Fall 2022 Councilor Mejia x City Services Project
Team 4 - Final report

Date: Dec 13th, 2022
Team Members: Yi Xiang, Yichen Wang, Di Kang, Dongyue Xu
Link to our team 4 github repo:
https://github.com/xdy1019/ds-councilor-mejia-city-services/tree/dev/fall22-team-4

- **Background + Motivation:**

The city allocates money to various funds designed to offer relief and support to benefit residents and businesses in Boston. Councilor Mejia wants to understand whether these benefits are being distributed equitably and if the money the city said they were going to spend has reached and impacted the people they said it would serve during the pandemic.

The goal is to assess whether the money is going and if it is being equitably distributed to each neighborhood.

- **Previous work:**

Previously for deliverable 4, we focused on answering the base project's 3 questions.

We've worked on the business licenses datasets among 3 categories(food, liquor and consumer affairs/others) and the business assistance fund dataset. We analyzed the number of licenses of each category in each neighborhood, plot geographic maps and heatmaps to visualize the statistics, and we also analyzed the number of business funds received from each neighborhood. We then compare between funds given to businesses with food/liquor/consumers license with the corresponding license distribution across the neighborhoods. Through the comparisons, we arrived at the conclusion of which neighborhood's funds are not distributed as needed during the pandemic.

We've also worked on the rental assistance funds datasets and analyzed the statistics of the rental assistance funds to applicants in each neighborhood. Compared with the demographic profiles and income level of those applicants in each neighborhood, we arrived at the conclusions of which neighborhoods are not given enough rental assistance funds during the pandemic.

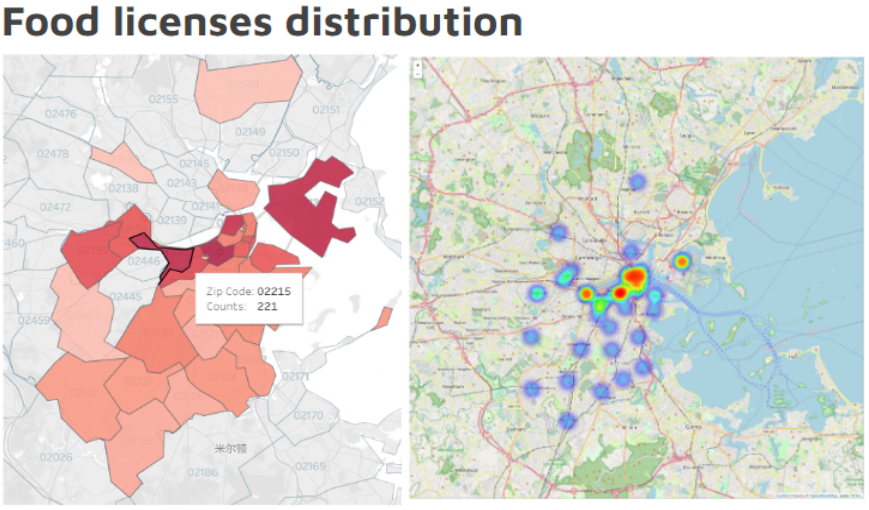
- **Data collection**:

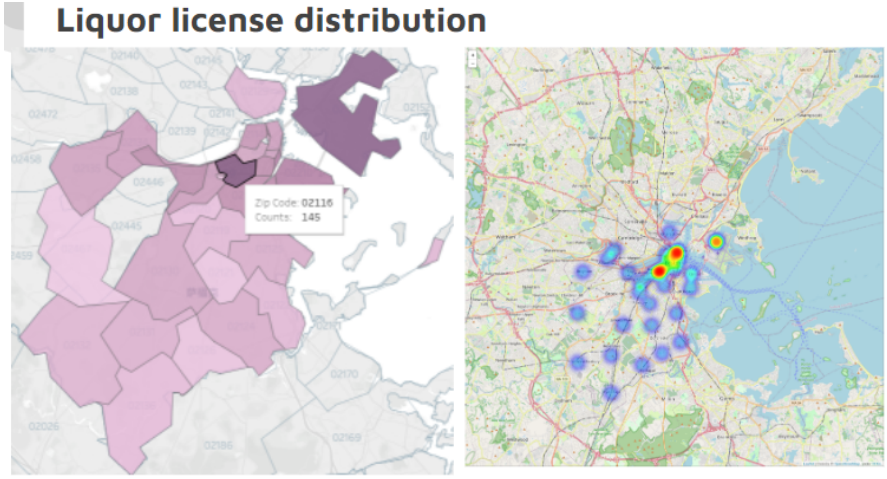
We use the following data that's given in the project drive:

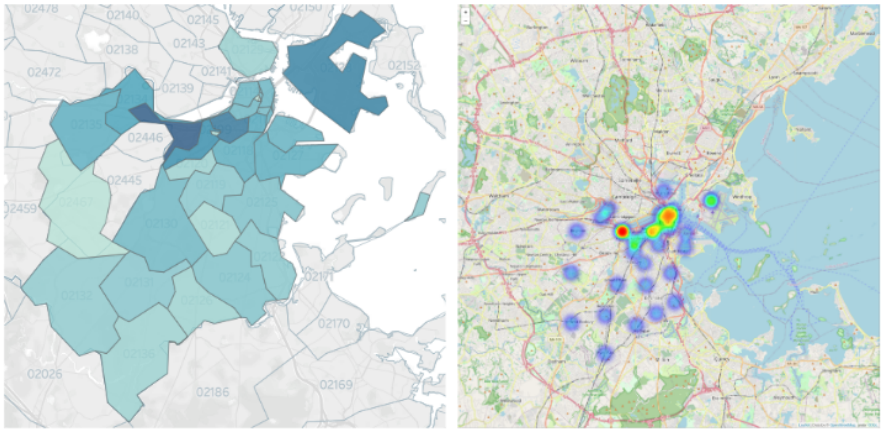
  - Small Business Relief Fund 2.0
  - Business Licenses data:
    - Food, Liquor, Consumer Affairs and other
  - 17F_Request-RRF_funds
  - Census Data: Demographic Info:
    - Boston-neighborhood-data

- **Data visualization and exploration:**

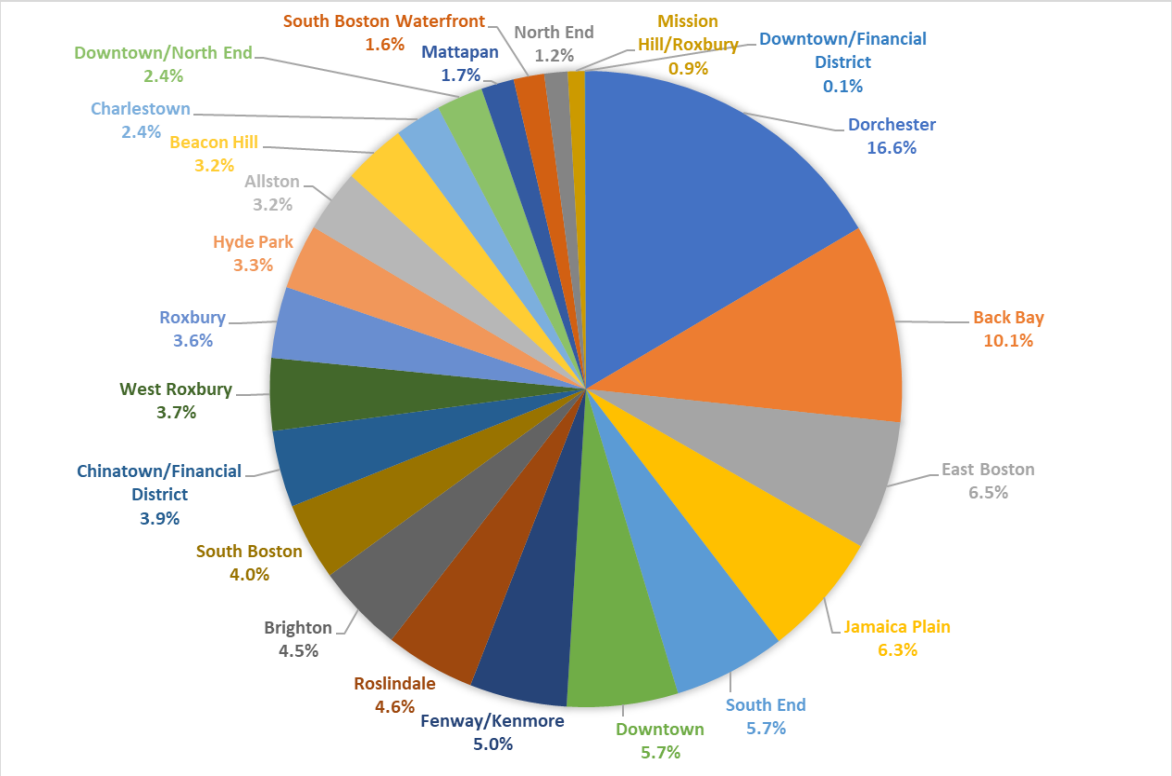
<u>Part 1: business funds/ licenses & demographics:</u>



