sweeping, washing and dust suppressants as urban PM control methods. Science of The Total Environment, 408(16), 3070-3084/ Retrieved from https://www.sciencedirect.com/science/article/pii/S0048969710004031
Bartolozzi, I., Baldereschi, E., Daddi, T., & Iraldo, F. (2018). The application of life cycle assessment (LCA) in municipal solid waste management: A comparative study on street sweeping services. Journal of Cleaner Production, 182, 455-465. Retrieved from https://www.sciencedirect.com/science/article/pii/S0959652618302610
[13] Salve, P.S., & Chokhandre, P. (2016). Assessing the exposure of street sweeping and potential risk factors for developing musculoskeletal disorders and related disabilities: a cross-sectional study. BMJ Open, 6(12), E012354. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5168656/
[14] Riccio, L., & Litke, A. (1986). Making a Clean Sweep: Simulating the Effects of Illegally Parked Cars on New York City's Mechanical Street-Cleaning Efforts. Operations Research, 34(5), 661-666. Retrieved from www.jstor.org/stable/170724
[15] Vanegas Useche, L.V., Abdel Wahab M.M., Parker, G.A. (2010). Effectiveness of gutter brushes in removing street sweeping waste. Waste Management, 30(2), 174-184. Retrieved from https://www.sciencedirect.com/science/article/pii/S0959652618302610

IV. Partner Organizations

This project was a collaboration between the following organizations within the City of Philadelphia: the Streets Department and GovLabPHL.

The evaluation was designed by all groups collectively.

The Streets Department designed and implemented the Mechanical Broom Street Cleaning Pilot from April 1, 2019 to November 30, 2019, recorded data on litter collected and miles driven, conducted the Litter Index survey in pilot and neighbor (selected areas adjacent to the pilot areas with no cleaning to provide a baseline for comparison) areas, surveyed residents in pilot areas, and provided data for evaluation.

Preliminary results of this study were shared with the Mayor by December 2019 for decision-making purposes with the goal of releasing a finalized report by February 2020. The results of this study are designed to inform future operational and funding decisions for mechanical broom street sweeping efforts in the City of Philadelphia.

GovLabPHL

The Kenney Administration is committed to using data and evidence to drive decision-making. The Streets Department partnered with GovLabPHL, a multi-agency intergovernmental team led by the Mayor's Policy Office to increase the practical use of data and evidence to make informed decisions through research and evaluation.

The City designed this research project to examine the effectiveness of their street sweeping efforts. This evaluation focused on both the implementation and the impact of the mechanical street cleaning pilot.

The results of this study are designed to inform future operational and funding decisions for mechanical broom street sweeping efforts in the City of Philadelphia.

V. Study Design

All six neighborhood areas that received mechanical street cleaning services from the City were included in this evaluation:

West Philadelphia[16]
Parkside Ave. to Lancaster Ave. from 52nd St. to Girard Ave.

Southwest Philadelphia
Woodland Ave. to Kingsessing Ave. from 49th St. to Cemetery Ave.

Kensington
2nd St. to Aramingo Ave. from Tioga St. to Lehigh Ave.

Strawberry Mansion
Sedgley St. to Lehigh Ave. from 29th St. to 33rd St.

Logan
Godfrey Ave. to Roosevelt Blvd. from Broad St. to 5th St.

South Philadelphia
McKean St. to Oregon Ave. from 4th St. to 8th St.

This study assessed both the implementation and the impact of the mechanical street cleaning pilot in the six areas.

- To assess implementation, GovLabPHL used data provided by Streets specifying the miles traveled, trash collected, and equipment used in each of the six pilot areas on each day of the program.

- For impact, GovLabPHL looked at the Litter Index levels in pilot and non-pilot areas measured at two points, before the pilot and during the pilot.

Because the pilot areas were chosen for their relatively high rate of litter, comparing changes in Litter Index to litter rates citywide was not a valid study design. This was especially true because research shows that people are more likely to litter in areas that already have more litter, making high-litter areas more difficult to clean.[18] To create as valid a comparison as possible, six areas adjacent to (but not within) the pilot areas - referred to

here as "neighbor" areas - were selected for Litter Index measurement before and during the pilot. Although neighbor areas were relatively cleaner before the pilot began (see Figure 6), they provided a reasonable baseline with which to compare the areas within the mechanical street cleaning pilot.

The City's Litter Index data provided the most direct measurement of the amount of litter on the streets, which was the primary target of the mechanical broom pilot. However, there were limitations to using this data to measure the pilot's effectiveness.

The Litter Index is collected by City staff doing visual assessments block by block, and takes time to collect. Figure 1 shows when blocks from different pilot and neighbor areas were assessed as part of the citywide 2018 Litter Index, and again as part of the 2019 Mechanical Broom Pilot. Because the amount of litter around the city changes over time, it is difficult to use the Litter Index to compare specific neighborhoods measured at specific times during the year.

Therefore, although the City explored the Litter Index ratings before and during the pilot, across pilot and neighbor areas, this was a very limited amount of information available to assess the impact of the study.

More frequent Litter Index surveys of pilot areas both before, during, and after sweeping could provide better measurement of the impact of future street sweeping efforts.

[16] The West Philadelphia and Southwest Philadelphia neighborhood pilot areas were combined five weeks after the pilot began after crews were able to complete both areas each week using a single crew.
[17] The Kensington neighborhood pilot area was split into two areas with one crew each five weeks after the pilot began after the crew was unable to complete the full area each week with a single crew.
[18] Meehan, S. (2019, June 18). You Asked: Why is there so much trash in Baltimore? We dug into the City's trash problem. The Baltimore Sun. Direct quote from Theresa DiDonato, Associate Professor, Loyola University. Retrieved from https://www.baltimoresun.com/ask/bs-md-ci-hearken-trash-20190502-story.html

