Determining usage levels of 311 service across various neighborhoods and socio-demographic groups in New York City.

New York University- Center for Urban Science and Progress (NYU-CUSP)

Sponsor Report

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1. Overview / Background

311 is the support service center created by the New York City City government, with the objective of attending all non-emergency inquiries, complaints and service requests from the general public to the local administration. By definition, 311 has a large open database (starting from 2010) that consolidates all of the received citizen requests regarding various topics, ranging from housing, noise and transportation to public health and public services, all of them related to various local government departments.

Although some initial approximations have been made to explore potential insights of the data contained in the 311 database, including geographical clustering analysis in order to determine potential hot-spots along the City, there's still various types of analysis that could be performed in order to obtain valuable information. Analysis of 311 database can be useful both for the 311 agency to successfully optimize its operation, as well as to various city agencies that use the information and cases registered by 311 to perform adjustments in order to provide measurements to improve their coverage.

A potential analysis that have been targeted as a priority within the 311 agency, is the one aiming to identify the different kind of user profiles segmented by type of service request and geographical area in the City. This kind of analysis would be of great value in order to asses the level of global coverage the service has achieved through the City, and could be useful to identify existing gaps in terms of coverage levels in the services provided, as well as segments of the population that are not being successfully attended.

As an answer to that, this project goal is to discover the influence of socio-demographic profile and characteristics of the neighborhood on usage patterns of 311 service requests.

In that sense, we think that the ability to link different socioeconomic features such as income, levels of education, housing values, etc., and demographic characteristics such as race, total population, age, etc., of the population living in different areas of the City and the number of service requests 311 received over a specific period of time, grouped by types, would be extremely useful, both to 311 as well to other city agencies.

Specifically, we aim to determine whether there are different types of "user's profiles" existing per each type of request, and use this analysis as an indicator of the level of universal coverage achieved by the service provided.

It is taking into consideration this initial approach that this project has been created. In this research the team will create an analytical model that can generate insights from different data sources containing socioeconomic and demographic features of the population that resides within

New York City. We will get this insights by assessing the correlations between these features and the number of service requests received by 311 in a specific period of time, in order to identify certain kinds of user profiles at defined geographical areas.

The expectation is that the developed model is not only limited to find these correlations, but can also be a useful tool for generating projections and estimations based on the propensity for 311 service requests. These insights will be based on population features, with the goal of identifying population changes in the City, and also to validate if certain demographic groups are being unattended or have lower probabilities of using the service.

Finally, the project aims to provide 311 with a powerful visualization tool that can display intuitive graphical representations about the relationship between population features that are being considered in the analytical model and the number and types of requests by each of the defined areas the team select for the analysis in the City (NTAs or Neighborhood Tabulation Areas). It is also expected that the tool provides a way to easily understand the possible dynamics that currently exist in regards of the volume of 311 service requests and the changes in population in defined areas.

2. Project Approach

2.1. General Approach:

The following list of global topics reflects the basic layout the capstone team defined for the execution of this project:

First Step - Data exploration and initial predictive model construction: On this initial phase the team estimated a first approximation to the agency's database, using a sub sample of the data (2014 full year), as well as selected external demographic features obtained from the American community survey (ACS) and NYC Pluto database.

With this information, the team obtained a first draft version of a predictive model using a machine learning algorithm called constrained linear regression (CLR); this technique was used because it offers the possibility of selecting the "best" set of features (i.e. those who have the highest explanatory capacity) from the complete list.

Once this list of selected features was obtained, the basic levels of correlations between the features, and the number of service requests was defined.

Second step - Request specific model construction: After the first phase of the project was completed, and the pilot results were shared with the agency, the team proceeded to refine

and select the number and types of features that were going to be used in the analytical model. The goal of this step was to move from a single general based model, to various request-specific models that allowed the measurement of the relationships between the selected features and specific types of requests.

The team compared the number of service requests per NTA and per type against the selected group of features based on the results obtained in the first steps of the project.

Third Step - Robust model construction: Once the results of the general and specific models were defined, the team applied other types of machine learning techniques (to be fully explained in section 2.3. Technical Methodology) to generate additional insights and improved results regarding classification and prediction of the number and types of service requests using selected demographic attributes.

Fourth step - Models analysis and profile creation: After the robust model was proven to be functional and effective, the team proceeded to establish the 'user profile' for each type of service request. That means, given a certain type of service request, a profile of the 'typical' new yorker that requests that type of service is established based on the socio demographic features. These profiles were constructed based on the coefficients obtained from the analytical regressions (previous step).

Fifth step - Visualization tool development: The development of the visualization tool started at the same time as the initial data exploration phase, in order to incorporate the milestones and partial results produced in each of the stages of the project.

In that sense, the visualization tool construction was a dynamic process that received continuous feedback from the analysis performed and meetings held with the sponsoring agency. The visualization tool aims to display in an intuitive manner a combination of four things:

1. First, the summary of the demographic features used in the construction of the analytical model
2. Second, the number of requests per type and per geographical location, as published by 311 open data.
3. Third, the number of requests per type and per geographical location, as 'predicted' by our model, based on the chosen demographic features.

4. Fourth, the type of service that a certain type of user is more likely to request from the agency. That is, given a certain combination of socio demographic features (or profile) for a hypothetical user, the type of request that this person would probably ask to 311.

Final step - Project report and presentation: The final deliverables of this project are going to be: 1. The technical report -a document that explains in great detail the framework, techniques and methodology used in the project, 2. The final presentation -that will serve as a summary of the other tasks performed during its scope, and 3. This Report - that aims to inform to 311, and other city agencies, the principal findings and applications of our research.

The team expects that these deliverables serve as a user guide for the agency, an input for future projects to be developed between 311 and CUSP, and a summary of all the task and finding the team achieved during the scope of the project.

2.2 Milestones and deliverables

The following is a list of the milestones and deliverables the team defined through the duration of the project. Details of the milestones are included in Table A:

- Milestone 1

Analysis of 311 data at granular level (census tract level).

Deliverable

A Dataset with service request information at a Census Tract and NTA Level.

The use of this resulting dataset is to verify the granularity of the sample, calibrate the chosen socio demographic features and its scales, and to prototype the overall model and web tool.

- Milestone 2

Building a model for socio-economic pattern detection and the propensity of service requests analysis through statistical and machine learning techniques like constrained linear regression and ensemble methods.

Deliverable

Model to be implemented at the back end of the web tool for rendering above mentioned analytics. Several data sets, besides 311 data, like demographics (ACS), pairs of origins and destinations (LEHD) are also used in the construction of this model.

- Milestone 3

Visualization of analyzed and processed information through web tool by developing a data browser.

This web application will provide information relating to behavior and propensity to request a service from 311 of New York City's residents and working commuters.

Deliverable

A comprehensive website with options to choose different maps for finding information about the nature of the problems NYC is facing (with the options as detailed on section 2.1., step 5)

The following print screens show components of the prototype web tool. Different features and functionalities are captured in the image below. Functionalities are further explained in detail later in Interactive Visualization (section 3.2) (Also available at http://nk1877.github.io/Capstone/prototype/#)

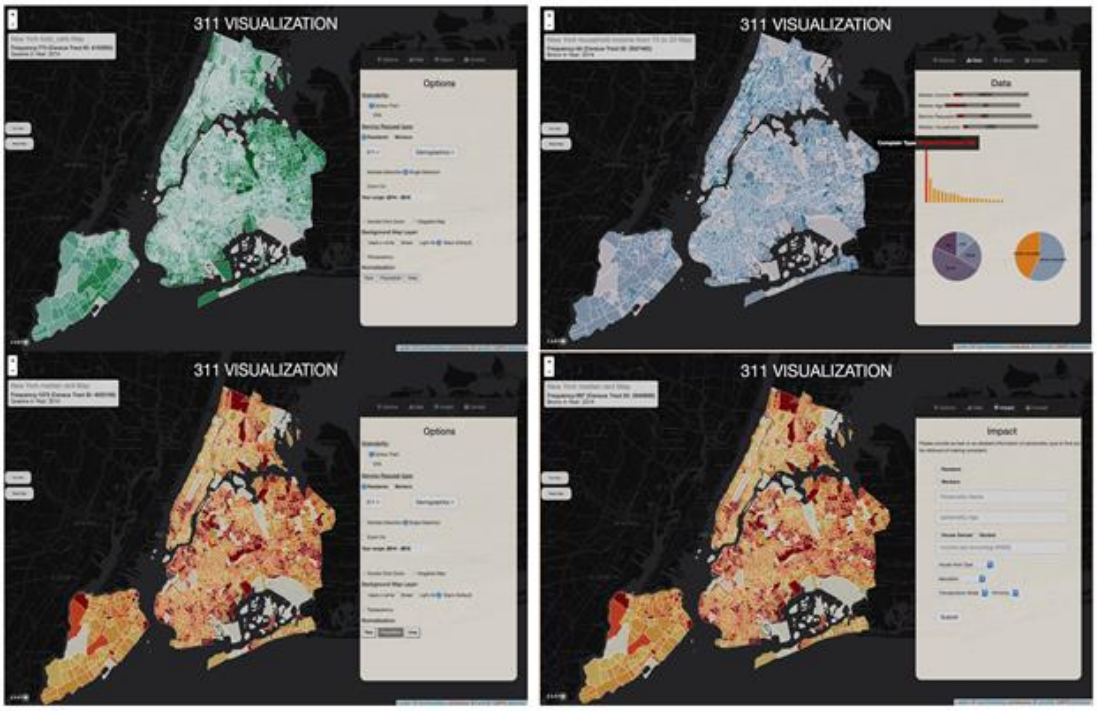


Figure 1. Web tool application.

- Milestone 4

  Preparing a report detailing the analysis and key findings of the project.

Deliverable

A comprehensive report with details of all the work and key information produced, conclusions and detailed methodology for reproducibility purposes.

Table A. Milestones and Deliverables Timeline

Work type /Phase	**Milestone/ Deliverables**	**Details**	**Date**
Prototype	Set goals and Scope of Work		Week of 5/9
Prototype	Compile 2014 subset Data from Census, ACS, PLUTO		Week of 5/30
Prototype	Build up data and analytics infrastructure for 2014 subset data	Must be reproducible code, for reusing later with the entire dataset	Week of 6/06
Prototype	Develop Machine Learning Model for 2014 subset data	Must be reproducible code, for reusing later with the entire dataset	Week of 6/06

Prototype	Estimate workers characteristics using LEHD estimations and Networks 2014	Must be reproducible code, for reusing later with the entire dataset	Week of 6/13
Prototype	Design a web-based interactive platform prototype with 2014 results	Must be reproducible code, for reusing later with the entire dataset	Week of 6/13
Final Model	Compile complete 2014 data for 311	CUSP data facility for processing	week of 6/20
Final Model	Compile complete 2014 Data from Census, ACS, PLUTO	CUSP data facility for processing	week of 6/20
Final Model	Build up data and analytics infrastructure	CUSP data facility for processing	week of 6/27
Final Model	Apply defined Machine Learning Model		week of 7/04
Final Model	Estimate workers characteristics using LEHD estimations and Networks		week of 7/11
Final Model	Design a web-based interactive platform with the total results		week of 7/18
Deliverable	Draft Sponsor Report	Sponsor (311)	week of 7/4
Deliverable	Feedback on Sponsor Report	Sponsor (311)	week of 7/11
Deliverable	Draft Technical Report	Mentor	week of 7/4
Deliverable	Feedback on Technical Report	Mentor	week of 7/11
Deliverable	Final Sponsor Report	Sponsor (311)	week of 7/18
Deliverable	Final Sponsor Presentation	Sponsor (311)	week of 7/18
Deliverable	Final Technical Report	Mentor	7/25
Deliverable	Poster	CUSP	7/28
Deliverable	Final Presentation	CUSP	7/28

2.3. Data sources

For the development of this project, the open data set of 311 service requests posted by the agency in the NYC Open data (https://nycopendata.socrata.com/) site for the year 2014 was used.

The external data sources used within the scope of the project were: for demographic and economic features: US Census Bureau American Community Survey (ACS) open data; for land use features: NYC Primary Land Use Tax Lot Output (PLUTO) open data; for the working population estimates: longitudinal employer household dynamics (LEHD) open data.

The initial list of selected demographic features used in the development of the analytical model, in conjunction with the 311 database, were divided in two groups: residents of the selected areas

(NTA's and Census Tracts), and non-resident workers that commute into the same areas according to the LEHD origin and destination databases.

The final list of selected socioeconomic and demographic features, and their categories, is shown in table B, while table C displays the list of local features:

Table B. Different groups and list of demographic characteristics

Population type	Feature group	Feature
Residents	Age	Population under 18
Residents and Workers		population between 18 and 34
		population between 35 to 64
		population 65 and over
	Race	Population white
		population black
		Population asian
		population hispanic
		population other race
	Family or non family household	family households
		nonfamily households
	education level	population education high school or less
		population education bachelors
		population education masters
		population education phd
	Owners vs renters	owner occupied units
		renter occupied units
	Transportation mean	transportation car
		transportation public
		tranportation motorcycle
		Transportation Other means
	Household income	household income less than 40
		household income from 40 to 75
		household income 75 and above
	House value	house value less than 100
		house value for 100 to 500
		house value 500 or more
	rent	rent less than 1000
		rent bewteen 1000 and 2000
		rent 2000 or more

Table C. List of local characteristics

Local Features
Median House Value
Median Age
Median Rent
Median Income
Normalized number of cars
Building density
Percentage of commercial area
Percentage of Retail area
Percentage of office area
Percentage of residential area
Inbound Commute Density
Population Density
Percentage of Tenant population

2.4. Technical Methodology

While subsection 2.1 provides a general outline of the different stages of the project and deliverables, it doesn't provide too much information about the techniques applied in the research.

The purpose of this subsection is to explain in detail the data cleaning and treatment steps, the analytical techniques, and the different experiments performed with the data. But we don't only aim to provide a description of the tools but the reasons why we chose them in order to accomplish our objectives.

In this subsection we will proceed as follows: first, we are going to explain how we grouped the data and the processes that we used for aggregating in the desirable way. Second, we explain how we chose the geographical granularity of our analysis and the final set, and scaling of the data used in the algorithms that will be explained in the next part.

Finally, we will talk about the construction of the webtool and how we incorporated the insights obtained by the analysis.

2.4.1. Step 1: Data cleaning, grouping, selection of variables and geographical granularity

311 database grouping: For our project we chose the 311 service requests database for the year 2014. The reason why we selected 2014 as the year of our study is because the demographic variables, that are the other main component of our analysis, come principally from the 2014 census estimates (the most recent update of census data).

The database was initially parsed to map each of the service requests using their latitude and longitude. Then, we aggregate the point results into two defined geographical areas: US Census tracts and US neighborhood tabulation areas (NTA) for New York City. The requests are grouped by type of service requests using the defined categories of the 311 database (180+ categories) to get the amount of service requests per type in each area.

Demographic characteristics grouping: after grouping the 311 requests, the demographic and economic variables to be analyzed were listed. Each of those variables were obtained in each area for two different population categories: resident and working population, resulting in two separate datasets of features:

1. Dataset containing the features associated with the resident population in each area, extracted directly from the ACS for each geographical unit within the city.
2. Dataset containing the features associated with the working population in each area, extracted from the ACS using the geographical areas defined as origins for working population coming into New York City using the LEHD origin and destination database. Both files: 'ny_od_main_JT00_2014.csv' - information about workers in New York State with residence in New York State, and 'ny_od_aux_JT00_2014.csv' -information about workers in New York State with residence outside the state, were used in this analysis.

In order to obtain a dataset containing an estimate of the features associated with the working population in each area, it was necessary to include all the socio-demographic characteristics of the commuting workers residence area; for this purpose, the team calculated the probability that a worker in a certain area belongs to a certain demographic category based on its place of residence; then, this probabilities were pondered by the actual number of workers obtained from LEHD, and an approximate of the working population under each demographic category was obtained for each demographic category or feature.

Finally, both datasets were aggregated into a single one; the result was a unique dataset that combined the defined geographical areas (Census Tracts or NTAs) as rows, and the demographic categories as columns, where each cell represented the number of people in each area under each demographic category.

Number of service requests per type and demographic features correlations: After the team obtained the datasets containing the counts of the different types of service requests and the

demographic features for each defined geographical area in the City, the existent correlations were calculated to generate a single matrix that summarizes all of this existing correlations between the number of service requests per type of user and of the defined demographic features; this initial analysis was performed as a first step to identify possible existing user profiles.

After obtaining the demographic variables datasets (for workers and residents) and the 311 total requests by type at both levels: NTA and Census Tract levels, we calculated the correlations between each of the individual variables and each type of request. The correlations were calculated in order to have a sense on how is the dynamic between the number of requests and each variable individually (in the next steps this dynamic is explored further but considering not only individual interactions but combined).

From the analysis the correlation results, it could be seen that the correlations at the NTA level are stronger than those at the Census Tract Level (that is, the chosen variables have a bigger impact over the number of requests if we aggregate by NTA rather than Census Tracts).

2.4.2. Step 2: *Linear multivariate regression and assemble methods for data analysis*

For each of the considered socio-economic features (age, wealth, race, education level, type of household, transportation type, housing values, rent values), different ranges were enumerated (as described in the data description subsection 2.3.). This means that the team defined several subgroups for the number of residents and workers with the value of a certain feature (for example, number of residents between 18 and 34 years old, number of workers with income higher than 75,000 per year, etc.)

Taking into account each of these subgroups, the team created a set of linear regressions, to define with a higher level of accuracy the effect of each type of demographic feature on the total number of each type of requests in a specific geographical area.

For each regression we get three important results:

1. The R squared value is a statistical measure of how close the data are to the fitted regression line. In other words, as close this number gets to 1, we can say that our estimations are closer to the observed figures.
2. A *Regression Coefficient* for each variable within the variable categories and each type of request. Given a type of request, each regression coefficient represents the rate of change of the number of service requests for that type as a function of change in the demographic variable.