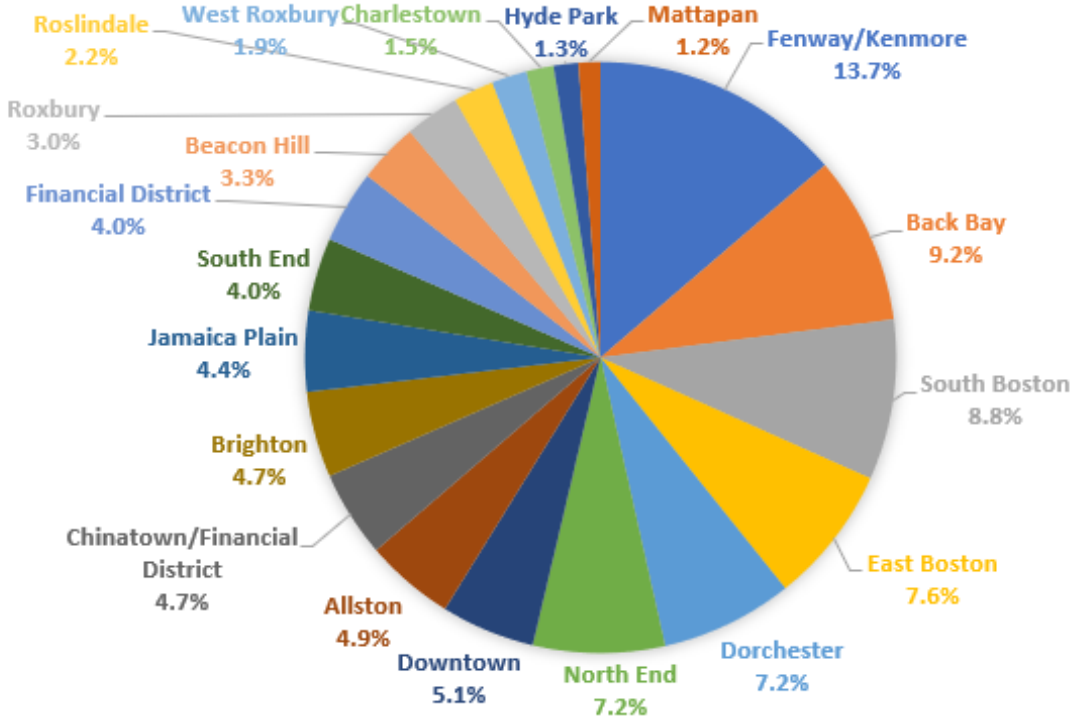




Overall Percentage of the Total Number of business funds in Each Neighborhood:



Overall Percentage of the Total Number of business licenses of all categories in Each Neighborhood:



Ethnicity ratio of the top 5 neighborhoods of business licenses:

Fenway/Kenmore

white: 54.21% black: 6.35% hispanic or latino: 9.65%
asian: 24.43% other or multiple: 5.35

Back_Bay

white: 71.76% black: 3.67% hispanic or latino: 6.77%
asian: 13.29% other or multiple: 4.51%

South Boston

white: 76.85% black: 4.03% hispanic or latino: 10.25%
asian: 5.48% other or multiple: 3.39%

East Boston

white: 71.76% black: 3.67% hispanic or latino: 6.77%
asian: 13.29% other or multiple: 4.51%