Figure 1: Date of litter indexing of pilot (top) and neighbor (bottom) areas, over time, shaded by area of the city covered in the pilot.
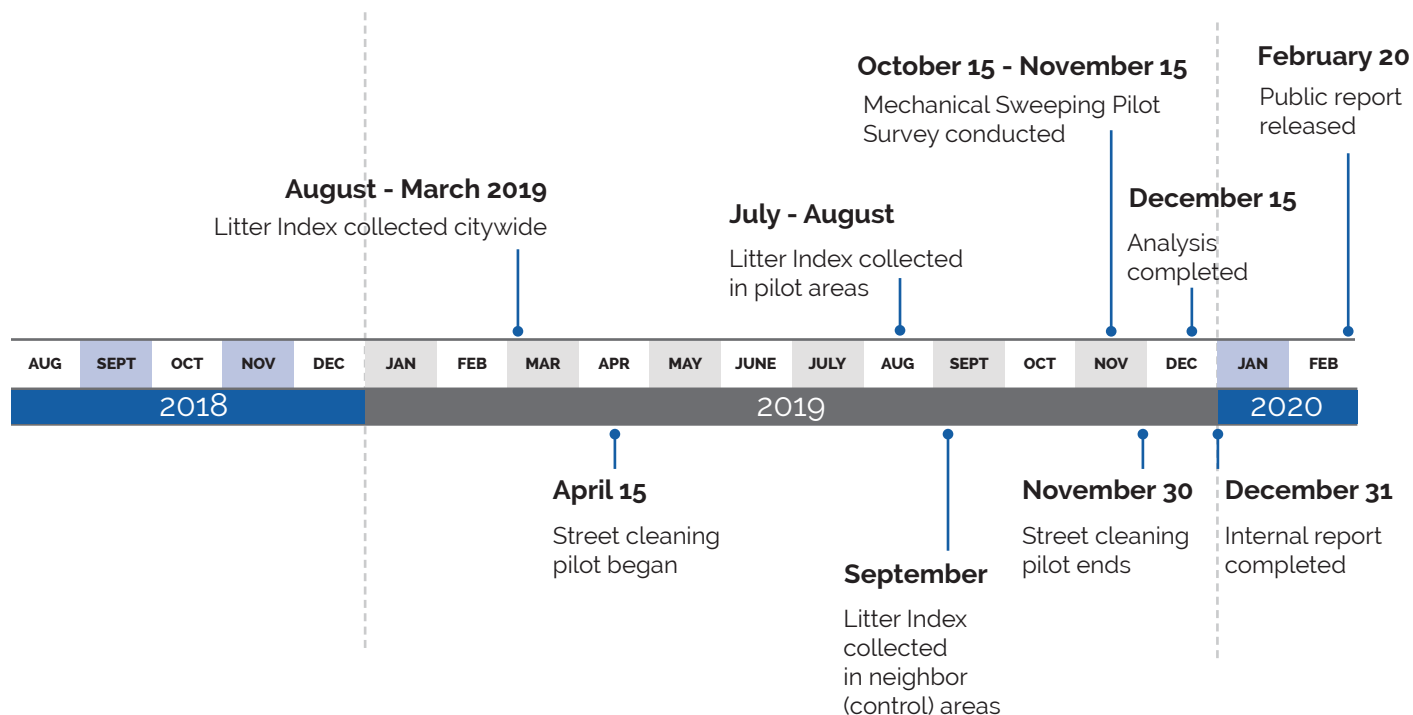

One way to supplement this information was with a comprehensive survey of residents in the pilot areas, conducted by the Streets Department during the pilot.

GovLabPHL analyzed the results of this survey, which measured resident experience with litter and satisfaction with the mechanical street cleaning pilot program. This provided evidence for how the pilot impacted resident experiences.

Because residents are the experts in their own day-to-day lives, and have much more information than City employees as to the quality of life in their neighborhoods, these surveys provided a rich source of information as to the real-life impact of street sweeping that was not captured in the limited Litter Index data that was available.

VI. Project Timeline

October 15 - November 15
Mechanical Sweeping Pilot Survey conducted

February 20
Public report released

August - March 2019
Litter Index collected citywide

July - August
Litter Index collected in pilot areas

December 15
Analysis completed

AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB

2018   **2019**   **2020**

April 15
Street cleaning pilot began

September
Litter Index collected in neighbor (control) areas

November 30
Street cleaning pilot ends

December 31
Internal report completed

VII. Financial Considerations

The pilot program had a total budget of $2.3 million. $1,321,720 was used for newly hired laborers (not including indirect costs). The rest of the budget was used to purchase new equipment (mechanical brooms and backpack blowers) and transport of equipment and laborers to each location.

The daily cost of each crew to operate their equipment per pilot area was $1,403. With all six cleaning crews, the daily cost of operations was $8,418. The program was in operation for 157 weekdays (Monday to Friday, excluding holidays) from April 15, 2019 to November 30, 2019.

VIII. Outcomes

There were three primary outcomes for this evaluation:

1. The amount of trash collected and miles traveled on each route, over time

2. Resident responses to the Mechanical Street Cleaning Pilot Program Survey

3. The Litter Index distribution (proportion of blocks with 1, 2, 3, and 4 rating) in pilot and neighbor areas

IX. Data Variables and Collection

In order to implement the pilot, the Streets Department provided the following data, covering the mechanical street cleaning pilot from April 2019 to November 2019:

- Daily data on street cleaning implementation in each pilot area, including:
    - Tonnage of trash collected
    - Mileage (reported by crews)[19]
    - Number of streets covered
- Survey responses from residents in pilot areas
- Litter Index data from the 2018 citywide survey and during the 2019 pilot, including:
    - Date surveyed
    - Location surveyed
    - Litter index rating at the location[20]

X. Hypotheses

- The amount of trash collected by street cleaning crews will initially increase as the program is implemented, and then decrease as streets become cleaner.

- The amount of miles covered by street cleaning crews each day will increase over time, as crews become more efficient and neighborhoods become cleaner.

- Compared to non-swept neighbor areas, pilot areas will have a lower number of blocks with 2 and 3 ratings and a higher number of 1 ratings during the mechanical street cleaning pilot. (The number of 4 ratings is unlikely to decrease, since 4 ratings require heavy equipment to clean the litter.)

XI. Analysis Plan

The impact on litter was assessed by comparing the Litter Index in pilot areas and neighbor areas before the pilot and during the pilot in order to estimate the reduction in blocks rated 2 or 3 on the Litter Index. Specifically, the difference in the Litter Index between areas with and without street cleaning before the pilot launched was compared to the difference in the Litter Index between areas with and without street cleaning during the pilot was completed. While this provides very limited evidence to evaluate the hypotheses, it resembles a difference-in-difference research design.[21]

[19] Tonnage and mileage was only collected starting May 14, 2019 once specific data collection infrastructure was set up.
[20] 1 indicates a clean block, 2 indicates a block with a few pieces of litter, 3 indicates a block that would require substantial effort to clean, and 4 indicates a block with litter at a scale requiring equipment to clean.
[21] Wing, C., Simon, K., & Bello-Gomez, R.A. (2018). Designing Difference in Difference Studies: Best Practices for Public Health Policy Research. Annual Review of Public Health, 39, 453-469. Retrieved from https://www.annualreviews.org/doi/10.1146/annurev-publhealth-040617-013507

XII. Results

Implementation

The effectiveness of the pilot program's implementation was measured based on tonnage of trash collected and mileage reported by street cleaning crews each day. Figure 2 shows the tons of litter collected per day and the graph on the right shows the miles traveled by the mechanical brooms per day.