3. A *Confidence Interval* associated to each coefficient. Since we are working with estimations, the confidence interval tell us the range of values that there is a 95% probability that the value of the coefficient lies within it. If the value of the coefficient on the previous point lies within the predicted confidence interval, we can trust on ours estimations.

This same process was repeated multiple times, modifying the proportions used for dividing the complete subgroup into a training data set (used as an input for inferring the parameters of the model), and validation data set (used to check the accuracy of the inferred parameters of the model), that were used to train and prove the accuracy of each regression -a process known as cross validation, in order to increase the explanatory capacity of the overall model for each of the subgroups.

Once all the outputs for all the iterations of the regressions were compiled in a single result for each of the subgroups - a process called bootstrapping aggregation or “Bagging”, the complete list of results were filtered based on their R2 (R squared), selecting only the ones with a value equal or great to 0.2.

Since the coefficients are assumed to follow a normal distribution, selecting the regressions with the highest R2 results allows us to get coefficients that are assumed to be the means of those normals distributions, and standard deviations that are taken as the width of the confidence interval divided by four, for each coefficient.

2.4.3. Step 3: *Evaluation of the estimation error and its spatial distribution*

Once the regressions were filtered by their R2 results, their projections (forecasted results) were compared to the ground-truth to find out if the relative error between the estimates the model produced and the actual results for each subgroup had any correlation in a spatial context, using an analysis defined as spatial autocorrelation that is based under the assumption that pairs of subjects that are close to each other are more likely to have values (in this case request by type) that are more similar.

The idea behind this analysis is to validate if certain types of additional features that are not directly related to individuals, but to neighborhood characteristics (features that were not included in the original regressions) could be a valuable addition to the analytical model to improve the accuracy of the predictions (i.e. reducing the error of the model). The list of characteristics is defined in subsection 2.3.

The Results of this analysis, demonstrated that the dynamic of 311 service requests is not only explained by the demographic features that we considered on the previous step, but there are more variables, such as characteristics of the neighborhood that should be taken into account.

2.4.4. Step 4: *Additional Regression with neighborhood features.*

When some of the spatial context features were identified as really important, the team performed an additional set of regressions using a logarithmic scale between the number of service requests by type and the set of neighborhood characteristics (table C)
The logarithmic scale is used in this case because the logarithm function is more sensitive to explain changes caused by small fluctuations on the variables.

Those features having positive coefficient cause additional increase of the service requests (when they go up) compared to what can be expected based on the population socio-demographic analysis and those having a negative coefficient facilitate decrease of the service requests.

Finally, once some reliable estimates for each subgroup were determined based on the accuracy of the model, the team proceeded to add them to the visualization tool, so that the user profile for each type of service request could be visualized against the predicted one produced by the model.

3. Results

3.1. Statistical Analysis

Annex number 1 summarizes the results obtained from the first step of the analytical model, where regressions on each type of request were performed using specific groups of demographic features, for both residents and workers independently. These results were filtered based on the capacity of the features to explain the number of request per type (R squared value)
.
Odd numbered tables in Annex 1 contain information related to the impact that each of the resident features included in the regressions have on the types of request (coefficients). The tables show the confidence interval the model estimated for each of them, and the overall level of R squared for each regression as well; even tables, contain the features from the working population.

A sample of this results were included in form of visualizations in Annex number 3, in order to provide an intuitive form of presenting the information, so the basic concepts can be more easy to understand.

Annex number 2 summarizes the results obtained from the second step of the analytical model, where regressions on each types of request were performed using neighborhood characteristics, and the results from the previous step (demographic characteristics); these results were filtered based on the capacity of the features to explain the number of request per type (R squared)

For those features having positive coefficient, an additional increase of the service requests is likely to be observed, compared to what can be expected based on the population socio-demographic analysis, and in that same sense, those having a negative coefficient - facilitate decrease of the service requests.

In order to provide some guidance on who to use the results presented in Annex 1 and Annex 2, a sample of request types were taken as base examples to understand how they work, and what type of valuable information that can be extracted from them.

Based in the analysis performed, 'Noise Residential' is the type with the higher number of service requests in 2014, followed by 'Heat/Hot Water' and 'Street Condition' So let's see what insights can derived about these types of requests:

The age of the resident population has a capacity to explain the number of received **'Noise Residential'** requests complaints through all NTAs, represented on the column 'R2 os' of table 1. This R squared value is the highest in that table (0.544) which means that the selected demographic variable do a better job explaining the number of requests for this type than for any other type. One reason for that, might be that since Noise Residential is the most requested type of service in the dataset, the model had more data to "learn" trends and draw conclusions. However, this is not a general rule since none of the working population variables was able to explain the volume of requests of this type.

Surprisingly, the results obtained showed that the population older than 65 is less likely to request this type of service from 311. However, it is imperative to avoid any interpretation without observing first at the dynamics of this population group over other types of requests: for almost every type in table 1, the category of "population 65 year old and over" has a negative coefficient associated with it. This could mean that, in general, people in areas with a high population of this age group have a low propensity of using 311 services when compared to younger people.

Household Income of Residents show a similar trend in terms of R squared and explanatory capacity (table 7). In this case, request type 'Noise Residential' shows the second

higher R squared among other types of service requests (after general **'Noise'** request types). From this category it is also noticeable that areas with high concentrations of households with income below $40,000 per year are positively correlated with this type of requests, while wealthier population groups are negatively correlated; in fact, the coefficient associated with low income households is the highest one for that category, closely followed by the **'Heat/how Water'** requests.

Another interest relationship can be found in table 9; in this case, the resident population identified as tenants have a positive coefficient, while homeowners have a negative one. This same relationship can be seen on a couple more of requests, such as **'heat/hot water'**, '**heating'**, and **'flooring stairs',** a very intuitive result, as all of this request are directly related to housing conditions.

The results shown in the population race category (table 11) brings also some insightful information: the first noticeable trend is that among all race profiles for residents, the asian population has a negative correlation for almost every type of service request, and even in cases where positive correlation was found the coefficient is close to zero if we consider its confidence interval (For instance the case of **'Sidewalk Condition'** request, where the coefficient is equal to 0.00015). For all cases where coefficients with these levels were obtained, it is most likely that all of them are not statistically significant, which means that there is not a certainty of the variable having a positive or a negative impact because of its marginality on the overall explanatory capacity of the model.

If we look for our main example **'Noise residential'** request in table 11, we can see that black, hispanic and other races populations are highly positive correlated with this type of request (compared to population white that has a coefficient that is almost a third and a fifth of those obtained for black and hispanic population respectively). Once again, we see that types of requests related to housing conditions, such as **'Heat/how water'**, **'Heating'**, **'Electric'**, **'Door Window'**, among others, show similar trends; in the case of the race, this types of requests have a higher relationship with black and hispanic populations.

At this point an important trend can be pointed out: tenants (as opposed to homeowners), living in zones with the lowest household income category (household income less than $40,000 per year), belonging to black and hispanic groups are more likely to request services related to housing conditions.

In that same sense, another example can be seen related to monthly rent levels paid by tenants (table 13), where some request types share similarities with each other; **Door/Window, Electric, Heat/Hot Water, Heating, Noise-Residential, Plumbing, Unsanitary Condition**, and

Water Leak request types present a high positive high coefficient on low rent values (below $1.000 per month), a low positive low coefficient with rents between $1.000 and $2.000 per month, and a negative coefficient with high rents (considered above $2.000 per month).

From this results, it is possible to interpret that residential units with lower rent values are usually accompanied by potentially faulty general conditions, such as broken windows, frequent power or heating failures, noisy neighbors, or relatively higher unsanitary living conditions.

It is important to notice that none of the categories related to housing conditions (with the exceptions of **'Heat/how water'**, and **'heating'**) are well explained by the local variables (table 19 in annex 2), and even in those cases, the only category that makes a good job at explaining the volume of requests is the population density.

In relation with the **'Street condition'** type of request, general analysis had not been performed using the first step of the analytical model, even when it's one of the top three types in terms of volume in the city, because the explanatory capacity of the selected demographic variables (tables 1 through 18) are not as high as the one other types of request have. From all demographic categories just four make a good job explaining the volume of requests for this type: House Value for residents (table 5), homeowners vs. Tenants for resident population (Table 9), resident's race (table 11), and the principal transportation mean for residents (table 15)..

Of the four, the last category comes not as a surprise, as places with high volumes of car transit have a higher probability of being positively correlated with this type of service request; moreover, the only transportation category that is negatively correlated is public transportation, reinforcing the general perception that places with high car presences will have more requests associated with **'Street condition'.**

Since the demographic variables did not show a high explanatory capacity for the number of **'Street condition'** requests, the local variables defined in the second part of the analytical model made a good complementary input. Table 19 in annex 2 shows that all of the selected local variables have an impact on this type of request. A couple of insights that can be derived from this table are that, there is a high volume of requests related to this type in areas with high proportions of retail and office built up areas, while there is a negative correlation with variables such as proportion of residential built up area and population density, and proportion of tenants.

Other types of service request, such as **"Air Quality"**, allow for some additional interpretation of the results obtained from the analytical mode.;

"Air Quality" requests for instance show a very unique behavior in terms of its relationship with the age ranges of residents, being among the few ones that have a positive

correlation with the range age above 65 years old, with a rather moderate result of R squared (0.39) for the whole age category.

What is really interesting is to see that the same category for the incoming working population is negatively correlated, perhaps because the size of that particular group is very small when compared to the other two ones.

Additionally, this type of request allow us to see the behavior of the information related to the education levels of both residents and incoming working population (tables 3 and 4); for the first group it is interesting to note that only the groups with a bachelor's and master's degree seem to be positively correlated to the number of request received, with a very high explanatory values of the category (R squared equal to 0.58); this could imply that well educated people are more concern about this type of issues along the city, discounting obviously PhD graduates from the group, as they are a very small portion of the overall population.

This hypothesis can actually be complemented by looking into the information provided by the resident's household income level and levels of monthly rent tenants pay; in the first case, households with a high per month income (above $75.000) have the highest coefficient of the three resulting ones, with the highest explanatory capacity on the category base on the results of the R squared (0.602); for the second case, tenants that pay the highest rent values per month (more than $2.000) have also the highest coefficient with a very high explanatory capacity of the category (R squared of 0.627).

Finally, when analyzing the transportation mean used by the resident group and its relationship with this type of request (shown on table 15), it is noticeable that all groups other than car users (motorcycle, public transportation and other means including biking and walking) have positive correlations, with an high explanatory capacity (R squared of 0.597); this results seems to be logical, as they could be more exposed to exterior conditions that allows them to notice problems in air quality.

All of this results can be actually summarized in a user profile having high income, high levels of education, with ages ranging from 18 to 34 or more than 65 years, that is a tenant paying a high monthly rent price (over $2.000), living in a non-family household, and that uses typically any kind of transportation mean other than car to commute to work, as the most propense to complaint about "Air Quality" issues.

Finally, we can make some general observations that are applicable through the whole set of results. For instance, features related to the incoming working population have impact on less request types than the resident characteristics. On Annex 1 (Even numbered tables), we can see that in average, the number of request types that meet the criteria of R squared values higher

than 0.2 are significantly lower than the one related to residents (Represented on odd numbered tables).

One noticeable exception of the previous point is found in table number 5 (Coefficients and confidence intervals associated with the groups of Resident Homeowner House Values), where it can be seen that this specific group have a significant impact just on a few types of request categories (Damaged Tree, Dead Tree, Overgrown Tree/Branches, and Root/Sewer/Sidewalk Condition, etc.).

The team estimates that this is caused mostly due the nature of this variable; since it is counting just the number of homeowners, seeing a significant correlation between these features and these types of requests (mostly about neighborhoods with green areas in residential zones) is natural. Moreover, in all these cases, it can be seen that the number of homeowners living in houses with higher values are positively correlated with the number of requests for this request types.

In general, the model seems to adjust well depending on the nature of the type of request and its relationship with the defined group of demographic characteristics; for instance in table 16, which contains impact of the working population's transportation means towards 311 request, the type "Taxi Complaint" that has a R square of 0.704 (high explanatory value), the coefficient obtained by the category commuting by public transit (0.05221) is noticeable higher of those obtained for the other available categories (with the exception of transportation motorcycle, that has a higher coefficient but is not statistically significant according to its confidence interval).

In this case, inference about the propensity of the working population to request a 311 service about this issue can be done on the fact that workers using public transportation, shown by the model, are more likely to request the service, whereas the people commuting by their own vehicles are not, which turns out to be a very intuitive result.

Finally, there are some interesting relationships that can be made from the overall annex; for instance, we can see that Asians among the other races are less likely to request 311 services, or that in general, resident population over 65 years old has a low propensity (negative correlation) with the number of request received per type by 311, that highly educated residents, with degree levels between High school and masters, have a higher propensity to request 311 services (excluding PhD graduates), or that low household income levels are in general more correlated to a higher number of requests.

Annex 4 shows the distribution of the error between the observed number of requests and the number of requests explained by the demographic variables for five different types of requests. It is noticeable that the error in Areas such as the Bronx and some parts of Queens is

high for Sidewalk Conditions and Noise. This is caused because the neighborhood dynamics in these areas is having an important effect over the number of 311 requests, and we are not capturing this effects on the first steps of the model.

The same thing could be said about Staten Island for Noise- Residential and Heat/How Water requests. Since Staten Island has certain unique characteristics (high residential population, high road infrastructure, etc.), the first stages of the model are not as accurate at explaining the number of requests for those types based merely on socio-demographic features, so it's necessary to look at neighborhood features.

3.2. Interactive Visualization Tool

The Web Tool is currently at its beta stage. Most features of the tool has been developed and are functional. Web tool has two main sections: map section and the Inspector section. Both, map and inspector sections, are designed to provide intuitive user experience for navigating information. Map provides a natural user experience where user can select the location (Census Tract or NTA) for which information is required. The user has option to select one or many locations for exploring or comparing information respectively. Map section has following features:

- Information box: Information box provides quick information about the location when mouse is hovered over like the type of service request and its frequency, selected location information etc.
- Map control Settings: It consists of two buttons full view and reset map. Full view gives flexibility to see the map in full view screen by removing the inspector tab. Similarly reset map provides flexibility to reset map to its original shape and size in case it is changed during data browsing process.

The Inspector section is divided into 4 section for providing necessary browsing options and flexibility to choose the information.

- Options Tab: It provides various option to adjust map. Tab provides flexibility to select level of granularity like NTA or census tract. This section provides option to visualize 180 service request types and 68 demographic features. This tab also provides flexibility to visualize working and residential population. Other important features are option to zoom certain census tract, option to choose single or multiple census tract, option to change

background layer, adjust transparency of inspector tab and freedom to choose normalization variable as raw, population and area.

- Data Tab: This tab provides top 20 service requests and some demographic information about the chosen the location. Demographic information includes ratio of renter vs owner of the property, age classification, per capita income, median age, etc.
- Model Tab: Model tab is designed to predict type of request people of certain demographic attributes are likely to make. This tab allows users to build hypothetical personalities where they provide information like age, income, if they own or rent the property, household type, preferable transportation mode, intensity etc. Application would use our model to predict which service request most likely their chosen personality would like to make. This helps in understanding the propensity of making requests by different groups of people.
- Team Tab: Team tab provides information about the team and role of each member in the project. It also contains mentor and sponsor agency information.

4. Assumptions and possible limitations

The following are the detected possible limitation and assumptions the team have used over the development of this project:

- Only selected socio economic characteristics of the general population have been included in the data analysis performed; this selection was based on the preferences suggested by the 311 agency, as well as those features that could provide some basic levels of differentiation in order to generate defined kinds of user profiles.
- The number of type of machine learning techniques used in the data analysis portion of the project were determined based on the initial data exploration results; the team defined the use of a basic algorithm for the initial phase of the data analysis (Linear regression model with feature regularization based on grouped demographic characteristics), and a more elaborated technique based on an ensemble methodology, using variable cross validation and bootstrap aggregation (bagging) for the final analysis phase.
- The methodology for obtaining estimates for the working population indicators is based on probabilities of the origin statistics (that is, what is the probability of a person that works in a certain area to belong to a certain group based on its origin location) and may not be as accurate as census data.

- The geographical granularity of the study seems to have an impact on the calculations; in that sense census tracts has proven to be fairly accurate in terms of the size of the sample and the level of prediction of the machine learning techniques, but bad for finding correlations because of their heterogeneity.

  In contrast, the total number of NTAs is lower when compared to the census tracts in the City (190 vs 1978), leading to a smaller sample, but allowing better correlation results between the features used in the model and the 311 service requests, as well as more stable results along the whole sample for the analytical model; in that sense the team chose to work with the later geographical aggregation unit.

5. Conclusions

After the analysis of the results and implications on the previous sections, the team have found the following conclusions:

- In term of the geographical grouping units, NTAs provided the most accurate level of aggregation through the development of the project, guaranteeing the best possible results in terms of the analytical model due to their size and homogeneity in terms of demographic and spatial features.
- The final analytical model developed by the capstone team showed statistically significant results related to the explanatory capacity and goodness of a fit of the features (both demographic and spatial) included in it for a high range of request types (more than 110 for the first step and more than 20 for the second step).
- In terms of the population groups used in the model, the resident group showed better results in terms of the number of types of request that successfully explained with a high level of accuracy when compared to the incoming working group, possibly due to the difference in proportions between them.
- Demographic features of the resident population such as age range, household income, owners vs tenants, race and transportation mode use to commute had the highest average capacity to explain a larger set of service request types; in contrast, features such as Education levels, home values and type of household showed the lowest average explanatory capacity.
- The methodology designed to measure the impact of the demographic features in a first phase of the model, to then assess the impact of the spatial features proved to be a highly

successful way to increase the overall accuracy of the model in terms of goodness of a fit, allowing for complaints that were not accurately explained by the demographic feature to be assessed in a better way by the use of spatial ones.