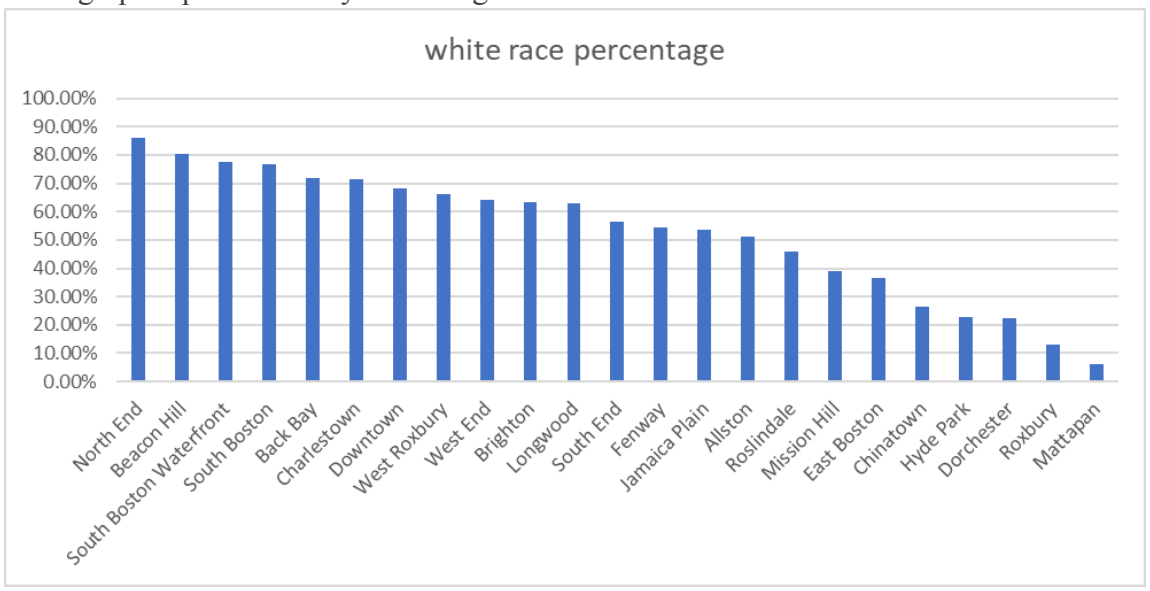
Dorchester

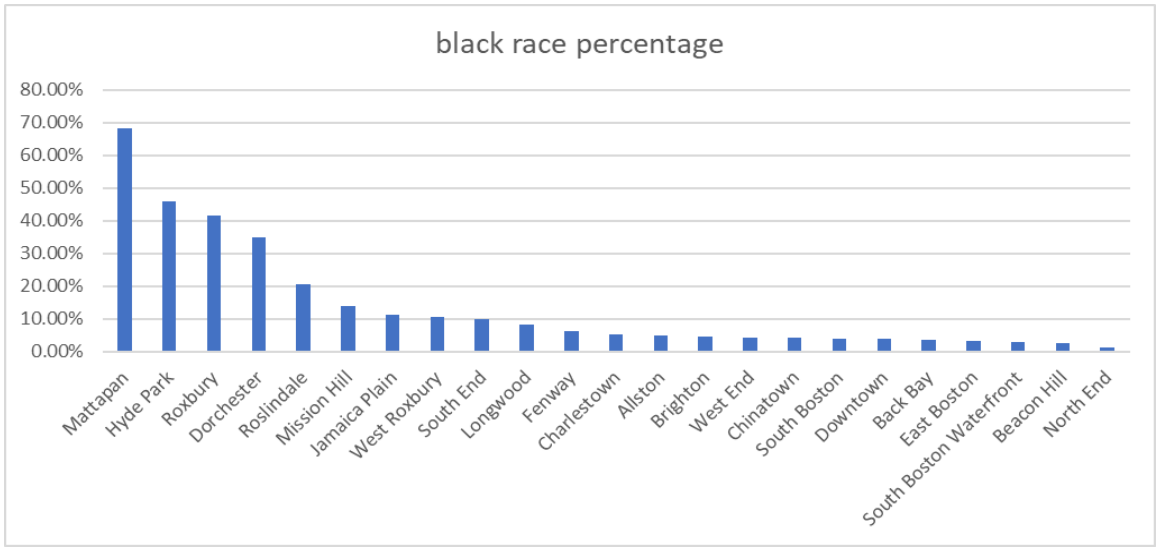
white: 22.43% black: 34.96% hispanic or latino: 20.69%
asian: 10.93% other or multiple: 10.98%

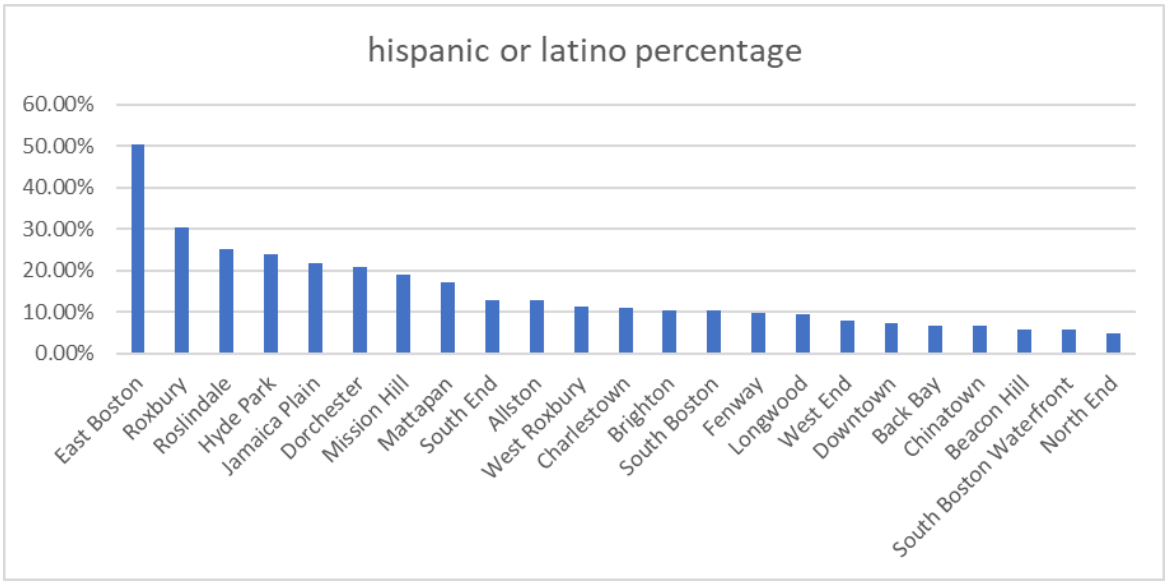
Ethnicity ratio of the top 5 neighborhoods of business funds received:

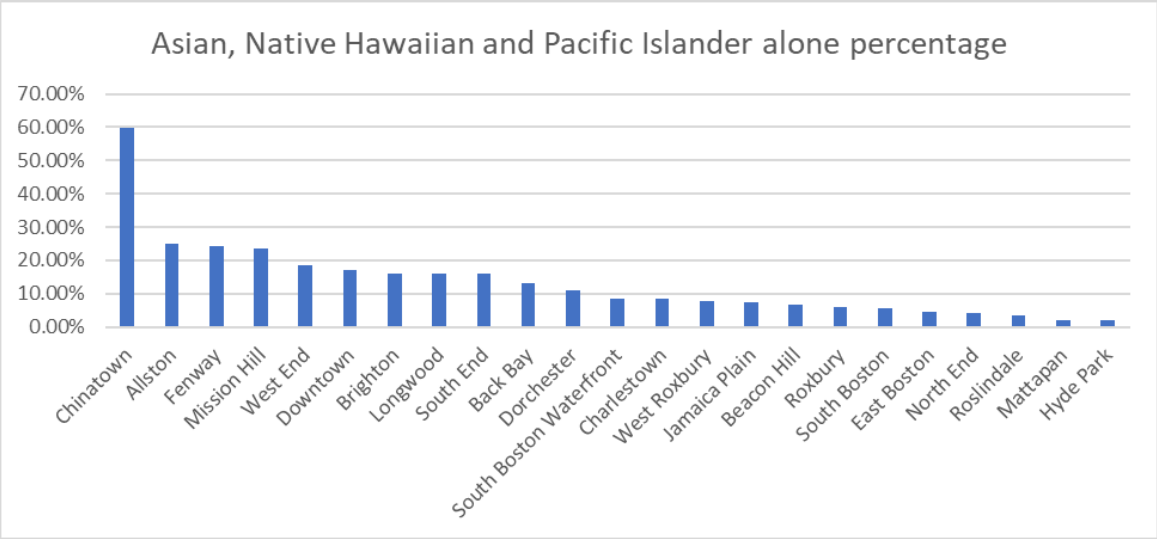
Dorchester
Back_Bay
East Boston
Jamaica Plain
white: 53.72% black: 11.43%
hispanic or latino: 21.75%
asian: 7.28% other or multiple: 5.82%
South End
white: 56.58% black: 10.07%
hispanic or latino: 12.88%
asian: 15.92% other or multiple: 4.55%

Demographic profiles analysis of neighborhoods:



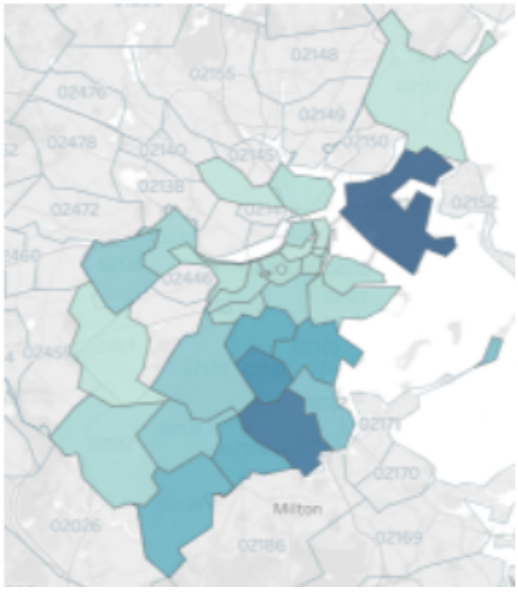






Part 2: Rental Assistance(RRF):

Total amount of rental assistance in each zip code (individual):



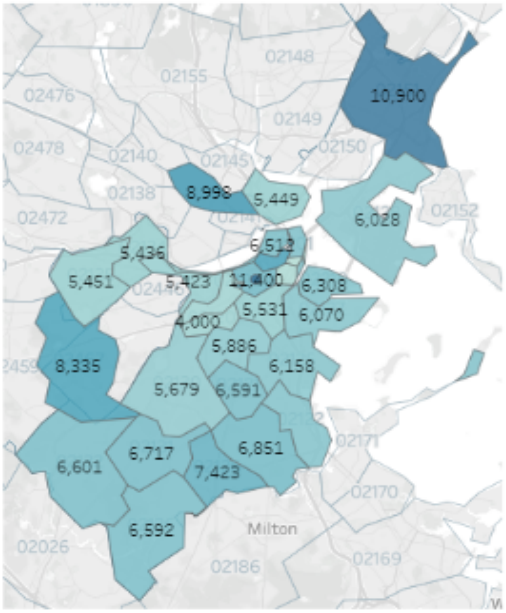
Top 5 neighborhoods of most total amount of rental assistance:

Dorchester	11566826.67
East Boston	4955249.44
Roxbury	2750995.58
Mattapan	2226937.41
Hyde Park	1977620.6

Bottom 5:

Fenway/Kenmore	287436.14
Charlestown	234290.97
North End	210123.37
Beacon Hill	92245.62
Financial District|Downtown	17339.34

Average amount of rental assistance in each zip code/neighborhood (individual):