After the start of the pilot, the Streets Department discovered that the Kensington area selected would require more resources to effectively sweep, while the West and Southwest Philadelphia neighborhoods were relatively easier to sweep. To address this, the Kensington pilot area was divided into two and allocated an additional crew, while the West and Southwest Philadelphia areas were combined and swept by a single crew. Because implementation data was collected by crew, the Kensington areas were split (labeled Kensington 1 and 2 in Figure 3) and the West and Southwest Philadelphia areas were combined in the implementation analysis.

Over the course of the pilot program, the amount of trash collected per day decreased and miles driven per day by the mechanical brooms increased over time. The initial decrease in tonnage reflected a decreasing amount of litter collected. This was in line with Hypothesis 1, which expected decreases in tonnage collected over time because of cleaner streets. Tonnage collected followed similar patterns across neighborhoods (Figure 3). In most neighborhoods, between 1 and 1.5 tons of litter were collected at the onset of the program, dropping closer to 0.5 tons over the first few months. South Philadelphia was an exception, where tons of litter collected started at the lower 0.5 ton rate. Most neighborhoods then experienced an increase near the end of the program, with the exception of the second Kensington neighborhood where collection remained relatively low.

The smaller, late increase in tons of litter collected per day could be due to several factors. First, as shown in the Litter Index analysis, the amount of litter in both pilot and neighbor areas increased in autumn 2019.

This change was unlikely to be due to mechanical broom activity since litter increased in both pilot and neighbor areas. Second, falling leaves during the autumn season increased the tonnage collected by all street sweeping efforts.[22]

Meanwhile, vehicle efficiency seemed to improve over time, as more ground was covered by the mechanical brooms each day. This was also in line with Hypothesis 2, which expected increases in miles traveled per day. The improvement in mileage was concentrated in the second Kensington area, Logan, and the West and Southwest Philadelphia areas, while the first Kensington neighborhood, South Philadelphia, and Strawberry Mansion remained consistent over time.

Figure 2: Tons of litter collected and miles traveled across all pilot areas each day. Each point represents a day of operations. The blue line provides the trend in tonnage or mileage over time.
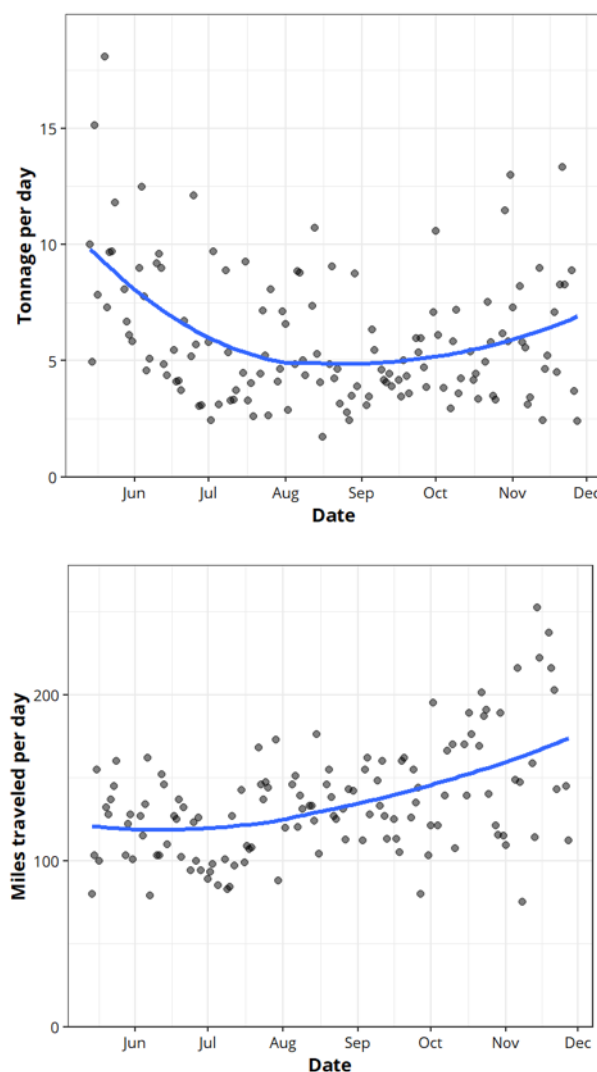
[22] Direct comparison of tonnage of litter collected by mechanical brooms between pilot and neighbor areas was not possible, because neighbor areas were by definition not swept by mechanical brooms.