- Spatial autocorrelation analysis, which can be seen for some types of requests in Annex 4, was a way to see that in some cases, the selected demographic variables weren't able to explain the volume of requests by themselves. Then, another set of regressions was conducted in order to find new ways of explaining the volume of requests using local features this time.
- Even though more than twenty types of requests were successfully explained by the local features, more neighborhood variables will be included in the future, as well as other methods of feature selection in this phase.
- The process of grouping the different types of demographic features into sub categories was definitive and highly helpful in order to successfully generate particular types of "User profiles" for each type of request, as seen on section 3.1 of this report.
- Due to the high volume of results generated as a final output, as well as the potential to apply this methodology and the analytical model to other 311 historical data (previous to 2014), it is highly recommended that the work initiated with this project is continued in the near future jointly by CUSP and 311.

6. Acknowledgments

The team would like to thank to Prof. Stanislav Sobolevsky at NYU- CUSP, for being the mentor of this project and for the guidance that he provided during its process.

The team would also like to thank NYC 311 for being the sponsor of this project. In particular, we want to thank Chenda Fruchter, Senior Director at 311, and her team. Without their support and feedback the conclusion of this project wouldn't be possible.

ANNEX 1

Coefficients and standard deviations associated with the demographic variables for types of requests with R2 greater than 0.2

Table 1. Coefficients and standard deviations associated with the groups of RESIDENTS AGE for types of requests with R2 greater than 0.2

Type of Request	Population under 18	population between 18 and 34	population between 35 to 64	population 65 and over	R2 os
APPLIANCE	0.00538 +/- 0.00099	0.00358 +/- 0.00110	-0.00044 +/- 0.00149	-0.00496 +/- 0.00242	0.408
Air Quality	-0.00485 +/- 0.00067	0.00610 +/- 0.00075	-0.00101 +/- 0.00101	0.00470 +/- 0.00165	0.39
Animal Abuse	0.00127 +/- 0.00054	0.00168 +/- 0.00060	0.00092 +/- 0.00081	-0.00176 +/- 0.00131	0.389
Bike/Roller/Skate Chronic	-0.00043 +/- 0.00007	0.00059 +/- 0.00007	-0.00028 +/- 0.00010	0.00065 +/- 0.00016	0.362
Boilers	0.00015 +/- 0.00016	0.00087 +/- 0.00018	-0.00013 +/- 0.00024	0.00010 +/- 0.00040	0.33
Consumer Complaint	-0.00445 +/- 0.00162	0.00670 +/- 0.00180	0.00337 +/- 0.00243	-0.00470 +/- 0.00396	0.359
DOOR/WINDOW	0.01396 +/- 0.00283	0.01132 +/- 0.00315	-0.00096 +/- 0.00425	-0.01491 +/- 0.00692	0.409
Dirty Conditions	0.00193 +/- 0.00167	0.00066 +/- 0.00185	0.00945 +/- 0.00250	-0.00949 +/- 0.00408	0.442
Drinking	-0.00027 +/- 0.00010	0.00046 +/- 0.00011	0.00041 +/- 0.00015	-0.00082 +/- 0.00024	0.411
ELECTRIC	0.01509 +/- 0.00272	0.00812 +/- 0.00303	0.00137 +/- 0.00409	-0.01562 +/- 0.00666	0.445
Electrical	-0.00017 +/- 0.00055	0.00124 +/- 0.00062	0.00103 +/- 0.00083	-0.00200 +/- 0.00136	0.32
FLOORING/STAIRS	0.01029 +/- 0.00232	0.00940 +/- 0.00258	-0.00091 +/- 0.00348	-0.01194 +/- 0.00567	0.365
Food Establishment	-0.00494 +/- 0.00068	0.00527 +/- 0.00076	0.00048 +/- 0.00102	0.00202 +/- 0.00166	0.404
GENERAL	0.00790 +/- 0.00258	0.01225 +/- 0.00287	0.00008 +/- 0.00388	-0.01092 +/- 0.00632	0.385
GENERAL CONSTRUCTION	0.00950 +/- 0.00174	0.00520 +/- 0.00194	-0.00080 +/- 0.00262	-0.00900 +/- 0.00427	0.318
General Construction/Plumbing	-0.00452 +/- 0.00347	0.00805 +/- 0.00386	0.00827 +/- 0.00522	-0.01184 +/- 0.00850	0.39
HEAT/HOT WATER	0.03906 +/- 0.01311	0.04966 +/- 0.01458	0.00323 +/- 0.01971	-0.04367 +/- 0.03207	0.313
Indoor Air Quality	-0.00248 +/- 0.00075	0.00429 +/- 0.00084	-0.00113 +/- 0.00113	0.00281 +/- 0.00185	0.332
Indoor Sewage	0.00050 +/- 0.00012	0.00025 +/- 0.00013	0.00015 +/- 0.00017	-0.00038 +/- 0.00028	0.373
Lead	-0.00087 +/- 0.00020	0.00071 +/- 0.00023	0.00059 +/- 0.00031	0.00059 +/- 0.00050	0.338
Litter Basket / Request	-0.00076 +/- 0.00022	0.00114 +/- 0.00024	0.00064 +/- 0.00032	-0.00033 +/- 0.00053	0.34
NONCONST	0.00446 +/- 0.00083	0.00333 +/- 0.00092	-0.00034 +/- 0.00124	-0.00357 +/- 0.00202	0.452

Type of Request	Population under 18	population between 18 and 34	population between 35 to 64	population 65 and over	R2 os
Noise	-0.04855 +/- 0.00536	0.05827 +/- 0.00597	-0.01030 +/- 0.00806	0.03335 +/- 0.01313	0.448
Noise - Commercial	-0.02564 +/- 0.00412	0.04855 +/- 0.00459	-0.00838 +/- 0.00620	-0.00064 +/- 0.01009	0.385
Noise - Residential	0.03233 +/- 0.01245	0.07796 +/- 0.01385	0.02492 +/- 0.01871	-0.10231 +/- 0.03046	0.544
Noise - Street/Sidewalk	-0.00588 +/- 0.00461	0.03500 +/- 0.00512	-0.00596 +/- 0.00692	-0.00921 +/- 0.01127	0.32
Noise - Vehicle	-0.00272 +/- 0.00145	0.01090 +/- 0.00161	-0.00035 +/- 0.00218	-0.00379 +/- 0.00355	0.432
OUTSIDE BUILDING	0.00032 +/- 0.00013	0.00042 +/- 0.00014	0.00017 +/- 0.00019	-0.00046 +/- 0.00031	0.378
Other Enforcement	-0.00119 +/- 0.00037	0.00150 +/- 0.00041	0.00109 +/- 0.00055	0.00038 +/- 0.00090	0.39
PAINT - PLASTER	0.00671 +/- 0.00132	0.00442 +/- 0.00147	-0.00044 +/- 0.00199	-0.00744 +/- 0.00324	0.36
PAINT/PLASTER	0.02754 +/- 0.00669	0.02178 +/- 0.00744	0.00283 +/- 0.01006	-0.03277 +/- 0.01637	0.337
PLUMBING	0.02980 +/- 0.00601	0.02096 +/- 0.00669	0.00121 +/- 0.00904	-0.03122 +/- 0.01472	0.393
Rodent	0.00155 +/- 0.00150	0.01206 +/- 0.00167	-0.00124 +/- 0.00226	-0.00257 +/- 0.00367	0.482
SAFETY	0.00322 +/- 0.00062	0.00300 +/- 0.00069	-0.00017 +/- 0.00094	-0.00412 +/- 0.00152	0.453
Sanitation Condition	0.00698 +/- 0.00145	-0.00214 +/- 0.00161	0.00711 +/- 0.00218	-0.00913 +/- 0.00355	0.309
UNSANITARY CONDITION	0.02716 +/- 0.00531	0.01941 +/- 0.00591	0.00106 +/- 0.00799	-0.02719 +/- 0.01300	0.407
Urinating in Public	-0.00013 +/- 0.00004	0.00024 +/- 0.00004	0.00002 +/- 0.00006	0.00002 +/- 0.00009	0.329
WATER LEAK	0.01380 +/- 0.00286	0.00961 +/- 0.00318	0.00024 +/- 0.00430	-0.01406 +/- 0.00700	0.377
Water Quality	-0.00013 +/- 0.00008	0.00026 +/- 0.00009	-0.00011 +/- 0.00012	0.00089 +/- 0.00019	0.332
Water System	-0.00278 +/- 0.00237	0.00045 +/- 0.00263	0.01617 +/- 0.00356	-0.01887 +/- 0.00579	0.359

Table 2. Coefficients and standard deviations associated with the groups of WORKERS AGE for types of requests with R2 greater than 0.2

Type of Request	population between 18 and 34_n	population between 35 to 64_n	population 65 and over_n	R2 os
Air Quality	0.00937 +/- 0.00282	0.00175 +/- 0.00459	-0.02355 +/- 0.01046	0.303
Broken Muni Meter	0.05466 +/- 0.02052	-0.04805 +/- 0.03345	0.04235 +/- 0.07614	0.378
Consumer Complaint	0.00464 +/- 0.00471	0.01312 +/- 0.00767	-0.04577 +/- 0.01746	0.355
Fire Alarm - Reinspection	0.00053 +/- 0.00015	0.00063 +/- 0.00024	-0.00286 +/- 0.00055	0.426
Fire Safety Director - F58	0.01812 +/- 0.00242	-0.02014 +/- 0.00394	0.02974 +/- 0.00897	0.446
Food Establishment	0.00805 +/- 0.00224	0.00375 +/- 0.00365	-0.02648 +/- 0.00830	0.424
Food Poisoning	0.00492 +/- 0.00081	0.00032 +/- 0.00132	-0.01041 +/- 0.00301	0.443
For Hire Vehicle Complaint	0.00229 +/- 0.00065	-0.00028 +/- 0.00106	-0.00332 +/- 0.00241	0.431
Found Property	0.00167 +/- 0.00020	-0.00111 +/- 0.00033	0.00013 +/- 0.00076	0.582
Homeless Encampment	0.01087 +/- 0.00180	-0.00150 +/- 0.00293	-0.01742 +/- 0.00666	0.334

Type of Request	population between 18 and 34_n	population between 35 to 64_n	population 65 and over_n	R2 os
Homeless Person Assistance	0.00653 +/- 0.00083	-0.00306 +/- 0.00136	-0.00365 +/- 0.00309	0.442
Non-Residential Heat	0.00129 +/- 0.00055	0.00090 +/- 0.00090	-0.00476 +/- 0.00206	0.365
Taxi Complaint	0.06131 +/- 0.00607	-0.03676 +/- 0.00990	-0.00746 +/- 0.02254	0.653
Taxi Report	0.00203 +/- 0.00018	-0.00211 +/- 0.00029	0.00251 +/- 0.00066	0.585

Table 3. Coefficients and standard deviations associated with the groups of RESIDENTS EDUCATION LEVEL for types of requests with R2 greater than 0.2

Type of Request	population education high school or less	population education bachelors	population education masters	population education phd	R2 os
Air Quality	-0.00170 +/- 0.00052	0.00393 +/- 0.00133	0.00664 +/- 0.00278	-0.00641 +/- 0.00755	0.58
Animal Abuse	0.00420 +/- 0.00051	0.00176 +/- 0.00129	-0.00148 +/- 0.00271	0.00180 +/- 0.00734	0.38
Bike/Roller/Skate Chronic	-0.00032 +/- 0.00005	0.00063 +/- 0.00013	-0.00004 +/- 0.00028	-0.00011 +/- 0.00077	0.464
Blocked Driveway	0.05942 +/- 0.00482	0.02734 +/- 0.01229	-0.01583 +/- 0.02571	-0.14484 +/- 0.06979	0.495
Bus Stop Shelter Placement	0.00009 +/- 0.00002	-0.00011 +/- 0.00006	0.00059 +/- 0.00013	-0.00088 +/- 0.00034	0.339
Derelict Vehicles	0.01062 +/- 0.00104	-0.00277 +/- 0.00265	0.00646 +/- 0.00554	-0.02315 +/- 0.01503	0.349
Dirty Conditions	0.01471 +/- 0.00148	0.00515 +/- 0.00376	0.00478 +/- 0.00788	-0.02049 +/- 0.02138	0.485
Food Establishment	-0.00106 +/- 0.00062	0.00852 +/- 0.00159	0.00012 +/- 0.00332	-0.02152 +/- 0.00901	0.449
General Construction/Plumbing	0.00543 +/- 0.00323	0.01827 +/- 0.00824	-0.00275 +/- 0.01725	-0.03617 +/- 0.04681	0.359
Hazardous Materials	0.00011 +/- 0.00020	0.00052 +/- 0.00051	0.00399 +/- 0.00106	-0.01072 +/- 0.00289	0.411
Illegal Parking	0.02311 +/- 0.00343	0.00716 +/- 0.00874	0.05178 +/- 0.01828	-0.16923 +/- 0.04962	0.403
Illegal Tree Damage	0.00008 +/- 0.00014	0.00166 +/- 0.00035	0.00067 +/- 0.00074	-0.00703 +/- 0.00200	0.454
Lead	0.00044 +/- 0.00015	-0.00069 +/- 0.00038	0.00460 +/- 0.00079	-0.00203 +/- 0.00214	0.58
Litter Basket / Request	0.00062 +/- 0.00019	0.00030 +/- 0.00049	0.00315 +/- 0.00103	-0.00373 +/- 0.00279	0.382
Noise	-0.02835 +/- 0.00411	0.07528 +/- 0.01048	0.01078 +/- 0.02193	-0.16906 +/- 0.05954	0.579
Noise - Helicopter	0.00007 +/- 0.00020	-0.00169 +/- 0.00051	0.00523 +/- 0.00106	0.00601 +/- 0.00288	0.3
Other Enforcement	0.00118 +/- 0.00031	0.00333 +/- 0.00080	0.00143 +/- 0.00167	-0.01091 +/- 0.00453	0.524
Recycling Enforcement	0.00031 +/- 0.00007	0.00039 +/- 0.00018	0.00022 +/- 0.00038	-0.00110 +/- 0.00102	0.318
Sanitation Condition	0.01440 +/- 0.00120	0.00166 +/- 0.00305	0.01206 +/- 0.00639	-0.05400 +/- 0.01735	0.411
Sidewalk Condition	-0.00063 +/- 0.00030	0.00272 +/- 0.00075	0.00453 +/- 0.00158	-0.01596 +/- 0.00428	0.536
Water Quality	0.00023 +/- 0.00007	0.00017 +/- 0.00018	0.00055 +/- 0.00037	0.00045 +/- 0.00100	0.367

Table 4. Coefficients and standard deviations associated with the groups of WORKERS EDUCATION LEVEL for types of requests with R2 greater than 0.2

Type of Request	population education high school and less_n	population education bachelors_n	population education masters_n	population education phd_n	R2 os
Air Quality	0.00198 +/- 0.00158	0.05178 +/- 0.01150	-0.14104 +/- 0.02528	0.27909 +/- 0.04717	0.322
Broken Muni Meter	0.01602 +/- 0.01104	0.30194 +/- 0.08023	-0.87860 +/- 0.17639	1.97821 +/- 0.32916	0.48
Consumer Complaint	-0.00381 +/- 0.00257	0.10949 +/- 0.01869	-0.24214 +/- 0.04109	0.30080 +/- 0.07667	0.394
EAP Inspection - F59	-0.00256 +/- 0.00024	0.00524 +/- 0.00174	-0.00074 +/- 0.00382	-0.01621 +/- 0.00712	0.63
Fire Safety Director - F58	-0.00836 +/- 0.00103	0.01885 +/- 0.00746	-0.00451 +/- 0.01639	-0.05821 +/- 0.03059	0.676
Food Establishment	-0.00405 +/- 0.00114	0.08331 +/- 0.00828	-0.18340 +/- 0.01821	0.22526 +/- 0.03398	0.421
Food Poisoning	-0.00192 +/- 0.00045	0.03111 +/- 0.00330	-0.06733 +/- 0.00725	0.08315 +/- 0.01352	0.433
For Hire Vehicle Complaint	-0.00044 +/- 0.00037	0.01119 +/- 0.00270	-0.02559 +/- 0.00594	0.03991 +/- 0.01109	0.353
Found Property	-0.00029 +/- 0.00011	0.00619 +/- 0.00081	-0.01482 +/- 0.00177	0.02607 +/- 0.00331	0.609
Homeless Person Assistance	-0.00011 +/- 0.00049	0.02026 +/- 0.00355	-0.05377 +/- 0.00780	0.11160 +/- 0.01456	0.392
Other Enforcement	-0.00020 +/- 0.00088	0.03806 +/- 0.00640	-0.08829 +/- 0.01407	0.11224 +/- 0.02626	0.343
Sidewalk Condition	0.00059 +/- 0.00078	0.03073 +/- 0.00568	-0.07592 +/- 0.01248	0.11814 +/- 0.02330	0.315
Taxi Complaint	-0.01164 +/- 0.00347	0.20071 +/- 0.02521	-0.46961 +/- 0.05543	0.80846 +/- 0.10343	0.654
Taxi Report	-0.00045 +/- 0.00009	0.00497 +/- 0.00064	-0.01138 +/- 0.00142	0.02121 +/- 0.00264	0.592

Table 5. Coefficients and standard deviations associated with the groups of RESIDENT HOMEOWNERS HOUSE VALUES for types of requests with R2 greater than 0.2

Type of Request	house value less than 100	house value for 100 to 500	house value 500 or more	R2 os
Damaged Tree	-0.02050 +/- 0.01336	0.02610 +/- 0.00230	0.01149 +/- 0.00178	0.437
Dead Tree	-0.00486 +/- 0.00934	0.01244 +/- 0.00161	0.00859 +/- 0.00125	0.385
Illegal Tree Damage	-0.00134 +/- 0.00167	0.00037 +/- 0.00029	0.00227 +/- 0.00022	0.372
Other Enforcement	-0.00135 +/- 0.00398	0.00075 +/- 0.00069	0.00541 +/- 0.00053	0.349
Overgrown Tree/Branches	-0.01804 +/- 0.01125	0.02406 +/- 0.00194	0.00756 +/- 0.00150	0.433
Root/Sewer/Sidewalk Condition	-0.01594 +/- 0.00702	0.01378 +/- 0.00121	0.00388 +/- 0.00094	0.399
Sewer	-0.02535 +/- 0.02174	0.04118 +/- 0.00375	0.00813 +/- 0.00290	0.394
Sidewalk Condition	0.00035 +/- 0.00381	-0.00226 +/- 0.00066	0.00611 +/- 0.00051	0.444
Street Condition	-0.05631 +/- 0.05056	0.06262 +/- 0.00872	0.06461 +/- 0.00675	0.431