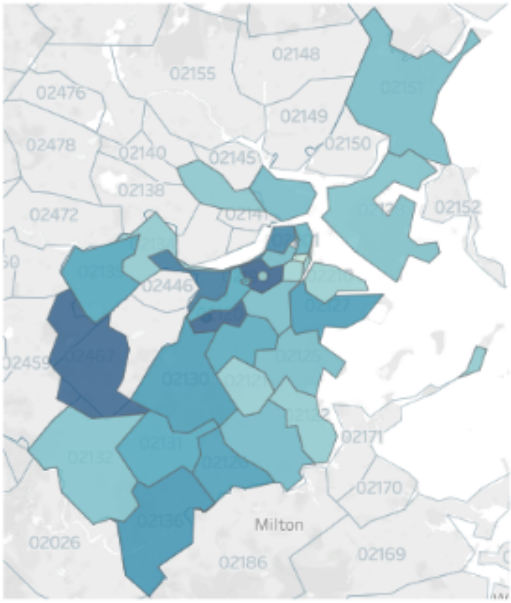
Top 5 neighborhoods of most average amount of rental assistance excluding outliers:

Beacon Hill	8385.965
Mattapan	7423.12
Roslindale	6717.128
West Roxbury	6601.008
Hyde Park	6592.069

Bottom 5:

Charlestown	5448.627
Allston	5436.277
Fenway/Kenmore	5423.323
Chinatown	4587.124
Financial District|Downtown	4334.835

Average income of applicant of RRF in each zip code/neighborhood:



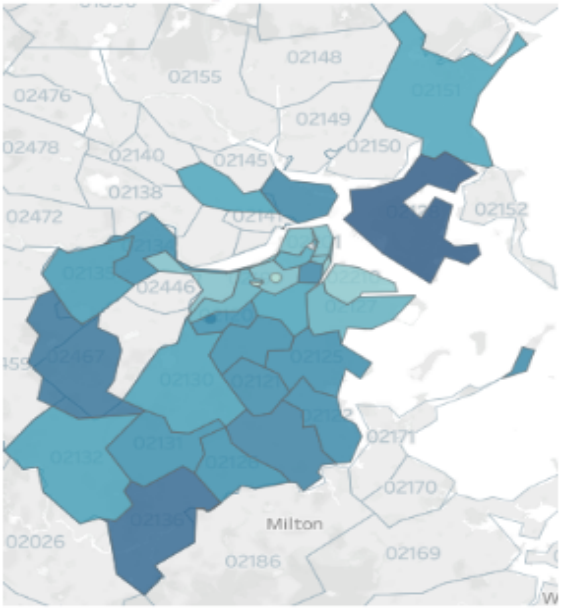
Top 5 neighborhoods of most average income:

Fenway/Kenmore	4237.78
Back Bay	3707.357
Hyde Park	3534.508
Jamaica Plain	3343.262
South Boston Waterfront	3327.855

Bottom 6:

Dorchester	2256.79
West Roxbury	2235.943
East Boston	2224.645
Allston	1989.26
Chinatown	1713.94
Financial District|Downtown	1150

Average household size of applicant of RRF in each zip code:



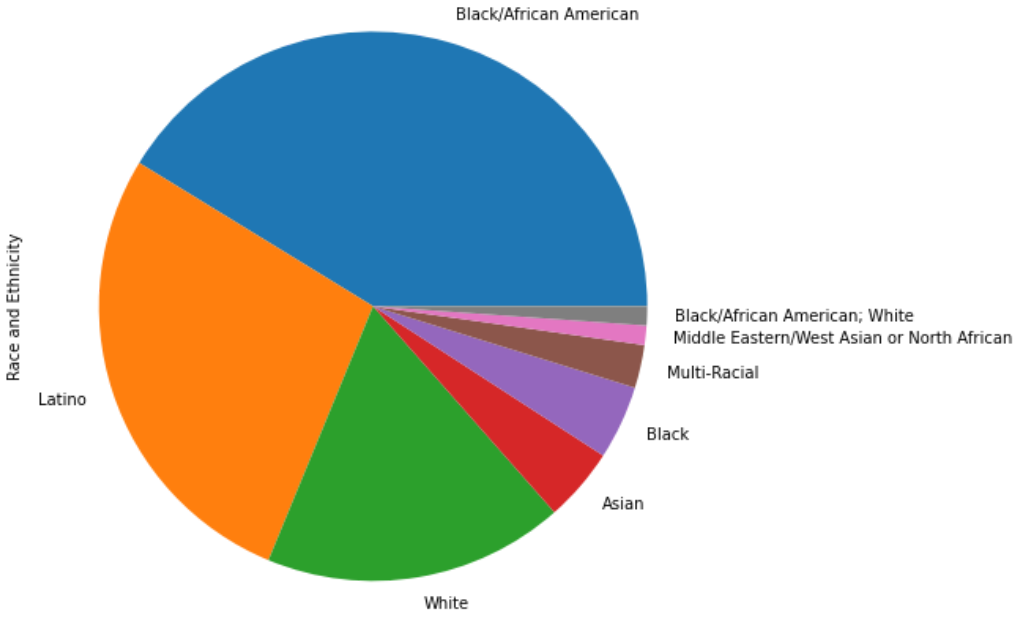
Top 5 neighborhoods of most average household size:

East Boston	3.003
Hyde Park	2.828
Charlestown	2.442
Chinatown	2.434
Dorchester	2.404

Bottom 5:

South Boston Waterfront	1.826
Financial District|Downtown	1.75
Back Bay	1.73
South Boston	1.552
Fenway/Kenmore	1.549

Ethnicity ratio among approved applicants of rental assistance funds:



- **Results obtained / questions answered:**

Question3: Where are the city's economic development licenses? Which communities are benefitting? Which communities are being left out?