Figure 3: Tons of litter collected across each pilot area each day. Each point represents a day of operations. The colored lines provides the trend in tonnage over time.
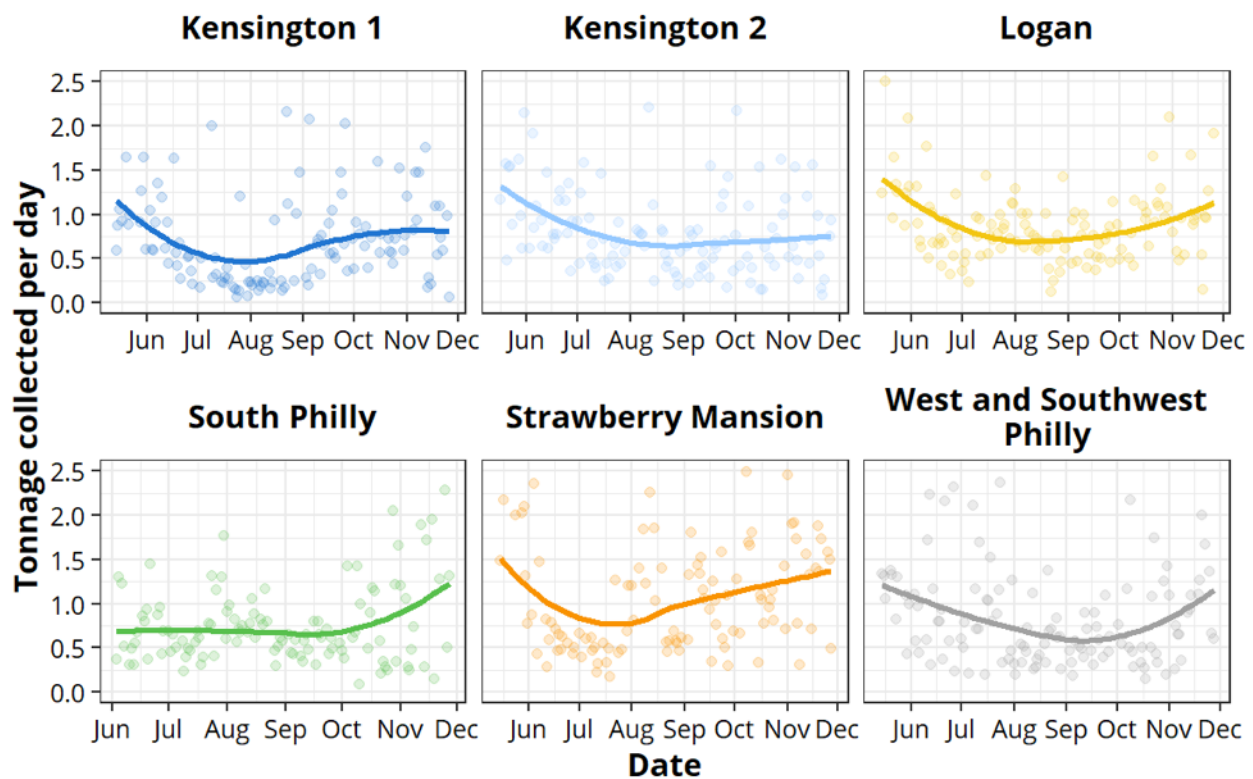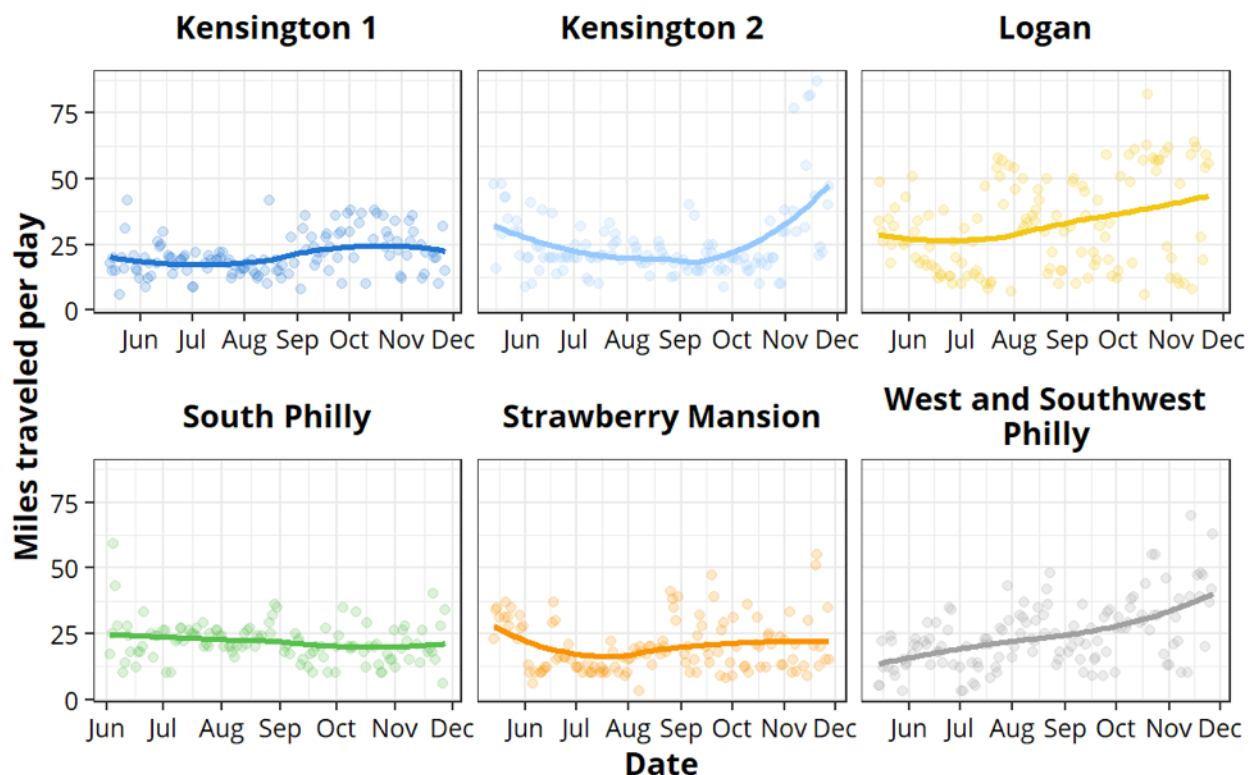

Figure 4: Miles traveled across each pilot area each day. Each point represents a day of operations. The colored lines provides the trend in mileage over time.
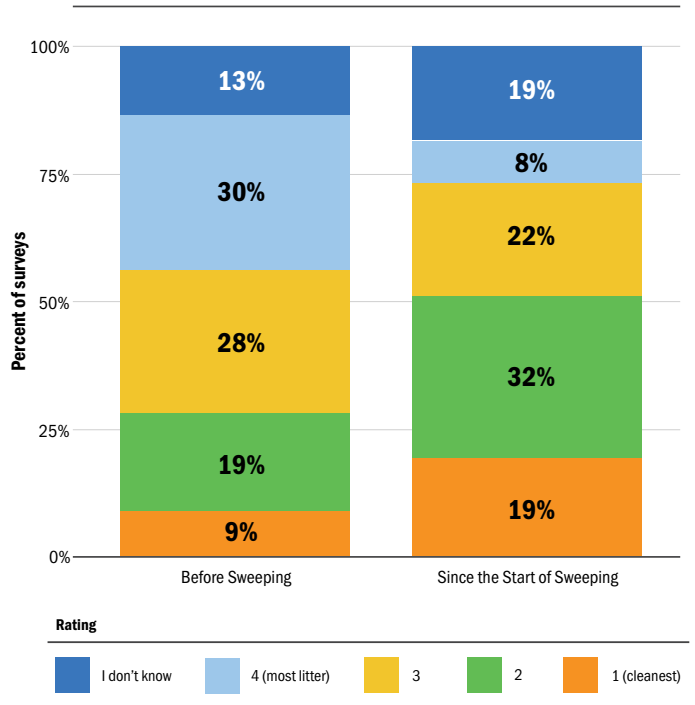
Resident Perceptions

The Streets Department conducted a ten question survey using door-to-door outreach to measure resident perceptions of litter and satisfaction with the Mechanical Broom Street Cleaning Pilot Program in the pilot areas (not in the neighbor areas).