Table 6. Coefficients and standard deviations associated with the groups of WORKERS HOMEOWNERS HOUSE VALUES for types of requests with R2 greater than 0.2

Type of Request	house value less than 100_n	house value for 100 to 500_n	house value 500 or more_n	R2 os
Broken Muni Meter	0.22149 +/- 0.05094	-0.03159 +/- 0.00703	0.00571 +/- 0.00351	0.36
Consumer Complaint	0.02422 +/- 0.01238	-0.00259 +/- 0.00171	0.00084 +/- 0.00085	0.313
Fire Alarm - Reinspection	0.00268 +/- 0.00040	-0.00033 +/- 0.00005	0.00003 +/- 0.00003	0.458
Fire Safety Director - F58	0.00271 +/- 0.00600	-0.00273 +/- 0.00083	0.00443 +/- 0.00041	0.391
Food Establishment	0.01778 +/- 0.00606	-0.00303 +/- 0.00084	0.00132 +/- 0.00042	0.416
Food Poisoning	0.01121 +/- 0.00226	-0.00177 +/- 0.00031	0.00059 +/- 0.00016	0.474
For Hire Vehicle Complaint	0.00478 +/- 0.00170	-0.00077 +/- 0.00023	0.00036 +/- 0.00012	0.394
Found Property	0.00221 +/- 0.00056	-0.00042 +/- 0.00008	0.00021 +/- 0.00004	0.583
Homeless Encampment	0.02155 +/- 0.00499	-0.00366 +/- 0.00069	0.00109 +/- 0.00034	0.377
Homeless Person Assistance	0.01133 +/- 0.00231	-0.00195 +/- 0.00032	0.00070 +/- 0.00016	0.421
Taxi Complaint	0.09270 +/- 0.01699	-0.01734 +/- 0.00234	0.00809 +/- 0.00117	0.64
Taxi Report	0.00182 +/- 0.00049	-0.00046 +/- 0.00007	0.00032 +/- 0.00003	0.569

Table 7. Coefficients and standard deviations associated with the groups of RESIDENTS HOUSEHOLD INCOME for types of requests with R2 greater than 0.2

Type of Request	household income less than 40	household income from 40 to 75	household income 75 and above	R2 os
APPLIANCE	0.01700 +/- 0.00226	-0.00230 +/- 0.00384	-0.00270 +/- 0.00086	0.522
Air Quality	0.00863 +/- 0.00146	-0.01509 +/- 0.00248	0.00903 +/- 0.00055	0.602
Animal Abuse	0.00406 +/- 0.00139	0.00507 +/- 0.00236	-0.00051 +/- 0.00053	0.398
Asbestos	0.00276 +/- 0.00048	-0.00327 +/- 0.00082	0.00213 +/- 0.00018	0.378
Bike/Roller/Skate Chronic	0.00079 +/- 0.00015	-0.00170 +/- 0.00025	0.00084 +/- 0.00006	0.52
Blocked Driveway	-0.08467 +/- 0.01425	0.27883 +/- 0.02417	-0.04893 +/- 0.00540	0.333
Boilers	0.00238 +/- 0.00040	-0.00078 +/- 0.00068	0.00033 +/- 0.00015	0.367
DOOR/WINDOW	0.04552 +/- 0.00652	-0.00128 +/- 0.01106	-0.00786 +/- 0.00247	0.502
Dirty Conditions	-0.00508 +/- 0.00442	0.04165 +/- 0.00751	-0.00213 +/- 0.00168	0.409
Drinking	0.00074 +/- 0.00028	0.00048 +/- 0.00047	0.00001 +/- 0.00010	0.307
ELECTRIC	0.03310 +/- 0.00649	0.01935 +/- 0.01101	-0.01032 +/- 0.00246	0.486
Elevator	0.01354 +/- 0.00238	-0.00400 +/- 0.00403	0.00118 +/- 0.00090	0.332
FLOORING/STAIRS	0.03699 +/- 0.00545	-0.00515 +/- 0.00925	-0.00543 +/- 0.00207	0.462
Food Establishment	0.00764 +/- 0.00178	-0.00949 +/- 0.00302	0.00665 +/- 0.00068	0.448
For Hire Vehicle Complaint	0.00285 +/- 0.00064	-0.00328 +/- 0.00108	0.00158 +/- 0.00024	0.307
Found Property	0.00085 +/- 0.00021	-0.00206 +/- 0.00036	0.00099 +/- 0.00008	0.387
GENERAL	0.04055 +/- 0.00609	-0.00257 +/- 0.01032	-0.00375 +/- 0.00231	0.493
GENERAL CONSTRUCTION	0.02517 +/- 0.00419	-0.00129 +/- 0.00710	-0.00489 +/- 0.00159	0.354
General Construction/Plumbing	0.00785 +/- 0.00913	0.00572 +/- 0.01549	0.00953 +/- 0.00346	0.424
HEAT/HOT WATER	0.19120 +/- 0.03002	-0.00219 +/- 0.05092	-0.02022 +/- 0.01138	0.468
HEATING	0.13272 +/- 0.02752	0.03134 +/- 0.04667	-0.02764 +/- 0.01043	0.361
Hazardous Materials	0.00091 +/- 0.00058	-0.00060 +/- 0.00099	0.00158 +/- 0.00022	0.457

Type of Request	household income less than 40	household income from 40 to 75	household income 75 and above	R2 os
Illegal Tree Damage	-0.00080 +/- 0.00041	0.00221 +/- 0.00070	0.00075 +/- 0.00016	0.387
Indoor Air Quality	0.00416 +/- 0.00202	-0.00295 +/- 0.00342	0.00320 +/- 0.00076	0.39
Indoor Sewage	0.00076 +/- 0.00030	0.00136 +/- 0.00051	-0.00023 +/- 0.00011	0.334
Lead	0.00032 +/- 0.00047	0.00065 +/- 0.00080	0.00155 +/- 0.00018	0.482
Litter Basket / Request	0.00190 +/- 0.00054	-0.00090 +/- 0.00091	0.00161 +/- 0.00020	0.377
NONCONST	0.01249 +/- 0.00197	0.00192 +/- 0.00335	-0.00206 +/- 0.00075	0.509
Noise	0.07007 +/- 0.01180	-0.13703 +/- 0.02001	0.07959 +/- 0.00447	0.654
Noise - Residential	0.21241 +/- 0.03093	0.05446 +/- 0.05246	-0.02546 +/- 0.01173	0.61
Noise - Vehicle	0.01631 +/- 0.00412	-0.00655 +/- 0.00698	0.00432 +/- 0.00156	0.385
OUTSIDE BUILDING	0.00113 +/- 0.00032	0.00101 +/- 0.00054	-0.00017 +/- 0.00012	0.357
Other Enforcement	0.00110 +/- 0.00093	0.00181 +/- 0.00157	0.00230 +/- 0.00035	0.499
PAINT - PLASTER	0.02089 +/- 0.00316	-0.00397 +/- 0.00536	-0.00313 +/- 0.00120	0.389
PAINT/PLASTER	0.09274 +/- 0.01534	0.01370 +/- 0.02603	-0.01897 +/- 0.00582	0.45
PLUMBING	0.09590 +/- 0.01385	0.00115 +/- 0.02349	-0.01548 +/- 0.00525	0.508
Recycling Enforcement	0.00037 +/- 0.00020	0.00033 +/- 0.00034	0.00026 +/- 0.00008	0.324
Rodent	0.03021 +/- 0.00390	-0.01371 +/- 0.00661	0.00496 +/- 0.00148	0.505
SAFETY	0.00898 +/- 0.00157	0.00198 +/- 0.00266	-0.00196 +/- 0.00059	0.493
Sidewalk Condition	0.00338 +/- 0.00084	-0.00550 +/- 0.00142	0.00418 +/- 0.00032	0.574
Taxi Complaint	0.03381 +/- 0.00737	-0.07730 +/- 0.01251	0.03632 +/- 0.00280	0.442
UNSANITARY CONDITION	0.07755 +/- 0.01217	0.02117 +/- 0.02064	-0.01742 +/- 0.00461	0.531
Urinating in Public	0.00041 +/- 0.00010	-0.00032 +/- 0.00017	0.00023 +/- 0.00004	0.333
WATER LEAK	0.03832 +/- 0.00656	0.01167 +/- 0.01112	-0.00976 +/- 0.00249	0.487
Water Quality	0.00003 +/- 0.00019	0.00057 +/- 0.00033	0.00041 +/- 0.00007	0.375

Table 8. Coefficients and standard deviations associated with the groups of WORKERS HOUSEHOLD INCOME for types of requests with R2 greater than 0.2

Type of Request	household income less than 10_n	household income form 10 to 40_n	household income form 40 to 75_n	household income 75 and above_n	R2 os
EAP Inspection - F59	-0.00212 +/- 0.00110	0.00331 +/- 0.00068	-0.00521 +/- 0.00067	0.00133 +/- 0.00008	0.679
Fire Alarm - Reinspection	0.00175 +/- 0.00045	-0.00057 +/- 0.00028	0.00017 +/- 0.00028	-0.00006 +/- 0.00003	0.407
Fire Safety Director - F58	-0.01029 +/- 0.00481	0.01547 +/- 0.00295	-0.02170 +/- 0.00294	0.00465 +/- 0.00034	0.585
Food Establishment	0.01220 +/- 0.00678	-0.00544 +/- 0.00416	0.00403 +/- 0.00415	-0.00076 +/- 0.00049	0.394
Food Poisoning	0.00685 +/- 0.00263	-0.00222 +/- 0.00161	0.00041 +/- 0.00161	-0.00006 +/- 0.00019	0.459
For Hire Vehicle Complaint	0.00029 +/- 0.00187	0.00212 +/- 0.00115	-0.00309 +/- 0.00115	0.00034 +/- 0.00013	0.37
Found Property	0.00179 +/- 0.00065	-0.00076 +/- 0.00040	0.00021 +/- 0.00040	0.00004 +/- 0.00005	0.55
Homeless Encampment	0.02000 +/- 0.00569	-0.00736 +/- 0.00349	0.00143 +/- 0.00348	-0.00016 +/- 0.00041	0.322

Type of Request	household income less than 10_n	household income form 10 to 40_n	household income form 40 to 75_n	household income 75 and above_n	R2 os
Homeless Person Assistance	0.01284 +/- 0.00262	-0.00579 +/- 0.00161	0.00246 +/- 0.00161	-0.00020 +/- 0.00019	0.324
Taxi Complaint	0.07528 +/- 0.02010	-0.03067 +/- 0.01233	0.00670 +/- 0.01230	0.00155 +/- 0.00144	0.618
Taxi Report	0.00109 +/- 0.00054	-0.00033 +/- 0.00033	-0.00028 +/- 0.00033	0.00017 +/- 0.00004	0.61

Table 9. Coefficients and standard deviations associated with the groups of RESIDENT HOME OWNERS vs RENTERS for types of requests with R2 greater than 0.2

Type of Request	owner occupied units	renter occupied units	R2 os
APPLIANCE	-0.00609 +/- 0.00091	0.00522 +/- 0.00043	0.391
Air Quality	0.00284 +/- 0.00071	0.00336 +/- 0.00034	0.344
Asbestos	0.00067 +/- 0.00020	0.00111 +/- 0.00009	0.363
Boilers	-0.00047 +/- 0.00014	0.00092 +/- 0.00006	0.486
Consumer Complaint	0.00117 +/- 0.00160	0.00556 +/- 0.00076	0.331
DOOR/WINDOW	-0.01758 +/- 0.00255	0.01526 +/- 0.00121	0.442
Damaged Tree	0.01789 +/- 0.00126	-0.00350 +/- 0.00060	0.492
Dead Tree	0.01050 +/- 0.00087	-0.00173 +/- 0.00041	0.403
Dirty Conditions	0.00943 +/- 0.00178	0.00567 +/- 0.00084	0.301
Drinking	-0.00015 +/- 0.00010	0.00042 +/- 0.00005	0.339
ELECTRIC	-0.01210 +/- 0.00274	0.01377 +/- 0.00130	0.334
Electrical	0.00069 +/- 0.00055	0.00117 +/- 0.00026	0.341
Elevator	-0.00279 +/- 0.00085	0.00493 +/- 0.00040	0.362
FLOORING/STAIRS	-0.01426 +/- 0.00209	0.01182 +/- 0.00099	0.409
Food Establishment	0.00239 +/- 0.00072	0.00325 +/- 0.00034	0.455
Food Poisoning	0.00093 +/- 0.00034	0.00126 +/- 0.00016	0.389
For Hire Vehicle Complaint	0.00013 +/- 0.00024	0.00096 +/- 0.00011	0.417
GENERAL	-0.01429 +/- 0.00221	0.01477 +/- 0.00104	0.508
General Construction/Plumbing	0.00894 +/- 0.00342	0.00734 +/- 0.00162	0.442
HEAT/HOT WATER	-0.06898 +/- 0.01099	0.07104 +/- 0.00519	0.488
HEATING	-0.05748 +/- 0.01039	0.05284 +/- 0.00491	0.361
Hazardous Materials	0.00118 +/- 0.00023	0.00075 +/- 0.00011	0.38
Illegal Tree Damage	0.00125 +/- 0.00016	0.00042 +/- 0.00008	0.366
Indoor Air Quality	-0.00002 +/- 0.00074	0.00254 +/- 0.00035	0.462
Lead	0.00128 +/- 0.00019	0.00085 +/- 0.00009	0.451
Litter Basket / Request	0.00084 +/- 0.00020	0.00111 +/- 0.00010	0.404
Missed Collection (All Materials)	0.01387 +/- 0.00146	-0.00209 +/- 0.00069	0.324
NONCONST	-0.00391 +/- 0.00079	0.00462 +/- 0.00038	0.361
Noise	0.02365 +/- 0.00618	0.02683 +/- 0.00292	0.321
Noise - Residential	-0.06152 +/- 0.01203	0.08870 +/- 0.00569	0.509

Type of Request	owner occupied units	renter occupied units	R2 os
Noise - Street/Sidewalk	-0.02013 +/- 0.00426	0.02266 +/- 0.00201	0.434
Noise - Vehicle	-0.00358 +/- 0.00142	0.00728 +/- 0.00067	0.452
OUTSIDE BUILDING	-0.00022 +/- 0.00012	0.00062 +/- 0.00006	0.31
Other Enforcement	0.00281 +/- 0.00035	0.00139 +/- 0.00017	0.498
Overgrown Tree/Branches	0.01456 +/- 0.00112	-0.00277 +/- 0.00053	0.442
PAINT - PLASTER	-0.00759 +/- 0.00125	0.00620 +/- 0.00059	0.334
PAINT/PLASTER	-0.03785 +/- 0.00597	0.03424 +/- 0.00282	0.411
PLUMBING	-0.03354 +/- 0.00551	0.03286 +/- 0.00260	0.429
Plumbing	0.00116 +/- 0.00050	0.00071 +/- 0.00024	0.304
Recycling Enforcement	0.00029 +/- 0.00007	0.00028 +/- 0.00004	0.331
Rodent	-0.00377 +/- 0.00135	0.01049 +/- 0.00064	0.542
Root/Sewer/Sidewalk Condition	0.00820 +/- 0.00067	-0.00220 +/- 0.00031	0.476
SAFETY	-0.00335 +/- 0.00063	0.00335 +/- 0.00030	0.388
Sewer	0.02128 +/- 0.00228	-0.00242 +/- 0.00108	0.303
Sidewalk Condition	0.00201 +/- 0.00038	0.00154 +/- 0.00018	0.422
Smoking	-0.00013 +/- 0.00025	0.00082 +/- 0.00012	0.326
Street Condition	0.05969 +/- 0.00490	0.00233 +/- 0.00232	0.446
UNSANITARY CONDITION	-0.02904 +/- 0.00496	0.02977 +/- 0.00234	0.433
Urinating in Public	0.00004 +/- 0.00004	0.00017 +/- 0.00002	0.356
WATER LEAK	-0.01555 +/- 0.00266	0.01467 +/- 0.00126	0.382
Water Quality	0.00056 +/- 0.00007	0.00025 +/- 0.00003	0.391

Table 10. Coefficients and standard deviations associated with the groups of WORKER HOME OWNERS vs RENTERS for types of requests with R2 greater than 0.2

Type of Request	owner occupied units_n	renter occupied units_n	R2 os
Air Quality	-0.00519 +/- 0.00076	0.00387 +/- 0.00049	0.375
Broken Muni Meter	-0.03140 +/- 0.00547	0.02374 +/- 0.00354	0.315
Consumer Complaint	-0.00511 +/- 0.00132	0.00457 +/- 0.00085	0.429
Fire Alarm - Reinspection	-0.00031 +/- 0.00004	0.00025 +/- 0.00003	0.497
Fire Safety Director - F58	-0.00140 +/- 0.00076	0.00288 +/- 0.00049	0.443
Food Establishment	-0.00394 +/- 0.00063	0.00317 +/- 0.00041	0.479
Food Poisoning	-0.00195 +/- 0.00023	0.00157 +/- 0.00015	0.555
For Hire Vehicle Complaint	-0.00101 +/- 0.00018	0.00087 +/- 0.00011	0.484
Found Property	-0.00045 +/- 0.00006	0.00038 +/- 0.00004	0.636
Hazardous Materials	-0.00101 +/- 0.00028	0.00077 +/- 0.00018	0.33
Homeless Encampment	-0.00401 +/- 0.00052	0.00292 +/- 0.00033	0.414
Homeless Person Assistance	-0.00197 +/- 0.00024	0.00154 +/- 0.00016	0.48
Non-Residential Heat	-0.00056 +/- 0.00016	0.00058 +/- 0.00010	0.363
Sidewalk Condition	-0.00174 +/- 0.00041	0.00141 +/- 0.00026	0.349

Type of Request	owner occupied units_n	renter occupied units_n	R2 os
Taxi Complaint	-0.01710 +/- 0.00176	0.01416 +/- 0.00114	0.706
Taxi Report	-0.00040 +/- 0.00006	0.00037 +/- 0.00004	0.6

Table 11. Coefficients and standard deviations associated with the groups of RESIDENTS RACE for types of requests with R2 greater than 0.2

Type of Request	Population white	population black	Population asian	population hispanic	population other race	R2 os
APPLIANCE	0.00050 +/- 0.00019	0.00257 +/- 0.00021	-0.00060 +/- 0.00040	0.00275 +/- 0.00023	-0.00163 +/- 0.00159	0.605
Animal Abuse	0.00065 +/- 0.00013	0.00115 +/- 0.00014	0.00005 +/- 0.00026	0.00121 +/- 0.00015	0.00221 +/- 0.00104	0.457
Boilers	0.00024 +/- 0.00004	0.00025 +/- 0.00004	-0.00011 +/- 0.00008	0.00042 +/- 0.00005	0.00020 +/- 0.00031	0.336
Bus Stop Shelter Placement	0.00005 +/- 0.00001	0.00004 +/- 0.00001	0.00001 +/- 0.00001	0.00002 +/- 0.00001	-0.00000 +/- 0.00005	0.305
DOOR/WINDOW	0.00175 +/- 0.00056	0.00692 +/- 0.00062	-0.00208 +/- 0.00116	0.00819 +/- 0.00067	-0.00476 +/- 0.00467	0.573
Dirty Conditions	0.00271 +/- 0.00041	0.00412 +/- 0.00045	0.00255 +/- 0.00084	0.00221 +/- 0.00049	0.00926 +/- 0.00338	0.4
Drinking	0.00005 +/- 0.00002	0.00000 +/- 0.00003	0.00013 +/- 0.00005	0.00024 +/- 0.00003	0.00105 +/- 0.00019	0.368
ELECTRIC	0.00177 +/- 0.00053	0.00794 +/- 0.00059	-0.00111 +/- 0.00110	0.00698 +/- 0.00064	-0.00239 +/- 0.00442	0.62
FLOORING/STAIRS	0.00132 +/- 0.00047	0.00498 +/- 0.00052	-0.00202 +/- 0.00097	0.00674 +/- 0.00056	-0.00335 +/- 0.00389	0.537
GENERAL	0.00212 +/- 0.00053	0.00589 +/- 0.00058	-0.00158 +/- 0.00109	0.00765 +/- 0.00063	-0.00227 +/- 0.00437	0.56
GENERAL CONSTRUCTION	0.00086 +/- 0.00037	0.00436 +/- 0.00040	-0.00084 +/- 0.00075	0.00400 +/- 0.00044	-0.00609 +/- 0.00303	0.404
HEAT/HOT WATER	0.01085 +/- 0.00274	0.02466 +/- 0.00301	-0.00676 +/- 0.00563	0.03909 +/- 0.00327	-0.02121 +/- 0.02268	0.467
HEATING	0.00664 +/- 0.00257	0.02008 +/- 0.00281	-0.00479 +/- 0.00528	0.02944 +/- 0.00306	-0.02417 +/- 0.02123	0.325
Illegal Parking	0.00986 +/- 0.00087	0.00306 +/- 0.00096	0.00802 +/- 0.00179	0.00326 +/- 0.00104	0.00736 +/- 0.00721	0.362
Illegal Tree Damage	0.00041 +/- 0.00004	0.00002 +/- 0.00004	0.00018 +/- 0.00008	0.00009 +/- 0.00004	0.00093 +/- 0.00031	0.32
Indoor Sewage	0.00012 +/- 0.00002	0.00042 +/- 0.00002	0.00003 +/- 0.00004	0.00015 +/- 0.00002	0.00015 +/- 0.00017	0.612
Lead	0.00062 +/- 0.00005	0.00021 +/- 0.00005	0.00005 +/- 0.00010	0.00018 +/- 0.00006	0.00045 +/- 0.00040	0.331
Litter Basket / Request	0.00061 +/- 0.00005	0.00027 +/- 0.00006	-0.00001 +/- 0.00011	0.00037 +/- 0.00006	0.00046 +/- 0.00045	0.349
NONCONST	0.00072 +/- 0.00017	0.00236 +/- 0.00019	-0.00034 +/- 0.00035	0.00221 +/- 0.00020	-0.00074 +/- 0.00141	0.608
Noise - Residential	0.01219 +/- 0.00245	0.03205 +/- 0.00268	-0.00566 +/- 0.00503	0.04855 +/- 0.00292	0.07302 +/- 0.02026	0.696
Noise - Vehicle	0.00201 +/- 0.00036	0.00110 +/- 0.00040	-0.00198 +/- 0.00075	0.00399 +/- 0.00043	0.00736 +/- 0.00301	0.362
Non-Emergency Police Matter	0.00058 +/- 0.00010	0.00024 +/- 0.00011	-0.00028 +/- 0.00021	0.00027 +/- 0.00012	0.00958 +/- 0.00083	0.4
OUTSIDE BUILDING	0.00015 +/- 0.00003	0.00031 +/- 0.00003	-0.00005 +/- 0.00006	0.00032 +/- 0.00003	-0.00002 +/- 0.00022	0.48
Other Enforcement	0.00094 +/- 0.00008	0.00036 +/- 0.00009	0.00075 +/- 0.00017	0.00017 +/- 0.00010	0.00355 +/- 0.00067	0.575

Type of Request	Population white	population black	Population asian	population hispanic	population other race	R2 os
PAINT - PLASTER	0.00066 +/- 0.00028	0.00316 +/- 0.00030	-0.00090 +/- 0.00057	0.00321 +/- 0.00033	-0.00342 +/- 0.00230	0.459
PAINT/PLASTER	0.00429 +/- 0.00136	0.01468 +/- 0.00149	-0.00358 +/- 0.00279	0.01928 +/- 0.00162	-0.01478 +/- 0.01121	0.51
PLUMBING	0.00408 +/- 0.00117	0.01632 +/- 0.00129	-0.00317 +/- 0.00241	0.01651 +/- 0.00140	-0.00967 +/- 0.00971	0.606
Recycling Enforcement	0.00019 +/- 0.00002	0.00012 +/- 0.00002	0.00005 +/- 0.00004	0.00005 +/- 0.00002	0.00017 +/- 0.00015	0.37
Rodent	0.00284 +/- 0.00036	0.00376 +/- 0.00040	-0.00103 +/- 0.00074	0.00453 +/- 0.00043	0.00266 +/- 0.00298	0.518
SAFETY	0.00043 +/- 0.00014	0.00141 +/- 0.00015	-0.00013 +/- 0.00028	0.00206 +/- 0.00016	-0.00133 +/- 0.00113	0.547
Sanitation Condition	0.00237 +/- 0.00034	0.00419 +/- 0.00038	0.00294 +/- 0.00071	0.00033 +/- 0.00041	0.00779 +/- 0.00285	0.357
Sidewalk Condition	0.00109 +/- 0.00009	0.00021 +/- 0.00010	0.00015 +/- 0.00019	0.00009 +/- 0.00011	0.00157 +/- 0.00076	0.442
Street Condition	0.01169 +/- 0.00132	0.00401 +/- 0.00145	0.00705 +/- 0.00271	-0.00184 +/- 0.00157	0.03681 +/- 0.01092	0.391
UNSANITARY CONDITION	0.00388 +/- 0.00105	0.01463 +/- 0.00115	-0.00167 +/- 0.00216	0.01537 +/- 0.00125	-0.00955 +/- 0.00868	0.599
WATER LEAK	0.00180 +/- 0.00058	0.00757 +/- 0.00063	-0.00078 +/- 0.00118	0.00746 +/- 0.00069	-0.00818 +/- 0.00476	0.555
Water Quality	0.00022 +/- 0.00002	0.00009 +/- 0.00002	0.00003 +/- 0.00004	0.00004 +/- 0.00002	0.00014 +/- 0.00015	0.373

Table 12. Coefficients and standard deviations associated with the groups of WORKERS RACE for types of requests with R2 greater than 0.2

Type Of Request	Population white_n	population black_n	Population asian_n	population hispanic_n	population other _n	R2 os
Broken Muni Meter	-0.01462 +/- 0.00473	-0.01918 +/- 0.00665	0.05452 +/- 0.01799	0.04164 +/- 0.00963	-0.17429 +/- 0.14242	0.355
Construction	-0.00974 +/- 0.00079	-0.00688 +/- 0.00111	0.01692 +/- 0.00299	-0.00559 +/- 0.00160	0.18487 +/- 0.02369	0.433
Consumer Complaint	-0.00631 +/- 0.00105	-0.00510 +/- 0.00148	0.01580 +/- 0.00399	0.00449 +/- 0.00214	0.05627 +/- 0.03160	0.332
EAP Inspection - F59	0.00053 +/- 0.00011	-0.00186 +/- 0.00016	-0.00068 +/- 0.00043	-0.00009 +/- 0.00023	0.01885 +/- 0.00344	0.458
Fire Alarm - Reinspection	-0.00015 +/- 0.00004	-0.00011 +/- 0.00005	0.00042 +/- 0.00015	0.00032 +/- 0.00008	-0.00043 +/- 0.00116	0.336
Fire Safety Director - F58	0.00070 +/- 0.00045	-0.00718 +/- 0.00063	0.00027 +/- 0.00170	0.00181 +/- 0.00091	0.05845 +/- 0.01349	0.562
Food Establishment	-0.00232 +/- 0.00056	-0.00168 +/- 0.00078	0.00799 +/- 0.00212	0.00203 +/- 0.00113	0.00927 +/- 0.01677	0.443
Food Poisoning	-0.00082 +/- 0.00022	-0.00116 +/- 0.00031	0.00123 +/- 0.00084	0.00125 +/- 0.00045	0.01139 +/- 0.00661	0.478
For Hire Vehicle Complaint	-0.00024 +/- 0.00016	-0.00054 +/- 0.00023	0.00022 +/- 0.00062	0.00075 +/- 0.00033	0.00429 +/- 0.00492	0.345
Found Property	-0.00005 +/- 0.00005	-0.00040 +/- 0.00008	-0.00021 +/- 0.00020	0.00049 +/- 0.00011	0.00182 +/- 0.00162	0.559
Homeless Person Assistance	-0.00009 +/- 0.00024	-0.00058 +/- 0.00034	-0.00171 +/- 0.00091	0.00079 +/- 0.00049	0.01166 +/- 0.00719	0.327
Taxi Complaint	-0.00084 +/- 0.00173	-0.01279 +/- 0.00243	-0.01352 +/- 0.00657	0.01383 +/- 0.00352	0.10112 +/- 0.05201	0.614
Taxi Report	0.00006 +/- 0.00005	-0.00051 +/- 0.00006	-0.00050 +/- 0.00017	0.00031 +/- 0.00009	0.00412 +/- 0.00138	0.641

Table 13. Coefficients and standard deviations associated with the groups of RESIDENTS MONTHLY RENT for types of requests with R2 greater than 0.2

Type of Request	rent less than 1000	rent bewteen 1000 and 2000	rent 2000 or more	R2 os
APPLIANCE	0.00999 +/- 0.00100	0.00576 +/- 0.00082	-0.00476 +/- 0.00093	0.572
Air Quality	0.00175 +/- 0.00064	0.00052 +/- 0.00053	0.01196 +/- 0.00060	0.627
Animal Abuse	0.00366 +/- 0.00067	0.00289 +/- 0.00055	-0.00038 +/- 0.00063	0.369
Asbestos	0.00081 +/- 0.00023	0.00062 +/- 0.00018	0.00271 +/- 0.00021	0.359
Bike/Roller/Skate Chronic	0.00014 +/- 0.00006	-0.00010 +/- 0.00005	0.00113 +/- 0.00006	0.632
Blocked Driveway	-0.03965 +/- 0.00704	0.07770 +/- 0.00577	-0.03831 +/- 0.00654	0.342
Boilers	0.00132 +/- 0.00017	0.00082 +/- 0.00014	0.00037 +/- 0.00016	0.463
DOOR/WINDOW	0.02565 +/- 0.00286	0.01899 +/- 0.00234	-0.01294 +/- 0.00266	0.565
Drinking	0.00023 +/- 0.00013	0.00066 +/- 0.00011	0.00018 +/- 0.00012	0.33
ELECTRIC	0.02275 +/- 0.00296	0.01916 +/- 0.00242	-0.01339 +/- 0.00275	0.529
Electrical	0.00097 +/- 0.00071	0.00150 +/- 0.00058	0.00111 +/- 0.00066	0.318
Elevator	0.00592 +/- 0.00108	0.00572 +/- 0.00088	0.00098 +/- 0.00100	0.368
FLOORING/STAIRS	0.01990 +/- 0.00243	0.01436 +/- 0.00199	-0.00968 +/- 0.00226	0.511
Food Establishment	0.00166 +/- 0.00080	0.00158 +/- 0.00066	0.00947 +/- 0.00075	0.471
For Hire Vehicle Complaint	0.00068 +/- 0.00029	0.00050 +/- 0.00024	0.00227 +/- 0.00027	0.394
Found Property	0.00001 +/- 0.00009	-0.00011 +/- 0.00008	0.00136 +/- 0.00009	0.517
GENERAL	0.02350 +/- 0.00261	0.01674 +/- 0.00214	-0.00656 +/- 0.00242	0.585
GENERAL CONSTRUCTION	0.01262 +/- 0.00192	0.01105 +/- 0.00158	-0.00821 +/- 0.00179	0.391
General Construction/Plumbing	0.00324 +/- 0.00442	0.00785 +/- 0.00363	0.01558 +/- 0.00411	0.418
HEAT/HOT WATER	0.09587 +/- 0.01287	0.09630 +/- 0.01056	-0.03756 +/- 0.01196	0.575
HEATING	0.07425 +/- 0.01232	0.07463 +/- 0.01010	-0.04002 +/- 0.01145	0.432
Hazardous Materials	0.00036 +/- 0.00029	0.00048 +/- 0.00024	0.00227 +/- 0.00027	0.381
Homeless Encampment	0.00174 +/- 0.00054	-0.00064 +/- 0.00044	0.00732 +/- 0.00050	0.347
Indoor Air Quality	0.00176 +/- 0.00093	0.00191 +/- 0.00077	0.00478 +/- 0.00087	0.472
Indoor Sewage	0.00089 +/- 0.00014	0.00058 +/- 0.00012	-0.00024 +/- 0.00013	0.353
Lead	-0.00020 +/- 0.00024	0.00121 +/- 0.00020	0.00214 +/- 0.00023	0.388
Litter Basket / Request	0.00064 +/- 0.00026	0.00108 +/- 0.00021	0.00214 +/- 0.00024	0.321
NONCONST	0.00741 +/- 0.00088	0.00592 +/- 0.00072	-0.00317 +/- 0.00081	0.549
Noise	0.00960 +/- 0.00448	-0.00068 +/- 0.00367	0.11092 +/- 0.00416	0.764
Noise - Residential	0.15388 +/- 0.01290	0.09206 +/- 0.01058	-0.03128 +/- 0.01199	0.681
Noise - Street/Sidewalk	0.03518 +/- 0.00565	0.01505 +/- 0.00463	0.01157 +/- 0.00525	0.355
Noise - Vehicle	0.00815 +/- 0.00185	0.00633 +/- 0.00152	0.00638 +/- 0.00172	0.443
OUTSIDE BUILDING	0.00083 +/- 0.00015	0.00085 +/- 0.00012	-0.00017 +/- 0.00013	0.386
Other Enforcement	-0.00046 +/- 0.00048	0.00223 +/- 0.00039	0.00350 +/- 0.00044	0.391
PAINT - PLASTER	0.01031 +/- 0.00145	0.00808 +/- 0.00119	-0.00595 +/- 0.00134	0.441
PAINT/PLASTER	0.04961 +/- 0.00670	0.04928 +/- 0.00550	-0.02995 +/- 0.00623	0.529
PLUMBING	0.05494 +/- 0.00607	0.04098 +/- 0.00498	-0.02589 +/- 0.00564	0.573
Recycling Enforcement	0.00005 +/- 0.00010	0.00043 +/- 0.00008	0.00043 +/- 0.00009	0.303

Type of Request	rent less than 1000	rent bewteen 1000 and 2000	rent 2000 or more	R2 os
Rodent	0.01746 +/- 0.00165	0.00741 +/- 0.00136	0.00519 +/- 0.00154	0.585
SAFETY	0.00510 +/- 0.00071	0.00461 +/- 0.00058	-0.00275 +/- 0.00066	0.541
Sidewalk Condition	-0.00006 +/- 0.00039	0.00091 +/- 0.00032	0.00570 +/- 0.00036	0.588
Taxi Complaint	0.00388 +/- 0.00315	-0.00556 +/- 0.00258	0.04932 +/- 0.00293	0.544
UNSANITARY CONDITION	0.04571 +/- 0.00532	0.04128 +/- 0.00436	-0.02506 +/- 0.00494	0.603
Urinating in Public	0.00015 +/- 0.00005	0.00012 +/- 0.00004	0.00033 +/- 0.00004	0.38
WATER LEAK	0.02288 +/- 0.00290	0.02073 +/- 0.00238	-0.01408 +/- 0.00269	0.546

Table 14. Coefficients and standard deviations associated with the groups of WORKERS MONTHLY RENT for types of requests with R2 greater than 0.2