The SWEEP and PMBC officers visited 9,663 residences over the course of a month. Approximately 2,473 residences (26 percent) completed the survey, a relatively high response rate for door-to-door outreach and for surveys in general. Approximately 7,190 residences were contacted but surveys were not completed due to no answer, a language barrier, or the property was abandoned.

The responses were analyzed by GovLabPHL and are summarized in Figure 5. The overall response from residents was favorable. Many of the residents appreciated the City's service and expressed seeing a positive difference in the cleanliness of their block.

The first part of the survey asked residents to rate the cleanliness of their block from 1 (cleanest) to (most litter) before and during the program. The graph below reflects the percentage of responses for each rating before and during the program.
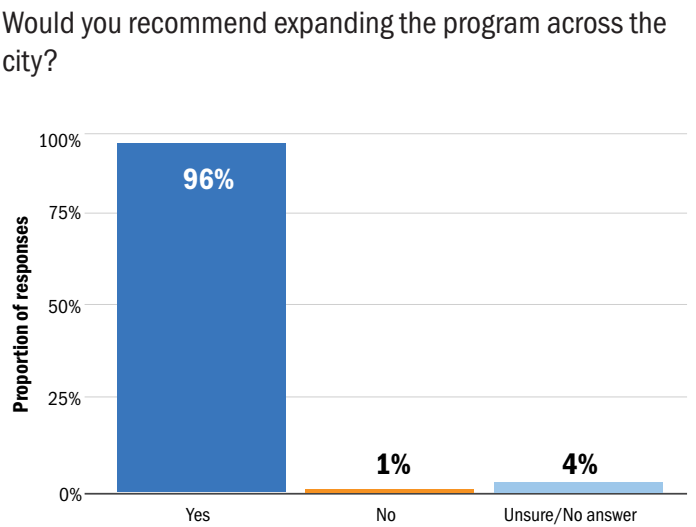
The 1 and 2 ratings (orange and green) increased after the start of the program while 3 and 4 ratings (yellow and light blue) decreased, indicating a decrease in the perception of litter in their neighborhood. There was the biggest decrease in 4 ratings, the highest amount of litter, from 30 to 8 percent.

In the second part of the survey, residents reported their satisfaction with the pilot program.

More than 96 percent of residents in each pilot area supported expanding the program across the city, with 78 percent of them recommending the continued sweeping frequency of weekly.

Ninety-two percent of residents also supported using the newly implemented backpack blowers to assist in moving dirt and debris along the curb.

Ninety-one percent supported moving their vehicles, making it easier for the mechanical brooms to sweep.

Figure 5: Percent of responses from the survey by resident litter rating. On average, residents said that their blocks were cleaner (lower ratings) during the mechanical broom pilot than they were before the mechanical broom pilot.

Rating

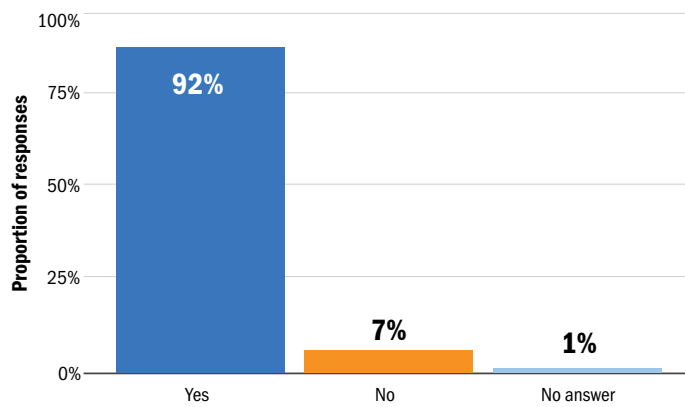| I don't know | 4 (most litter) | 3 | 2 | 1 (cleanest) |

Would you recommend expanding the program across the city?

How frequently would you recommend receiving mechanical sweeping service on your block?
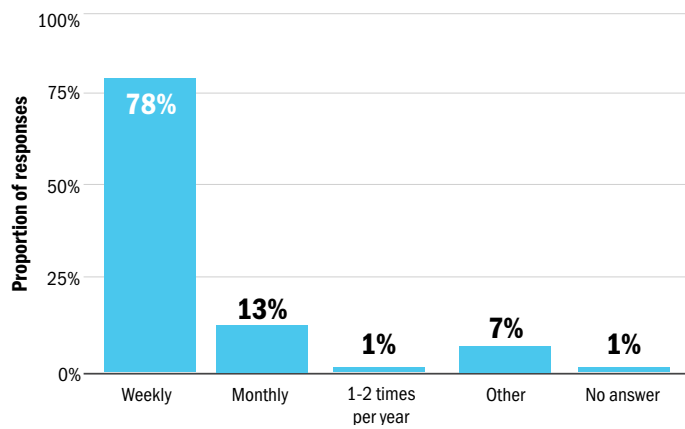
Do you support using backpack blowers to remove loose dirt and debris from along curb lines?

Would you support moving your vehicle to allow street sweeping brooms to remove debris along the curb line?
(answers shown only from people who drive or park on the street)
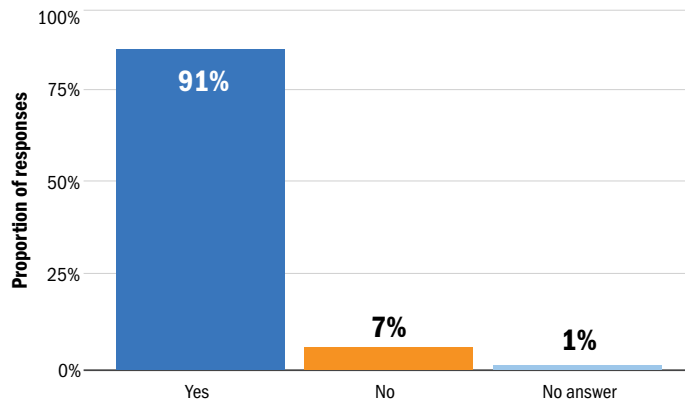
Litter Index

While it seemed the effectiveness and efficiency of implementation increased over time and resident perceptions were positive, the Litter Index ratings did not fully reflect the same results.