Type of Request	rent less than 1000_n	rent bewteen 1000 and 2000_n	rent 2000 or more_n	R2 os
EAP Inspection - F59	0.00006 +/- 0.00032	-0.00042 +/- 0.00018	0.00230 +/- 0.00009	0.677
Fire Alarm - Reinspection	0.00074 +/- 0.00012	-0.00035 +/- 0.00007	0.00006 +/- 0.00004	0.383
Fire Safety Director - F58	0.00095 +/- 0.00140	-0.00159 +/- 0.00079	0.00740 +/- 0.00042	0.681
Food Establishment	0.00382 +/- 0.00189	-0.00150 +/- 0.00107	0.00046 +/- 0.00057	0.361
Food Poisoning	0.00240 +/- 0.00073	-0.00120 +/- 0.00041	0.00066 +/- 0.00022	0.406
For Hire Vehicle Complaint	0.00039 +/- 0.00053	-0.00015 +/- 0.00030	0.00041 +/- 0.00016	0.322
Found Property	0.00046 +/- 0.00018	-0.00028 +/- 0.00010	0.00030 +/- 0.00005	0.555
Homeless Encampment	0.00680 +/- 0.00154	-0.00378 +/- 0.00087	0.00143 +/- 0.00046	0.347
Homeless Person Assistance	0.00309 +/- 0.00074	-0.00169 +/- 0.00042	0.00086 +/- 0.00022	0.325
Taxi Complaint	0.02257 +/- 0.00546	-0.01346 +/- 0.00308	0.01179 +/- 0.00163	0.623
Taxi Report	0.00021 +/- 0.00015	-0.00020 +/- 0.00008	0.00048 +/- 0.00004	0.643

Table 15. Coefficients and standard deviations associated with the groups of RESIDENTS TRANSPORTATION MEAN for types of requests with R2 greater than 0.2

Type of Request	transportation car	transportation public	tranportation motorcycle	Transportation Other means	R2 os
APPLIANCE	-0.00472 +/- 0.00112	0.00632 +/- 0.00063	-0.67422 +/- 0.18128	-0.00794 +/- 0.00171	0.337
Air Quality	-0.00127 +/- 0.00063	0.00084 +/- 0.00035	0.33691 +/- 0.10249	0.01003 +/- 0.00097	0.597
Animal Abuse	0.00138 +/- 0.00062	0.00248 +/- 0.00035	-0.03283 +/- 0.10012	-0.00161 +/- 0.00095	0.301
Asbestos	-0.00049 +/- 0.00021	0.00072 +/- 0.00012	0.09072 +/- 0.03410	0.00126 +/- 0.00032	0.357
Bike/Roller/Skate Chronic	-0.00016 +/- 0.00006	-0.00002 +/- 0.00003	0.01763 +/- 0.00972	0.00112 +/- 0.00009	0.501
Blocked Driveway	0.04713 +/- 0.00634	0.02771 +/- 0.00355	-0.63137 +/- 1.02890	-0.03875 +/- 0.00972	0.37
Boilers	-0.00066 +/- 0.00017	0.00091 +/- 0.00009	-0.07885 +/- 0.02707	-0.00025 +/- 0.00026	0.383
Consumer Complaint	0.00035 +/- 0.00171	0.00296 +/- 0.00096	-0.33262 +/- 0.27713	0.01339 +/- 0.00262	0.43

Type of Request	transportation car	transportation public	tranportation motorcycle	Transportation Other means	R2 os
DOOR/WINDOW	-0.01471 +/- 0.00311	0.01856 +/- 0.00174	-1.84389 +/- 0.50561	-0.02289 +/- 0.00478	0.33
Damaged Tree	0.02245 +/- 0.00114	-0.00079 +/- 0.00064	0.23124 +/- 0.18518	0.00072 +/- 0.00175	0.659
Dead Tree	0.01203 +/- 0.00095	-0.00103 +/- 0.00053	0.23898 +/- 0.15416	0.00250 +/- 0.00146	0.406
Derelict Vehicle	0.01608 +/- 0.00125	-0.00157 +/- 0.00070	0.36123 +/- 0.20269	-0.00160 +/- 0.00192	0.416
Dirty Conditions	0.01030 +/- 0.00180	0.00733 +/- 0.00101	0.25905 +/- 0.29163	-0.00255 +/- 0.00276	0.424
Drinking	-0.00001 +/- 0.00011	0.00035 +/- 0.00006	-0.00168 +/- 0.01861	0.00022 +/- 0.00018	0.317
ELECTRIC	-0.00914 +/- 0.00311	0.01813 +/- 0.00174	-1.73971 +/- 0.50491	-0.02353 +/- 0.00477	0.321
Elevator	-0.00347 +/- 0.00101	0.00531 +/- 0.00056	-0.69840 +/- 0.16345	-0.00183 +/- 0.00154	0.309
Food Establishment	0.00030 +/- 0.00068	0.00062 +/- 0.00038	0.15210 +/- 0.11021	0.01081 +/- 0.00104	0.499
Food Poisoning	-0.00005 +/- 0.00033	0.00011 +/- 0.00018	0.01713 +/- 0.05304	0.00498 +/- 0.00050	0.397
For Hire Vehicle Complaint	-0.00034 +/- 0.00025	0.00037 +/- 0.00014	-0.03463 +/- 0.04054	0.00253 +/- 0.00038	0.472
Found Property	-0.00014 +/- 0.00008	-0.00012 +/- 0.00005	0.02156 +/- 0.01362	0.00153 +/- 0.00013	0.46
GENERAL	-0.01290 +/- 0.00275	0.01673 +/- 0.00154	-1.41700 +/- 0.44711	-0.01645 +/- 0.00422	0.403
General Construction/Plumbing	0.00625 +/- 0.00375	0.00391 +/- 0.00210	0.95111 +/- 0.60933	0.01512 +/- 0.00576	0.449
HEAT/HOT WATER	-0.06045 +/- 0.01377	0.07943 +/- 0.00771	-7.39603 +/- 2.23611	-0.07540 +/- 0.02113	0.347
Hazardous Materials	0.00036 +/- 0.00025	0.00036 +/- 0.00014	0.08777 +/- 0.04086	0.00173 +/- 0.00039	0.387
Homeless Encampment	-0.00076 +/- 0.00048	-0.00015 +/- 0.00027	0.12137 +/- 0.07845	0.00798 +/- 0.00074	0.378
Homeless Person Assistance	-0.00073 +/- 0.00027	-0.00003 +/- 0.00015	0.02131 +/- 0.04433	0.00497 +/- 0.00042	0.413
Illegal Parking	0.03036 +/- 0.00415	0.00620 +/- 0.00233	0.69926 +/- 0.67439	0.02595 +/- 0.00637	0.316
Illegal Tree Damage	0.00092 +/- 0.00017	0.00010 +/- 0.00009	0.13024 +/- 0.02731	0.00138 +/- 0.00026	0.389
Indoor Air Quality	-0.00208 +/- 0.00081	0.00172 +/- 0.00045	-0.08008 +/- 0.13140	0.00350 +/- 0.00124	0.429
Lead	-0.00002 +/- 0.00021	0.00086 +/- 0.00012	0.07350 +/- 0.03409	0.00049 +/- 0.00032	0.412
Litter Basket / Request	-0.00018 +/- 0.00021	0.00085 +/- 0.00012	0.11413 +/- 0.03465	0.00092 +/- 0.00033	0.416
Missed Collection (All Materials)	0.01805 +/- 0.00150	-0.00310 +/- 0.00084	0.60806 +/- 0.24305	0.00875 +/- 0.00230	0.406
NONCONST	-0.00348 +/- 0.00093	0.00576 +/- 0.00052	-0.58773 +/- 0.15057	-0.00633 +/- 0.00142	0.36
Noise	-0.00668 +/- 0.00461	0.00017 +/- 0.00258	2.32366 +/- 0.74782	0.11055 +/- 0.00707	0.662
Noise - Commercial	-0.01494 +/- 0.00481	0.01003 +/- 0.00269	1.68352 +/- 0.78110	0.03624 +/- 0.00738	0.37
Noise - Residential	-0.04973 +/- 0.01438	0.10172 +/- 0.00805	-5.11293 +/- 2.33437	-0.09661 +/- 0.02206	0.466
Noise - Vehicle	-0.00529 +/- 0.00160	0.00618 +/- 0.00090	-0.02611 +/- 0.26011	0.00179 +/- 0.00246	0.401

Type of Request	transportation car	transportation public	tranportation motorcycle	Transportation Other means	R2 os
OUTSIDE BUILDING	-0.00030 +/- 0.00013	0.00081 +/- 0.00008	-0.07851 +/- 0.02179	-0.00067 +/- 0.00021	0.346
Other Enforcement	0.00179 +/- 0.00037	0.00080 +/- 0.00021	0.16210 +/- 0.06043	0.00351 +/- 0.00057	0.493
Overgrown Tree/Branches	0.01851 +/- 0.00099	-0.00006 +/- 0.00056	0.04891 +/- 0.16129	-0.00065 +/- 0.00152	0.64
PAINT/PLASTER	-0.03080 +/- 0.00713	0.04275 +/- 0.00399	-4.50888 +/- 1.15767	-0.05115 +/- 0.01094	0.305
PLUMBING	-0.02770 +/- 0.00666	0.03985 +/- 0.00373	-3.98594 +/- 1.08158	-0.04676 +/- 0.01022	0.348
Recycling Enforcement	0.00020 +/- 0.00008	0.00016 +/- 0.00005	0.03837 +/- 0.01314	0.00042 +/- 0.00012	0.344
Rodent	-0.00611 +/- 0.00167	0.00912 +/- 0.00093	0.24412 +/- 0.27067	-0.00310 +/- 0.00256	0.462
Root/Sewer/Sidewalk Condition	0.01082 +/- 0.00061	-0.00090 +/- 0.00034	0.12783 +/- 0.09937	-0.00015 +/- 0.00094	0.641
SAFETY	-0.00280 +/- 0.00073	0.00411 +/- 0.00041	-0.28510 +/- 0.11913	-0.00496 +/- 0.00113	0.31
Sanitation Condition	0.01322 +/- 0.00163	0.00431 +/- 0.00091	0.05930 +/- 0.26428	0.00016 +/- 0.00250	0.344
Sewer	0.02851 +/- 0.00223	-0.00027 +/- 0.00125	-0.11511 +/- 0.36285	0.00609 +/- 0.00343	0.431
Sidewalk Condition	0.00015 +/- 0.00036	0.00035 +/- 0.00020	0.20569 +/- 0.05894	0.00499 +/- 0.00056	0.54
Snow	0.00872 +/- 0.00085	0.00102 +/- 0.00048	0.22672 +/- 0.13802	-0.00061 +/- 0.00130	0.416
Street Condition	0.06179 +/- 0.00538	-0.00370 +/- 0.00301	1.31439 +/- 0.87347	0.05701 +/- 0.00825	0.457
Taxi Complaint	-0.00607 +/- 0.00291	-0.00315 +/- 0.00163	0.65852 +/- 0.47178	0.05382 +/- 0.00446	0.437
UNSANITARY CONDITION	-0.02305 +/- 0.00593	0.03656 +/- 0.00332	-3.24687 +/- 0.96323	-0.04472 +/- 0.00910	0.335
Urinating in Public	-0.00008 +/- 0.00004	0.00011 +/- 0.00002	0.00306 +/- 0.00632	0.00025 +/- 0.00006	0.397
Water Quality	0.00043 +/- 0.00009	0.00016 +/- 0.00005	0.02383 +/- 0.01400	0.00040 +/- 0.00013	0.303
Water System	0.01502 +/- 0.00261	0.00593 +/- 0.00146	-0.43630 +/- 0.42318	0.01199 +/- 0.00400	0.309

Table 16. Coefficients and standard deviations associated with the groups of WORKERS TRANSPORTATION MEAN for types of requests with R2 greater than 0.2

Type of Request	transportation car_n	transportation public_n	tranportation motorcycle_n	Transportation Other means_n	R2 os
Air Quality	-0.01531 +/- 0.00194	0.02791 +/- 0.00390	-0.01990 +/- 0.10139	-0.01601 +/- 0.00292	0.424
Consumer Complaint	-0.01904 +/- 0.00367	0.03911 +/- 0.00741	-0.74134 +/- 0.19242	0.00190 +/- 0.00555	0.317
EAP Inspection - F59	0.00128 +/- 0.00034	-0.00404 +/- 0.00069	0.00345 +/- 0.01800	0.00906 +/- 0.00052	0.666
Fire Alarm - Reinspection	-0.00061 +/- 0.00011	0.00107 +/- 0.00023	0.01264 +/- 0.00601	-0.00088 +/- 0.00017	0.45
Fire Safety Director - F58	0.00160 +/- 0.00148	-0.00741 +/- 0.00299	-0.10834 +/- 0.07765	0.02898 +/- 0.00224	0.622
Food Establishment	-0.00968 +/- 0.00164	0.01646 +/- 0.00330	0.11975 +/- 0.08586	-0.01073 +/- 0.00248	0.52

Type of Request	transportation car_n	transportation public_n	tranportation motorcycle_n	Transportation Other means_n	R2 os
Food Poisoning	-0.00402 +/- 0.00060	0.00624 +/- 0.00122	0.05359 +/- 0.03167	-0.00293 +/- 0.00091	0.534
For Hire Vehicle Complaint	-0.00317 +/- 0.00049	0.00587 +/- 0.00099	-0.11261 +/- 0.02562	0.00138 +/- 0.00074	0.45
Found Property	-0.00096 +/- 0.00016	0.00138 +/- 0.00032	0.00007 +/- 0.00826	0.00013 +/- 0.00024	0.61
General Construction/Plumbing	-0.02245 +/- 0.01140	0.04109 +/- 0.02300	0.51563 +/- 0.59744	-0.04500 +/- 0.01724	0.375
Hazardous Materials	-0.00332 +/- 0.00076	0.00635 +/- 0.00152	-0.02393 +/- 0.03957	-0.00337 +/- 0.00114	0.338
Homeless Person Assistance	-0.00418 +/- 0.00063	0.00619 +/- 0.00126	0.05103 +/- 0.03277	-0.00250 +/- 0.00095	0.356
Indoor Air Quality	-0.01021 +/- 0.00252	0.01838 +/- 0.00509	-0.17341 +/- 0.13217	-0.00463 +/- 0.00381	0.311
Litter Basket / Request	-0.00480 +/- 0.00071	0.00827 +/- 0.00144	0.03605 +/- 0.03739	-0.00605 +/- 0.00108	0.318
Other Enforcement	-0.00535 +/- 0.00125	0.01076 +/- 0.00253	0.03622 +/- 0.06571	-0.00953 +/- 0.00190	0.303
Sidewalk Condition	-0.00568 +/- 0.00104	0.01095 +/- 0.00210	0.05043 +/- 0.05444	-0.00905 +/- 0.00157	0.44
Taxi Complaint	-0.03643 +/- 0.00444	0.05221 +/- 0.00895	0.08974 +/- 0.23244	0.00131 +/- 0.00671	0.704
Taxi Report	-0.00086 +/- 0.00013	0.00109 +/- 0.00026	-0.01775 +/- 0.00688	0.00136 +/- 0.00020	0.677

Table 17. Coefficients and standard deviations associated with the groups of RESIDENTS LIVING IN FAMILY HOUSEHOLDS VS NON-FAMILY HOUSEHOLDS for types of requests with R2 greater than 0.2

Type of Request	family households	nonfamily households	R2 os
Air Quality	-0.00184 +/- 0.00048	0.00721 +/- 0.00041	0.619
Animal Abuse	0.00363 +/- 0.00048	0.00046 +/- 0.00040	0.351
Asbestos	-0.00006 +/- 0.00015	0.00184 +/- 0.00013	0.495
Bike/Roller/Skate Chronic	-0.00033 +/- 0.00005	0.00068 +/- 0.00004	0.512
Blocked Driveway	0.06697 +/- 0.00481	-0.02912 +/- 0.00407	0.405
Dirty Conditions	0.01377 +/- 0.00146	0.00048 +/- 0.00123	0.395
Electrical	0.00148 +/- 0.00048	0.00069 +/- 0.00041	0.301
Food Establishment	-0.00097 +/- 0.00055	0.00618 +/- 0.00046	0.517
Food Poisoning	-0.00077 +/- 0.00026	0.00272 +/- 0.00022	0.403
For Hire Vehicle Complaint	-0.00001 +/- 0.00021	0.00138 +/- 0.00018	0.373
Found Property	-0.00047 +/- 0.00007	0.00081 +/- 0.00006	0.513
General Construction/Plumbing	0.00704 +/- 0.00300	0.00796 +/- 0.00254	0.443
Hazardous Materials	0.00016 +/- 0.00019	0.00137 +/- 0.00016	0.466
Homeless Encampment	-0.00209 +/- 0.00037	0.00473 +/- 0.00031	0.425
Homeless Person Assistance	-0.00137 +/- 0.00021	0.00292 +/- 0.00018	0.393
Indoor Air Quality	-0.00081 +/- 0.00063	0.00414 +/- 0.00053	0.527
Lead	0.00048 +/- 0.00016	0.00130 +/- 0.00014	0.502
Litter Basket / Request	0.00050 +/- 0.00018	0.00145 +/- 0.00015	0.387

Type of Request	family households	nonfamily households	R2 os
Noise	-0.02435 +/- 0.00368	0.06577 +/- 0.00311	0.679
Noise - Residential	0.09340 +/- 0.01285	0.02204 +/- 0.01087	0.321
Noise - Vehicle	0.00277 +/- 0.00136	0.00632 +/- 0.00115	0.314
Other Enforcement	0.00154 +/- 0.00032	0.00181 +/- 0.00027	0.462
Recycling Enforcement	0.00029 +/- 0.00007	0.00027 +/- 0.00006	0.332
Rodent	0.00711 +/- 0.00141	0.00718 +/- 0.00119	0.352
Sidewalk Condition	-0.00026 +/- 0.00030	0.00313 +/- 0.00025	0.516
Taxi Complaint	-0.01620 +/- 0.00231	0.02948 +/- 0.00195	0.579
Taxi Report	-0.00050 +/- 0.00009	0.00085 +/- 0.00008	0.376
Urinating in Public	0.00002 +/- 0.00003	0.00024 +/- 0.00003	0.385
Water Quality	0.00024 +/- 0.00007	0.00038 +/- 0.00006	0.35

Table 18. Coefficients and standard deviations associated with the groups of WORKERS LIVING IN FAMILY HOUSEHOLDS VS NON-FAMILY HOUSEHOLDS for types of requests with R2 greater than 0.2

Type of Request	family households_n	nonfamily households_n	R2 os
Broken Muni Meter	-0.00306 +/- 0.00326	0.00899 +/- 0.00470	0.333
EAP Inspection - F59	-0.00096 +/- 0.00008	0.00215 +/- 0.00011	0.49
Fire Alarm - Reinspection	-0.00001 +/- 0.00003	0.00009 +/- 0.00004	0.404
Fire Safety Director - F58	-0.00307 +/- 0.00030	0.00705 +/- 0.00044	0.655
Food Establishment	-0.00041 +/- 0.00038	0.00143 +/- 0.00055	0.375
Food Poisoning	-0.00045 +/- 0.00014	0.00106 +/- 0.00021	0.426
For Hire Vehicle Complaint	-0.00018 +/- 0.00011	0.00054 +/- 0.00015	0.376
Found Property	-0.00019 +/- 0.00003	0.00038 +/- 0.00005	0.598
Homeless Encampment	-0.00113 +/- 0.00031	0.00207 +/- 0.00045	0.375
Homeless Person Assistance	-0.00062 +/- 0.00015	0.00124 +/- 0.00021	0.437
Panhandling	-0.00004 +/- 0.00001	0.00009 +/- 0.00002	0.316
Taxi Complaint	-0.00729 +/- 0.00103	0.01464 +/- 0.00149	0.667
Taxi Report	-0.00028 +/- 0.00003	0.00055 +/- 0.00004	0.706

ANNEX 2

Coefficients and standard deviations associated with the neighborhood characteristics for types of requests with R2 greater than 0.2

Table 19. Coefficients and standard deviations associated with the neighborhood characteristic for types of requests with R2 greater than 0.2

Type of Request	Median House Value	Median Age	Median Rent	Median Income	Cars per capita	Building Density	Proportion of Commercial area	Proportion of retail area	Proportion of Office area	Proportion of Residential area	Inbound Commute Density	Population Density	Proportion of Tenants	const	R2 os
Lead	8.5e-07+/-3.6e-07	-0.013 +/- 0.011	-0.000 +/- 0.000	5.08e-06+/-4.17e-06	-0.123 +/- 0.404	1.784 +/- 0.631	0.883 +/- 1.114	-3.255 +/- 1.777	-2.939 +/- 0.919	0.550 +/- 1.045	4.6e-07+/-6.4e-07	-0.000 +/- 0.000	0.578 +/- 0.732	-1.212 +/- 1.577	0.144
New Tree Request	3.49e-06+/-4.6e-07	-0.006 +/- 0.014	0.000 +/- 0.000	-0.000 +/- 0.000	-0.511 +/- 0.457	0.921 +/- 0.765	3.183 +/- 1.445	0.646 +/- 2.252	-1.417 +/- 1.169	3.301 +/- 1.367	5.1e-07+/-8.2e-07	-0.000 +/- 0.000	-2.563 +/- 0.865	-2.444 +/- 2.022	0.282
Other Enforcement	1.8e-06+/-3.3e-07	-0.042 +/- 0.010	-0.000 +/- 0.000	6.3e-07+/-3.65e-06	-0.603 +/- 0.320	0.117 +/- 0.537	-3.219 +/- 1.013	6.561 +/- 1.586	0.028 +/- 0.820	-2.428 +/- 0.959	-3e-08+/-5.8e-07	-7.75e-06+/-2.66e-06	-1.590 +/- 0.612	4.771 +/- 1.421	0.167
General Construction/Plumbing	1.65e-06+/-3.4e-07	-0.014 +/- 0.010	-0.000 +/- 0.000	-4.27e-06+/-3.78e-06	0.273 +/- 0.323	1.318 +/- 0.526	-0.557 +/- 1.050	3.938 +/- 1.649	-0.245 +/- 0.812	-0.368 +/- 0.998	-2e-07+/-6e-07	-4.68e-06+/-2.74e-06	-0.165 +/- 0.629	-0.502 +/- 1.440	0.117
Graffiti	1.48e-06+/-5e-07	-0.045 +/- 0.015	0.001 +/- 0.000	-0.000 +/- 0.000	-0.290 +/- 0.478	1.603 +/- 0.779	0.954 +/- 1.553	9.799 +/- 2.438	-1.810 +/- 1.201	0.621 +/- 1.476	-5.9e-07+/-8.8e-07	-0.000 +/- 0.000	-1.070 +/- 0.930	0.119 +/- 2.130	0.137
Taxi Complaint	1.3e-07+/-4.9e-07	0.000 +/- 0.014	0.000 +/- 0.000	0.000 +/- 0.000	-0.491 +/- 0.474	0.587 +/- 0.773	0.486 +/- 1.510	3.806 +/- 2.454	-3.327 +/- 1.170	-1.338 +/- 1.428	-9e-07+/-8.5e-07	4.35e-06+/-3.95e-06	0.484 +/- 0.912	-1.738 +/- 2.075	0.234

Type of Request	Median House Value	Median Age	Median Rent	Median Income	Cars per capita	Building Density	Proportion of Commercial area	Proportion of retail area	Proportion of Office area	Proportion of Residential area	Inbound Commute Density	Population Density	Proportion of Tenants	const	R2 os
HEAT/HOT WATER	0	0	0	0	0	0	0	0	0	0	0	0.000 +/- 0.000	0	-1.075 +/- 0.091	0.152
Noise	1.03e-06+/- 2.4e-07	0	0	6.8e-07+/- 1.68e-06	0	0	0	0	0	0	6.7e-07+/- 3.2e-07	0	0	-0.904 +/- 0.112	0.149
Construction	0	0	0	0	1.576 +/- 0.303	0	0	0	-3.225 +/- 3.348	0	-2.2e-06+/- 3.12e-06	0	0	-1.884 +/- 0.299	0.189
HEATING	0	0	0	0	0	0	0	0	0	0	0	0.000 +/- 0.000	0	-0.950 +/- 0.089	0.147
Sidewalk Condition	1.64e-06+/- 3.6e-07	-0.016 +/- 0.011	-0.000 +/- 0.000	7.1e-06+/- 4.03e-06	-0.508 +/- 0.343	1.007 +/- 0.558	-0.787 +/- 1.113	2.581 +/- 1.754	-0.466 +/- 0.862	-1.073 +/- 1.059	-1.28e-06+/- 6.3e-07	-5.04e-06+/- 2.94e-06	-1.062 +/- 0.673	1.353 +/- 1.530	0.133
Dead Tree	2.42e-06+/-4e-07	-0.008 +/- 0.012	0.000 +/- 0.000	-7.42e-06+/- 4.48e-06	0.780 +/- 0.383	-0.594 +/- 0.624	2.123 +/- 1.244	-2.442 +/- 1.953	-1.502 +/- 0.962	1.971 +/- 1.182	1.4e-07+/- 7.1e-07	2.34e-06+/- 3.24e-06	0.600 +/- 0.745	-3.586 +/- 1.706	0.118
Street Condition	9.6e-07+/- 2.5e-07	-0.021 +/- 0.007	-0.000 +/- 0.000	3.44e-06+/- 2.82e-06	-0.066 +/- 0.241	-0.367 +/- 0.393	-0.767 +/- 0.783	2.157 +/- 1.230	0.429 +/- 0.606	-1.477 +/- 0.744	-1.5e-07+/- 4.4e-07	-3.48e-06+/- 2.04e-06	-0.748 +/- 0.469	2.500 +/- 1.074	0.236
Snow	9e-07+/- 3.1e-07	-0.029 +/- 0.009	-0.000 +/- 0.000	1.54e-06+/- 3.5e-06	0.417 +/- 0.299	0.337 +/- 0.487	-0.646 +/- 0.970	1.311 +/- 1.524	-1.142 +/- 0.751	-0.297 +/- 0.923	4.5e-07+/- 5.5e-07	-9.06e-06+/- 2.53e-06	0.372 +/- 0.581	0.568 +/- 1.331	0.151

Type of Request	Median House Value	Median Age	Median Rent	Median Income	Cars per capita	Building Density	Proportion of Commercial area	Proportion of retail area	Proportion of Office area	Proportion of Residential area	Inbound Commute Density	Population Density	Proportion of Tenants	const	R2 os
Indoor Air Quality	0	0	0	0	0	0	0	0	0	0	9.4e-07+/-4.1e-07	0.000 +/- 0.000	0	-0.960 +/- 0.088	0.199
Food Establishment	1.25e-06+/-4e-07	0.026 +/- 0.012	0.000 +/- 0.000	5e-08+/- 4.44e-06	0.271 +/- 0.380	0.476 +/- 0.618	-1.782 +/- 1.233	8.681 +/- 1.936	0.381 +/- 0.954	-2.228 +/- 1.172	-1.62e-06+/-7e-07	2.06e-06+/- 3.21e-06	0.915 +/- 0.738	-1.347 +/- 1.690	0.284
Root/Sewer/Sidewalk Condition	2.15e-06+/- 4.5e-07	-0.010 +/- 0.014	0.001 +/- 0.000	-0.000 +/- 0.000	1.359 +/- 0.432	2.583 +/- 0.740	2.802 +/- 1.357	4.507 +/- 2.154	-3.595 +/- 1.119	2.755 +/- 1.282	-2.8e-07+/- 7.8e-07	-0.000 +/- 0.000	0.175 +/- 0.819	-5.201 +/- 1.934	0.264
Air Quality	1.37e-06+/- 4.2e-07	-0.010 +/- 0.013	0.000 +/- 0.000	3.92e-06+/- 4.74e-06	-0.743 +/- 0.416	-0.753 +/- 0.697	-1.334 +/- 1.315	3.629 +/- 2.059	-1.135 +/- 1.065	-1.920 +/- 1.245	-6e-07+/- 7.5e-07	3.06e-06+/- 3.45e-06	-0.573 +/- 0.794	1.433 +/- 1.845	0.133
Overgrown Tree/Branches	1.74e-06+/- 3.7e-07	-0.051 +/- 0.011	0.001 +/- 0.000	-0.000 +/- 0.000	0.318 +/- 0.353	0.733 +/- 0.575	1.325 +/- 1.146	3.617 +/- 1.807	-2.263 +/- 0.888	1.974 +/- 1.091	-5.2e-07+/- 6.5e-07	-0.000 +/- 0.000	-0.666 +/- 0.693	-1.064 +/- 1.576	0.247
Blocked Driveway	5.4e-07+/- 4.1e-07	-0.025 +/- 0.012	0.002 +/- 0.000	-0.000 +/- 0.000	-0.384 +/- 0.396	1.656 +/- 0.638	-0.353 +/- 1.271	3.671 +/- 2.004	0.010 +/- 0.984	0.761 +/- 1.210	-5.1e-07+/- 8.2e-07	-0.000 +/- 0.000	-1.066 +/- 0.773	-0.503 +/- 1.754	0.193
Damaged Tree	2.01e-06+/- 3.3e-07	-0.036 +/- 0.010	0.001 +/- 0.000	-0.000 +/- 0.000	-0.001 +/- 0.309	-0.234 +/- 0.504	1.457 +/- 1.004	1.473 +/- 1.583	-2.002 +/- 0.778	1.843 +/- 0.955	3.2e-07+/- 5.7e-07	-8.93e-06+/- 2.65e-06	-1.157 +/- 0.607	-0.557 +/- 1.380	0.25
Illegal Tree Damage	1.58e-06+/- 3.9e-07	-0.011 +/- 0.011	0.001 +/- 0.000	-7.79e-06+/- 4.2e-06	0.303 +/- 0.355	-0.233 +/- 0.581	-0.165 +/- 1.142	7.565 +/- 2.041	-1.339 +/- 0.888	-0.031 +/- 1.083	6.5e-07+/- 6.5e-07	-1.08e-06+/- 3.05e-06	-0.213 +/- 0.700	-1.009 +/- 1.572	0.121

ANNEX 3

Visual representation of results obtained in step number 1 for selected types of complaints