Table 1 shows the change in average rating of the pilot and neighbor areas before and during the pilot program. Since a Litter Index rating of 1 is the cleanest, a decrease in the Litter Index is a good outcome, indicating a decrease in the amount of litter measured in an area.

Between the 2018 citywide Litter Index, and the 2019 Litter Index conducted in pilot and neighbor areas, the average Litter Index rating declined more for pilot areas than the neighbor areas, indicating more litter in pilot areas.

In Logan and Strawberry Mansion, the average Litter Index rating of the pilot area improved, indicating some reductions in litter, but not as much as the neighbor area that was not part of the pilot.

Table 1: Change in average Litter Index rating in pilot and neighbor areas before and during the pilot program.

Area	Change in average Litter Index rating in Pilot Area	Change in average Litter Index rating in Neighbor Area
Logan	-0.07	-0.30
Kensington	0.39	0.18
South Philadelphia	0.30	0.14
Southwest Philadelphia	0.10	-0.08
Strawberry Mansion	-0.18	-0.19
West Philadelphia	0.64	0.19

Figure 6: Proportion of blocks by Litter Index rating before and during the pilot program. The dark blue bars represent the pilot area and the light blue bars represent the neighbor area used for comparison.
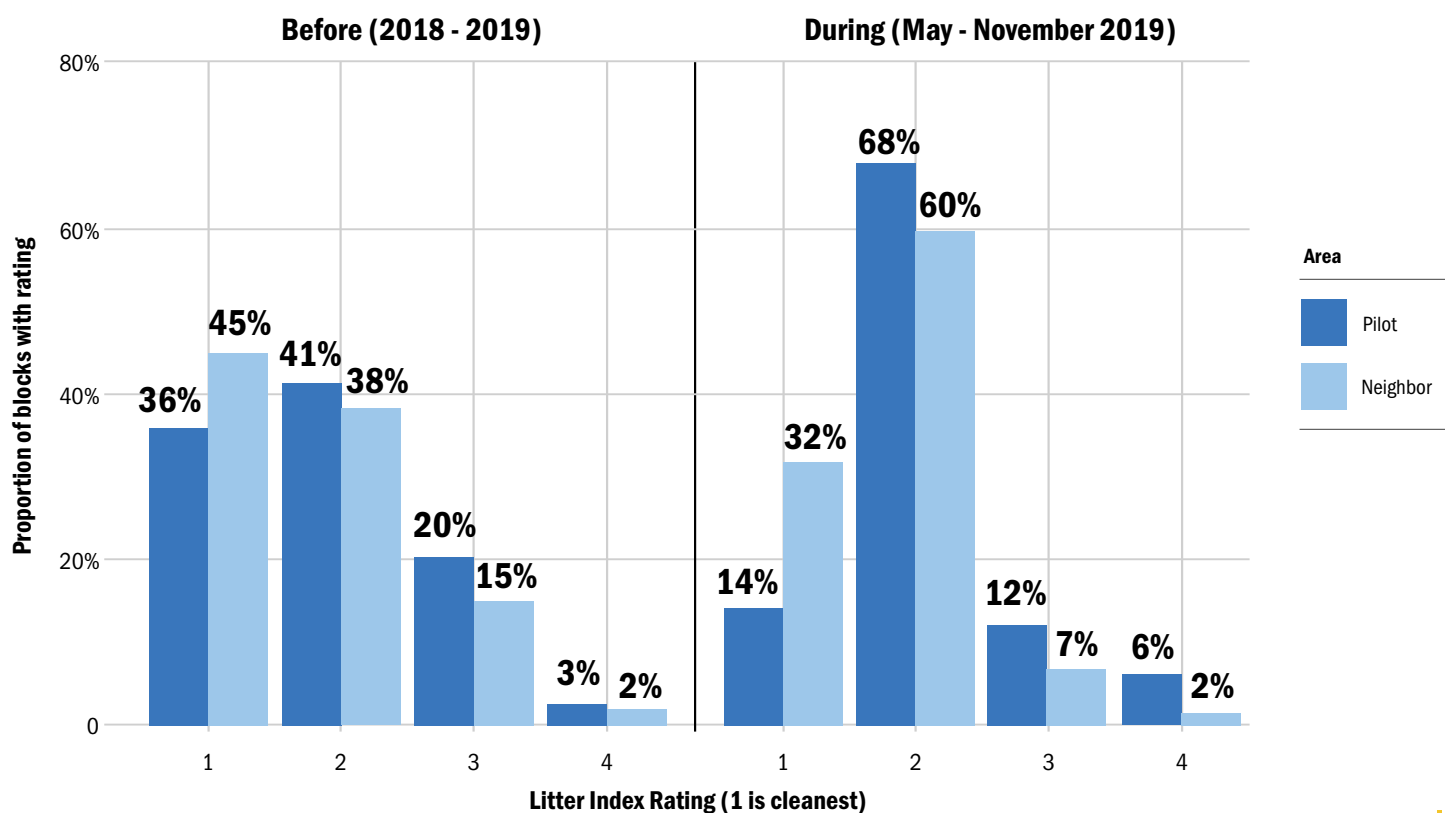
XII. Results

In Kensington, South Philadelphia, and West Philadelphia, the average Litter Index rating declined for both the pilot and neighbor area, but more so for the pilot area.

In Southwest Philadelphia, the average Litter Index rating of the pilot area declined, while the average Litter Index rating of the neighbor area improved.

Before the mechanical broom pilot, the targeted areas looked mostly like the chosen comparison areas, shown in the graph on the left of Figure 6. Pilot areas had lower proportions of 1 ratings, and higher proportions of 2's and 3's. When measured during the pilot (the graph on the right of Figure 6), all areas (swept and unswept) had greater proportions of 2 ratings, and pilot areas had more litter, not less litter, compared to neighbor areas. The change in the difference between pilot and neighbor areas was also analyzed, and the only pilot area that may have seen improvements (more 1's compared to neighbor areas) was Strawberry Mansion.

As described earlier, it is important to note that blocks in the pilot and neighbor areas were surveyed at different times, and not always as a group. This could have played a role in the rating differences. For instance, if there is a citywide change in the amount of litter on city streets, measurement at varying times could be reflecting this citywide trend and not the pilot program's effects. Because collecting litter index data is labor- and time-intensive, the City does not currently have this data.