Figure 1. Coefficients for selected complaint types by resident age category

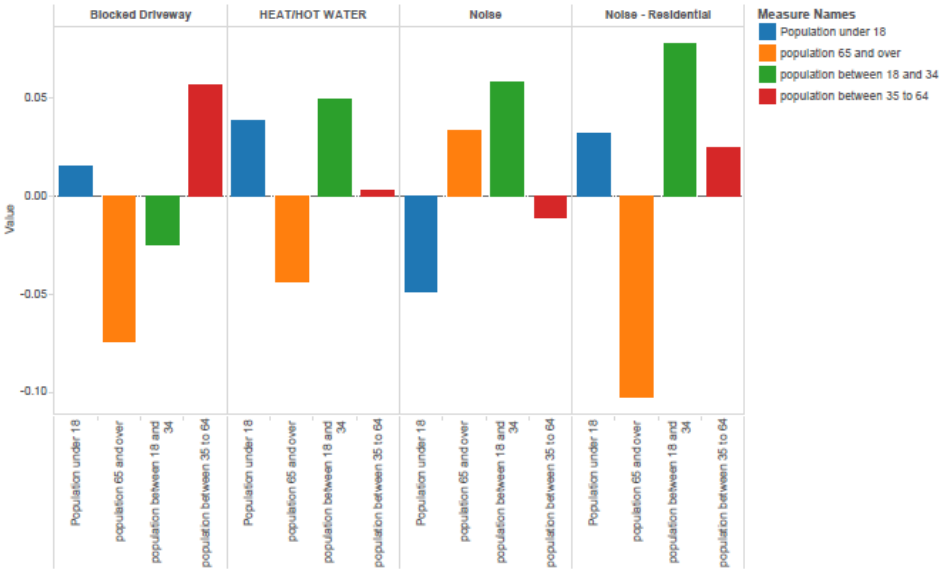


Figure 2. Coefficients for selected complaint types by workers age category

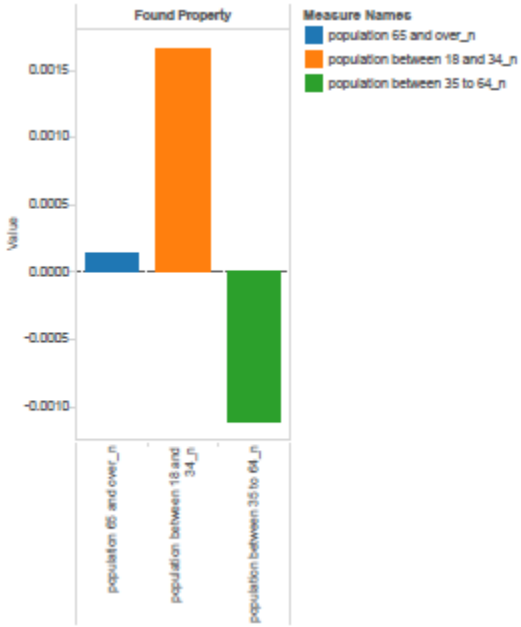


Figure 3. Coefficients for selected complaint types by resident Race type

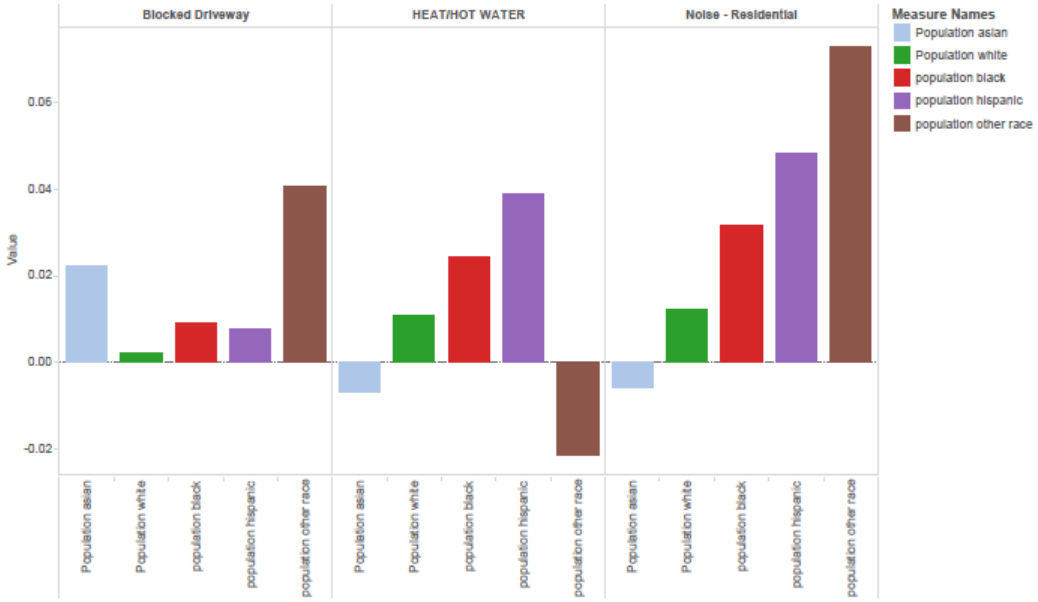


Figure 4. Coefficients for selected complaint types by resident education level

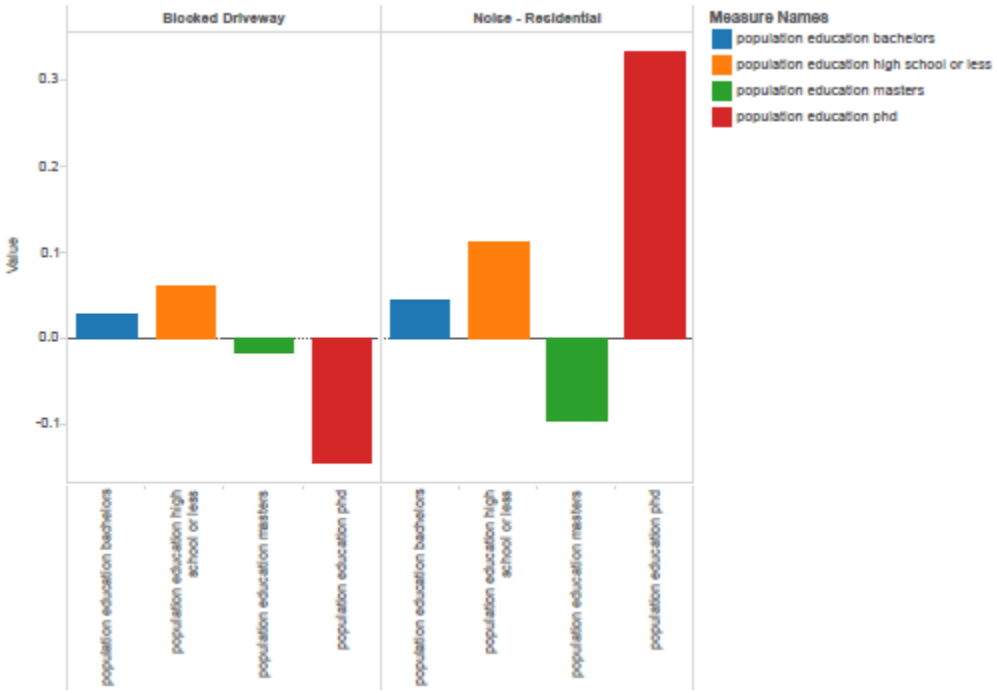


Figure 5. Coefficients for selected complaint types by worker education level

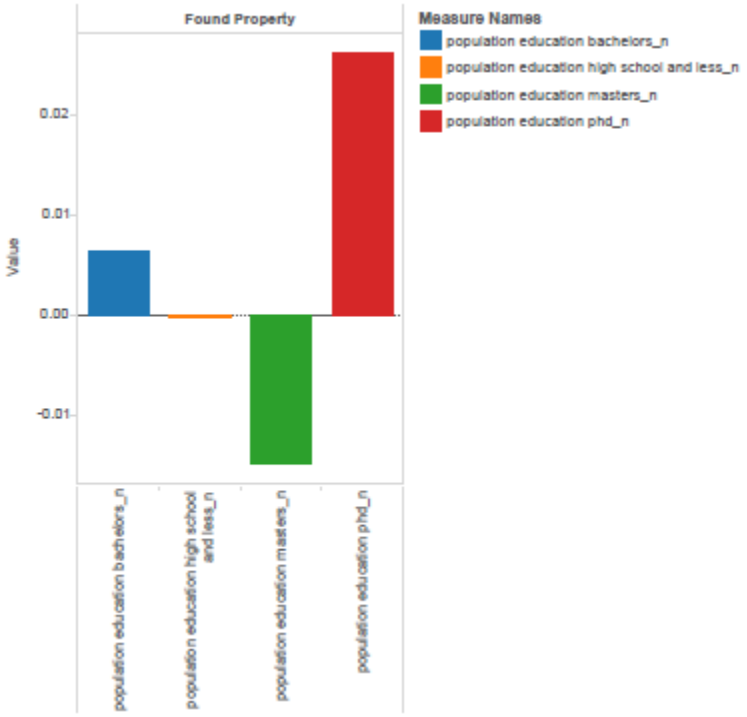


Figure 6. Coefficients for selected complaint types by resident household income level

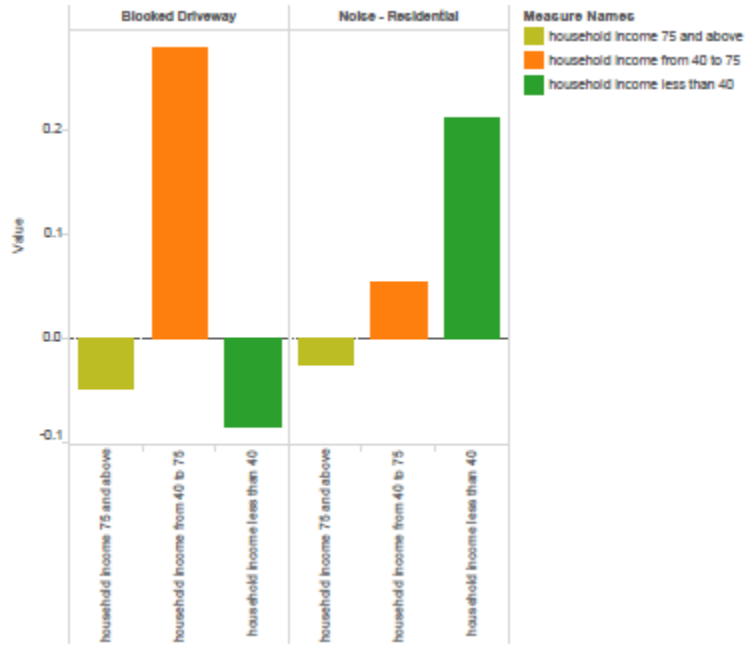


Figure 7. Coefficients for selected complaint types by worker household income level

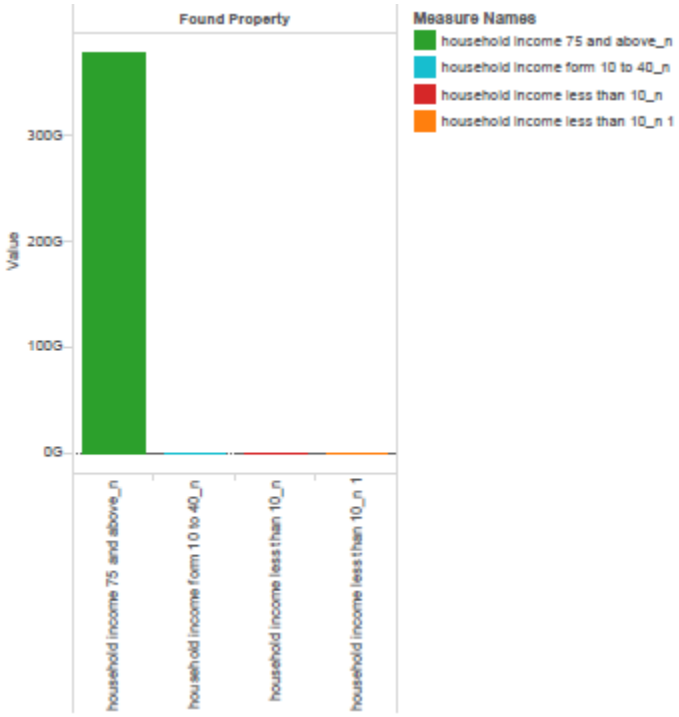


Figure 8. Coefficients for selected complaint types by resident Owner or renter

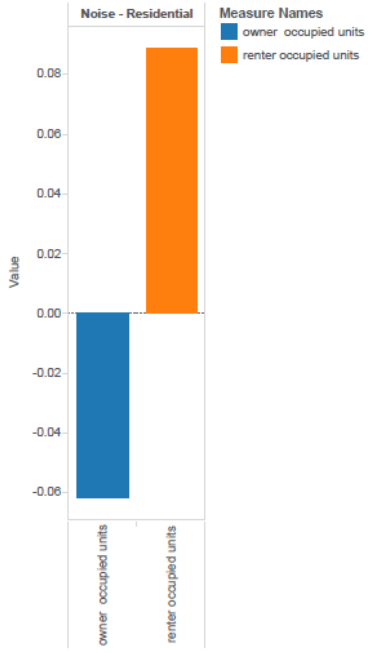


Figure 9. Coefficients for selected complaint types by worker Owner or renter

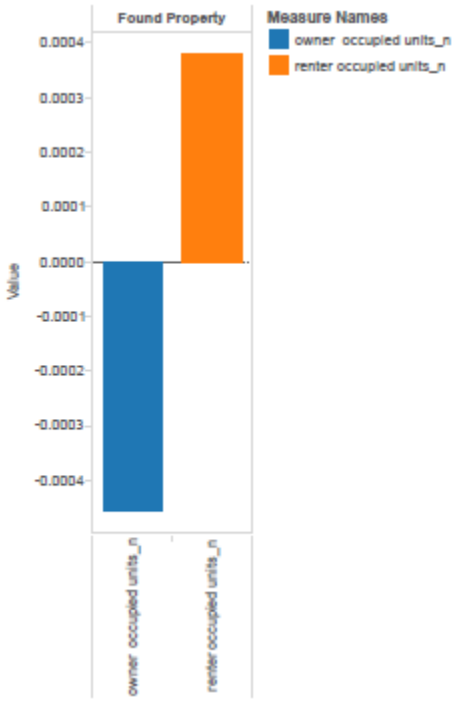


Figure 10. Coefficients for selected complaint types by resident rent by price

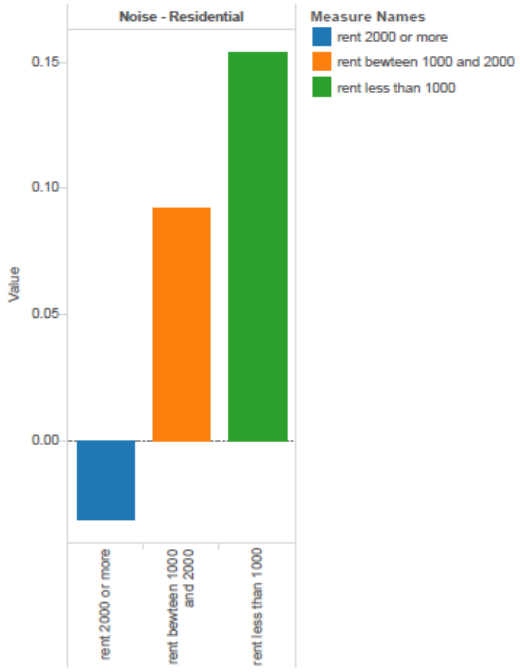


Figure 11. Coefficients for selected complaint types by worker rent by price

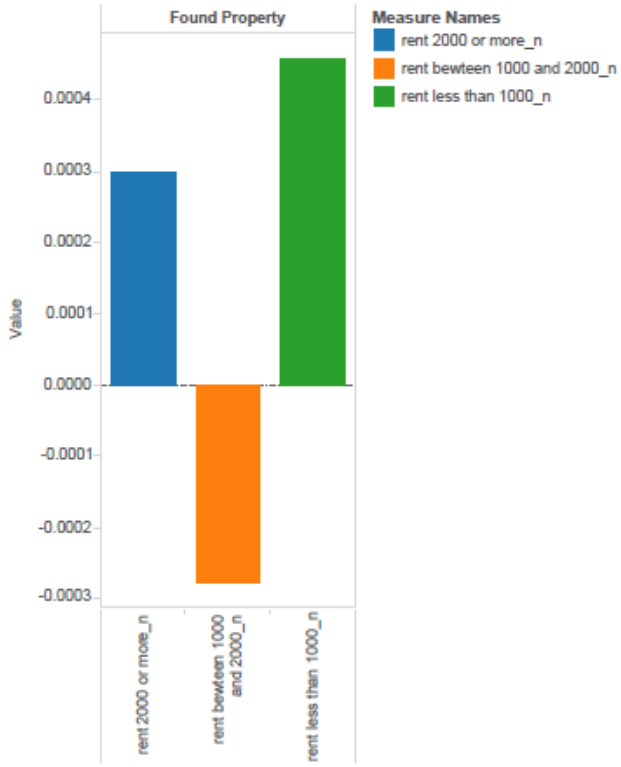


Figure 12. Coefficients for selected complaint types by resident transportation method

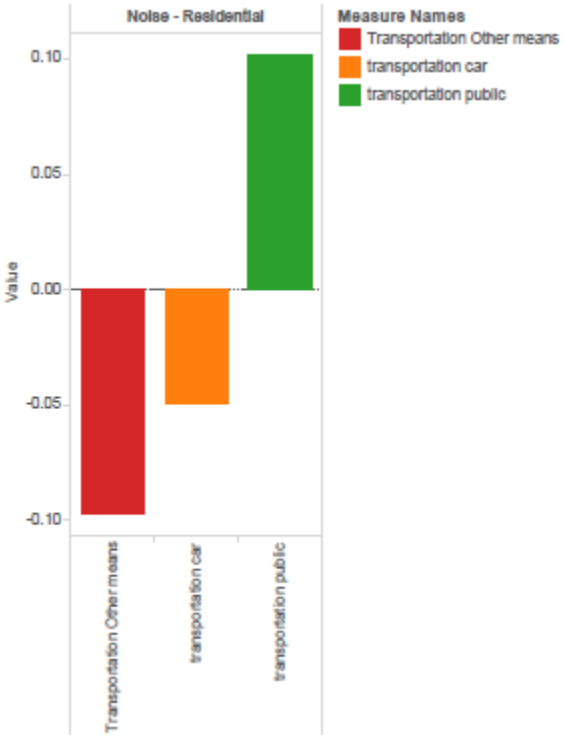


Figure 13. Coefficients for selected complaint types by worker transportation method

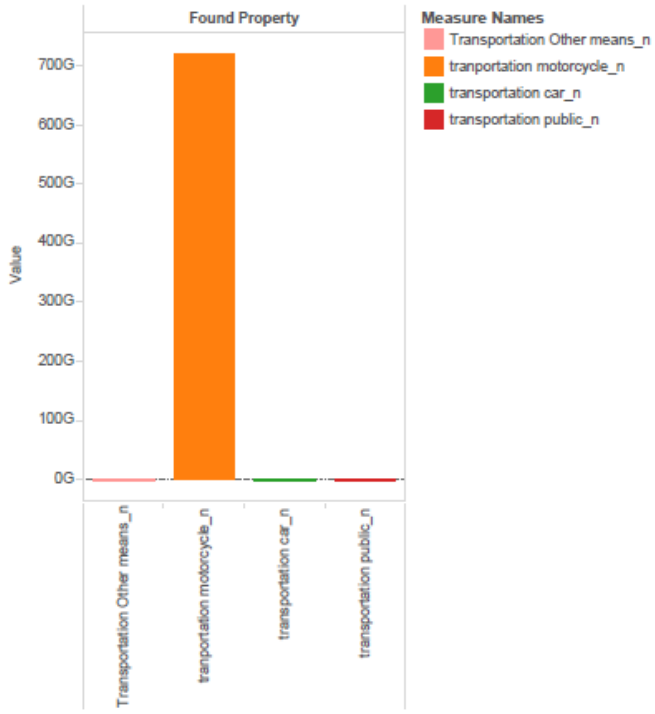


Figure 14. Coefficients for selected complaint types by resident type of household

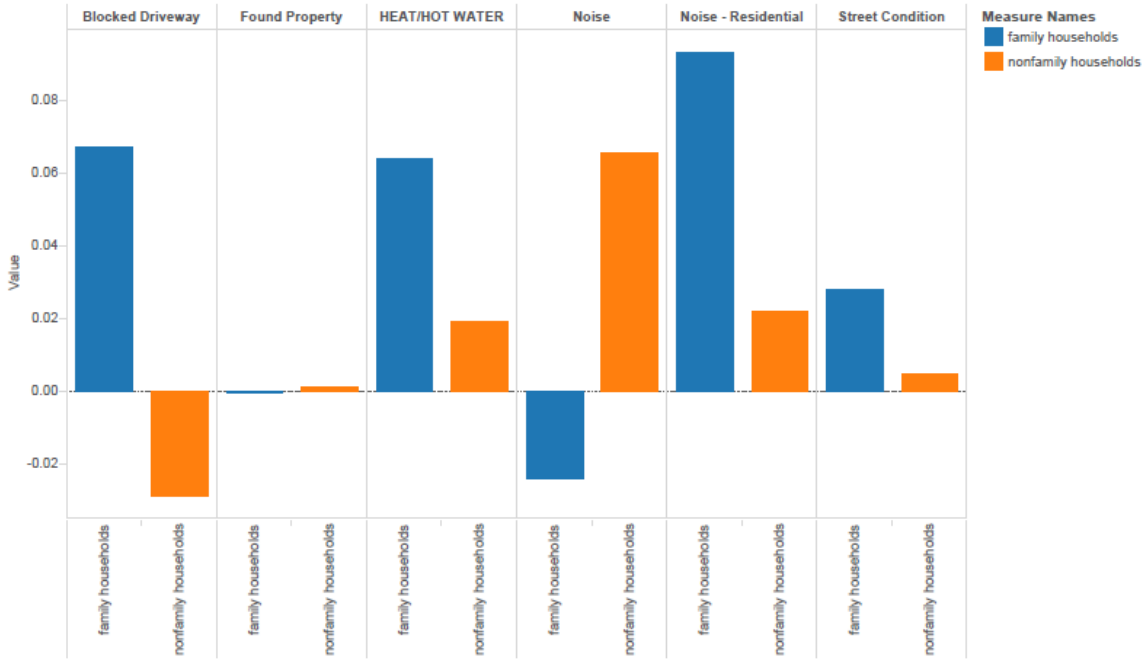
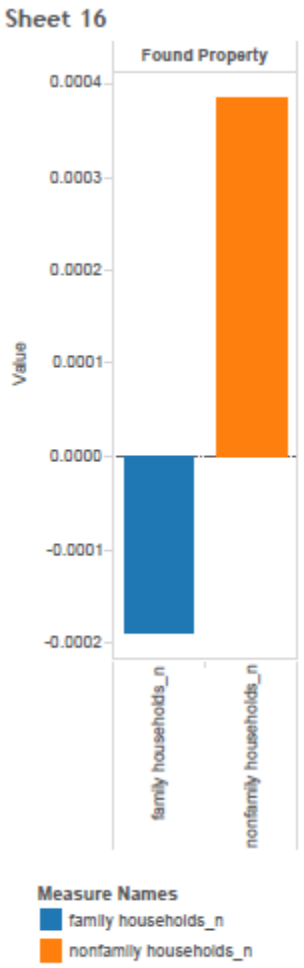


Figure 15. Coefficients for selected complaint types by worker type of household



Annex 4
Distribution of the error between the observed number of requests and the number of requests explained by the demographic variables