XIII. Ethical Concerns and Potential Risks

Residents living in pilot areas stand to benefit from cleaner streets, but may also object to the use of mechanical street cleaning vehicles and backpack blowers. The Streets Department's survey of residents in the pilot areas was motivated in part to evaluate this concern.

Other areas of Philadelphia could also benefit from the street cleaning, but did not benefit during this pilot because of its limited geographic scope. This concern was justified primarily by the high cost of rolling out the mechanical street cleaning program citywide, and the need to carefully measure its impact before committing substantial taxpayer dollars to the effort.

Questions were raised about the impact of emissions from backpack blowers on air quality. However, federal, state, and local regulations (for example, from the Consumer Product Safety Commission) do not recognize a substantial risk from exhaust to users of backpack blowers; the engines used by the blowers are below the 100-horsepower threshold set by the Health Department for requiring inspection. The City is interested in working with Personnel Health or Occupational Health and Safety to ensure there is minimal risk to any City employees operating backpack blowers to service the City of Philadelphia.

XIV. Recommendations

Given these findings, GovLabPHL makes the following recommendations:

1. Continue the Mechanical Broom Street Cleaning Pilot for at least an additional year and evaluate the program again at the conclusion of 2020.

2. Consider maintaining the existing pilot areas, and/or piloting with larger areas using the same six neighborhoods, and test residents moving their vehicles on scheduled street sweeping days.

3. Conduct a Litter Index before, during, and after the next phase of the pilot.

4. Conduct resident perception surveys in the pilot and neighbor areas during the next phase of the pilot.

5. Make improvements to the litter indexing process to ensure there is more continuity across who is indexing, and when neighborhoods are indexed throughout the year.

6. Continue monitoring the use of the backpack blowers to be responsive to any impact on the environment or on the users.

7. GovLabPHL would also be supportive of working with the Streets Department to pilot and evaluate other creative alternatives to address litter and illegal dumping.

XV. Follow-Up

The collaboration between the Streets Department and GovLabPHL will continue in 2020. This analysis will be used to help conduct an evaluation of the second phase of the pilot occurring from April 2020 to November 2020.

XVI. Appendix

Resident Perception Survey Questions

Street Sweeping Programs by City

Resident Perception Survey Questions

Mechanical Street Cleaning Pilot Programs

The City of Philadelphia is conducting a Mechanical Cleaning Pilot Program in various areas of the city. We are providing this survey to gain your feedback on services provided. We are committed to providing you with the best service possible, so we welcome your comments. Thank you.

The City Mechanical Cleaning Pilot Program began in April 2019. It is being conducted in the following areas of the city. Please select the boundary you live in.

West Philadelphia- Parkside Ave to Lancaster Ave from 52nd St to Girard Ave

Southwest- Woodland Ave to Kingessing Ave from 49th St to Cemetery Ave

Kensington- 2nd St to Aramingo Ave from Tioga St to Lehigh Ave

Strawberry Mansion- Sedgley St to Lehigh Ave from 29th St to 33rd St

Logan- Godfrey Ave to Roosevelt Blvd from Broad St to 5th St

South Philadelphia- McKean St to Oregon Ave from 4th St to 8th St

-Please Select- ▼

On a scale of 1 to 4, rate the cleanliness of your block BEFORE the mechanical street cleaning pilot program

Please use the following rating system to complete the questions. "A rating of (1) being little to no litter, (2) being litter in the amount that can be picked up by one person, (3) being litter in the amount that would need a team to clean up and (4) being litter that would require a large cleanup effort and/or heavy machinery to remove debris."

| ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ I don't know |

On a scale 1 to 4, please rate the cleanliness of your block SINCE THE START OF mechanical street cleaning service.

Please use the following rating system to complete the questions. "A rating of (1) being little to no litter, (2) being litter in the amount that can be picked up by one person, (3) being litter in the amount that would need a team to clean up and (4) being litter that would require a large cleanup effort and/or heavy machinery to remove debris."

| ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ I don't know |

How frequently would you recommend receiving mechanical sweeping service on your block?

(Mark only one box)

○ Once a week

○ Once a month

○ 1-2 times per year

○ Other

Do you support using backpack blowers to remove loose dirt and debris from along curb lines?

(Mark only one box)

○ Yes

○ No

Do you drive and park on the street?

○ Yes

○ No

Would you support moving your vehicle to allow street sweeping brooms to remove debris along the curb line?

(Mark only one box)

○ Yes

○ No
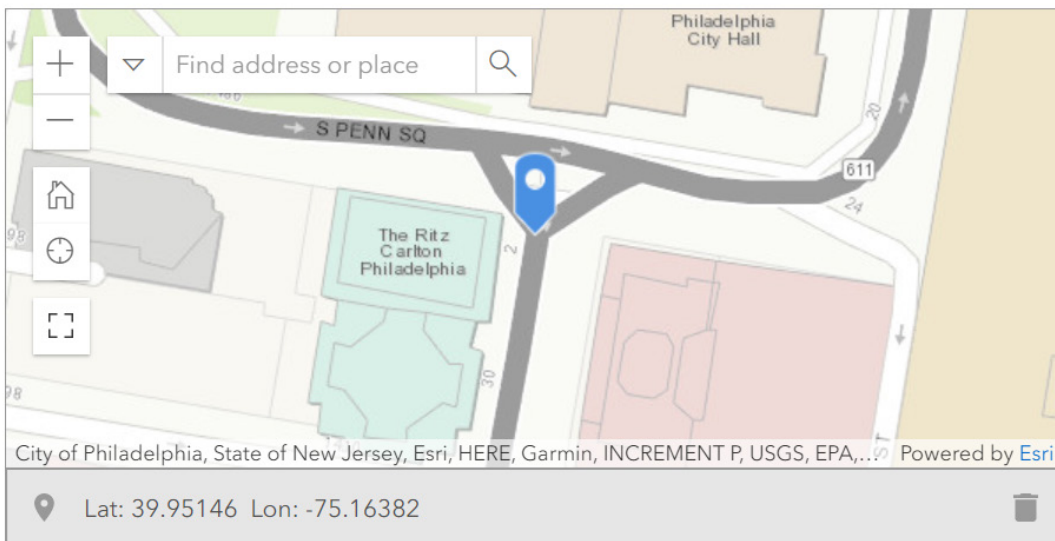
○ I do not drive or park on street

Would you recommend expanding the program across the city?
(Mark only one box)

○ Yes	○ No	○ Unsure

Add your Address

Lat: 39.95146 Lon: -75.16382

Street Sweeping Programs By City

Key

Street Sweeping Program

Y = City government service   **C =** Privately contracted service   **Y/C =** Mixed program (some services contracted)

City Coverage

C = Citywide[23]   **L =** Limited to downtown/business/ commercial or residential areas   **U =** Unknown or unclear

Parking Restrictions

Y = Parking restrictions in all or some areas   **V =** Only voluntary removal   **U =** Unknown or unclear

Population Ranking	City	Street Sweeping Program	City Coverage	Downtown/ Business/ Commercial Frequency	Residential Frequency	Times of Year and Day	Parking Restrictions	Other Areas/ Service
1	New York, NY[24]	Y	C	Once a week to multiple times a week	Once a week to multiple times a week		Y	
2	Los Angeles, CA[25]	Y	C	Periodic to once a week to multiple times a week	Periodic to once a week to multiple times a week	Business district - early morning cleanings to minimize disruptions	Y	Special events Bike lanes
3	Chicago, IL[26]	Y	C	Bi-monthly	Bi-monthly	Apr. to Mid-Nov.	Y	
4	Houston, TX[27]	Y	C	Once a week	Once a quarter		U	
5	Phoenix, AZ[28]	Y	C	Major and collector streets - every 14 days Downtown business corridor - twice a week	Once a quarter		V	Bulk trash collection
6	Philadelphia, PA[29]	Y	L	1 to 6 times a week, average of 3 to 4 times a week	Not swept		U	

[23] It was considered citywide if more than 90 percent of city streets were swept at least once a year.

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XVI. Appendix - Street Sweeping Programs by City

Population Ranking	City	Street Sweeping Program	City Coverage	Downtown/ Business/ Commercial Frequency	Residential Frequency	Times of Year and Day	Parking Restrictions	Other Areas/ Service
7	San Antonio, TX[30]	Y	C	Arterial - once a quarter	Twice a year		U	
8	San Diego, CA[31]	Y	C	Once a week	Once a month	Posted routes - specific Non-posted routes - 7 AM to 2 PM	Y	Community events Special cleanings include bike ways
9	Dallas, TX[32]	Y/C	L	5 times a week by transportation department Major thoroughfares - once a month by contractors	Not swept	Downtown - nighttime	U	
10	San Jose, CA[33]	Y/C	C	2 to 4 times a month by transportation department	Once a month by contractor	High traffic streets - 2 AM to 11 AM	Y	Downtown sweeps include bike routes
11	Austin, TX[34]	Y	C	Once a month	6 times a year		V	
12	Jacksonville, FL[35]	C	L	Unknown	Twice a month		V	
13	Fort Worth, TX[36]	C	U	Unknown	Unknown		U	
14	San Francisco, CA[37]	Y	C	At least once per week	Weekly or every other week	Year round	Y	
15	Columbus, OH[38]	Y	C	Twice a week or once a month	Once to twice a month	Apr. 1 to Oct. 31	Y	
16	Charlotte, NC[39]	C	C	Unknown	Unknown		U	

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XVI. Appendix - Street Sweeping Programs by City

Population Ranking	City	Street Sweeping Program	City Coverage	Downtown/ Business/ Commercial Frequency	Residential Frequency	Times of Year and Day	Parking Restrictions	Other Areas/ Service
17	Indianapolis, IN[40]	Y	C	Downtown - 4 times a week	Inside combined sewer overflow area - 3 times a month Outside combined sewer overflow area - twice a year	Daytime shift - 7 AM to 3 PM Sun. to Thu. Overnight shift - 11 PM - 7 AM Tue. to Sat.	V	Bike lanes and green way trail - 4 times a year
18	Seattle, WA[41]	Y	C	90% of arterial streets - weekly or bi-weekly	90% of arterial streets - weekly or bi-weekly	Daytime, nighttime, and leaf season routes	V	
19	Denver, CO[42]	Y	C	Once a month	Once a month	Apr. to Nov.	Y	
20	Washington, DC[43]	Y	C	Commercial areas, freeways, main arterials - unknown	Densely-populated neighborhoods with high-volume pedestrian traffic residential - weekly	9:30 AM to 11:30 AM or 12:30 PM to 2:30 PM Major roadways - overnight	Y	
21	El Paso, TX[44]	Y	C	Great Streets - every 2 weeks Downtown - 4 times a week	Every street - at least 4 times a year		U	Bike lanes - once a month
22	Boston, MA[45]	Y	C	Most of the city - every other week	Most of the city - every other week	Apr. 1 to Nov. 30 Some neighborhoods - year round Most of the city - daytime Corridors and main roads - nighttime	Y	

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XVI. Appendix - Street Sweeping Programs by City

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23	Nashville, TN[46]	Y	C	Monthly	Monthly		U	
24	Portland, OR[47]	Y	C	Major arterials - 6 to 8 times a year	1 to 2 times a year	Daytime or night-time by district	U	Central Business District sweeping include a special treatment process for the Transit Mall and Light Rail facilities and sweeping of pedestrian walkways and bike lanes
25	Las Vegas, NV[48]	Y	C	Every 2 weeks Some areas - daily or weekly	Every 2 weeks Some areas - daily or weekly	Mon. to Fri.	U	
26	Detroit, MI[49]	Y	C	Every ten weeks	Every ten weeks	Begins mid-Apr.	Y	
27	Oklahoma City, OK[50]	C	L	Unknown	Not swept		U	
28	Memphis, TN[51]	C	C	Unknown	Unknown		U	
29	Louisville, KY[52]	Y	C	Unknown	3 times a year	8:30 AM to 3:30 PM (7 AM to 5 PM), Mar. to Nov. Dec. to Feb. weather permitting	Y	Major suburban transportation routes - 3 times a year

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Population Ranking	City	Street Sweeping Program	City Coverage	Downtown/ Business/ Commercial Frequency	Residential Frequency	Times of Year and Day	Parking Restrictions	Other Areas/ Service
30	Baltimore, MD[53]	Y	C	Downtown - daily Central District - weekly	Four corners of city - monthly with odd sides one week and even sides the other week		V	
64	Pittsburgh, PA[54]	Y	C	Level 1 (heavy commercial business) - twice a week Level 2 (neighborhood business) - once a week	Level 3 (residential areas) - once or twice a month Level 4 (neighborhood streets) - 2 to 4 times a year	Apr. 1 to Nov. 30 Business - nighttime Residential - 8 AM to 2:30 PM	U	

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City of
Philadelphia