The top five neighborhoods that got food licenses are Fenway/Kenmore(393), Back_Bay(266), South Boston(245), East Boston(217) and Dorchester(216). The top five neighborhoods benefited from the business assistance fund are Fenway/Kenmore, Dorchester, Jamaica Plain, Back Bay, and South End.

The top five neighborhoods got liquor licenses among all are South Boston(168), Back_Bay(160), North End(143), East Boston(131) and Fenway/Kenmore(130). There is only one place that receives business funds with liquor licenses, which is the North End neighborhood. Thus, South Boston, Back Bay, East Boston and Fenway are left out from business funds for businesses with liquor licenses.

Fenway/Kenmore, Back bay, South Boston, Dochester and East Boston are the top 5 neighborhoods that got the licenses for (consumer affairs and others), however, the top 5 neighborhoods that receive the most number of funds for businesses having (consumers & other) licenses are Dochester, Rosindale, Charlestown, North End and Roxbury. Thus, Fenway/Kenmore, Back Bay, South Boston and East Boston are left out from business funds for businesses with consumer affairs licenses.

Question1: Where did business assistance go during the pandemic? What were the demographic profiles of the communities where the businesses were located?

The top five of the number of business licenses of all categories among all neighborhoods are Fenway/Kenmore, Back_Bay, South Boston, East Boston and Dorchester. The top five of the number of business assistance funds received of all categories across all neighborhoods are Dorchester, Back_Bay, East Boston, Jamaica Plain and South End.
Our conclusion is that the Fenway/Kenmore region needs more business funds during the pandemic.

For the demographic profiles, please reference the ethnicity ratio statistics and demographic profile bar charts of each race from page4-page6 in the exploration part of our report.

Question2: Where did the city's rental assistance go during the pandemic? What were the demographic profiles of the recipients of these funds?

Bottom 5 neighborhoods with the lowest average income of the applicants are: Chinatown, Allston, East Boston, West Roxbury and Dorchester.

Compared with the total amount of RRF and average amount of RRF, we conclude that the rental assistance was given as needed in Dorchester, West Roxbury and East Boston, which is also due to the fact that Dorchester has the highest number of applicants(1769), and East Boston has the 2nd highest number of applicants(822).
However, Chinatown and Allston are among the lowest 5 of average rental assistance, so we conclude that the rental funds are not given sufficiently to these 2 neighborhoods.

- **Limitations of results:**

Our answers for the basic 3 questions are limited to the data files given. The limitations of results will come from the limitations in the datasets that we used. For the business funds dataset, it doesn't specify exactly during which period the funds were given and the amount given, so our inference of which neighborhood's business funds are being equitably distributed is only based on the number of business names that receive funds in each neighborhood, rather than the total amount that were granted, which will cause some inaccuracies of our conclusions for question 3 and 1.

- **Challenges faced:**
  - Need to convert Zip Code to Neighborhood manually for some datasets.
  - Some of the data is incomplete and unclear.
    - Deal with missing value was painful
    - Same data resource didn't have the same data fields
  - Datasets lack descriptions, which make it difficult to analyze.

- **311 Extension Project:**

Question we raised:

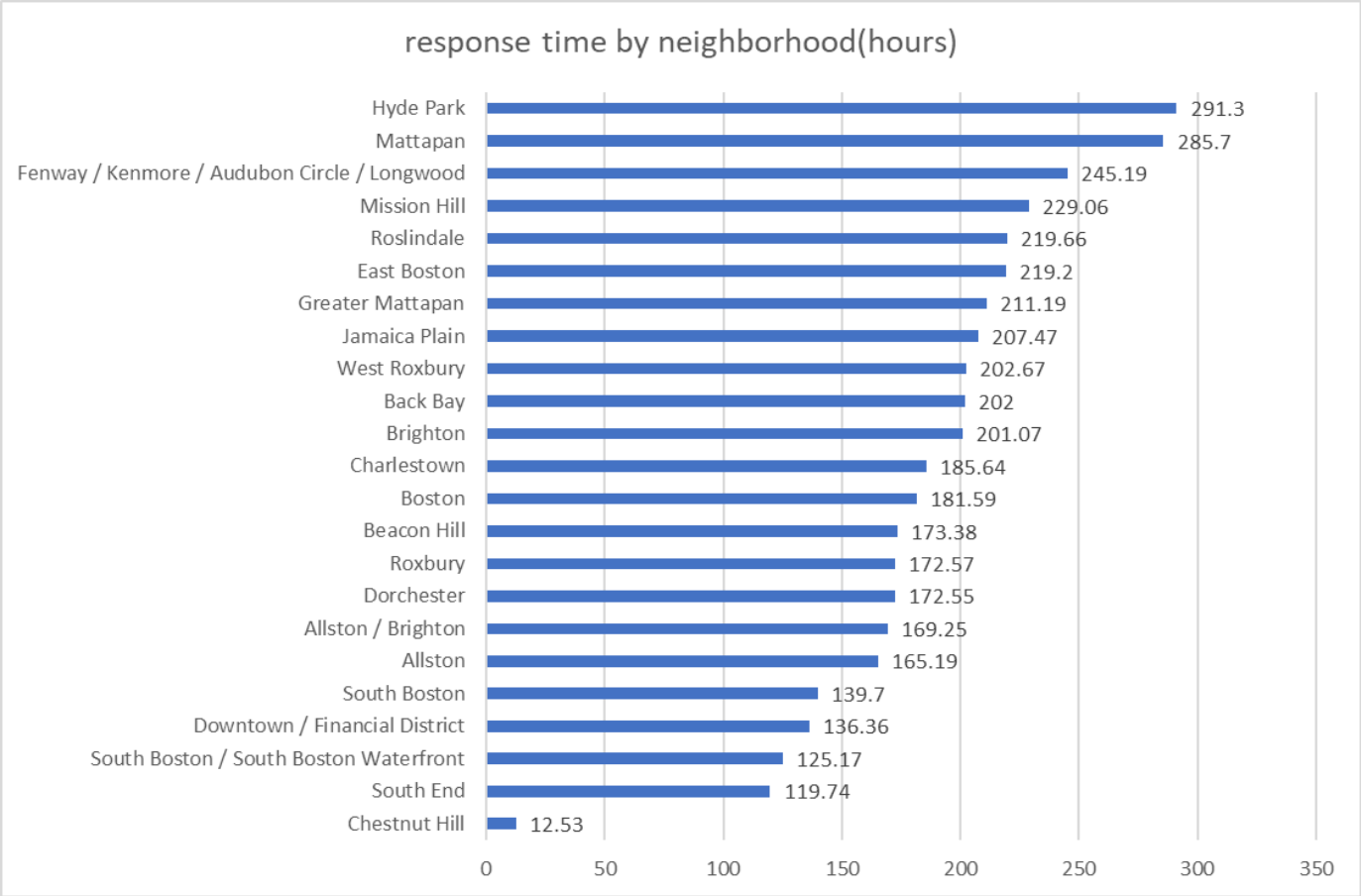
→ In the city's responses to Boston residents' service requests, which neighborhood on average gets served more quickly, which neighborhood gets served slower? What are the characteristics of those neighborhoods in terms of request services?

Datasets that we use:

→ Boston 311 service requests https://data.boston.gov/dataset/311-service-requests

1. **Analysis of 311 service requests dataset in 2021:**

   The below graph is the average service requests' response time in each neighborhood:

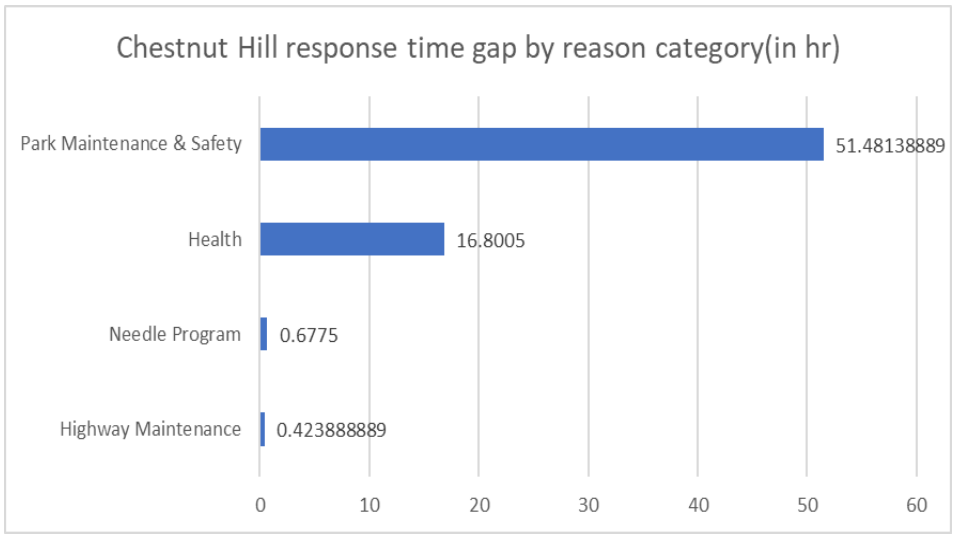


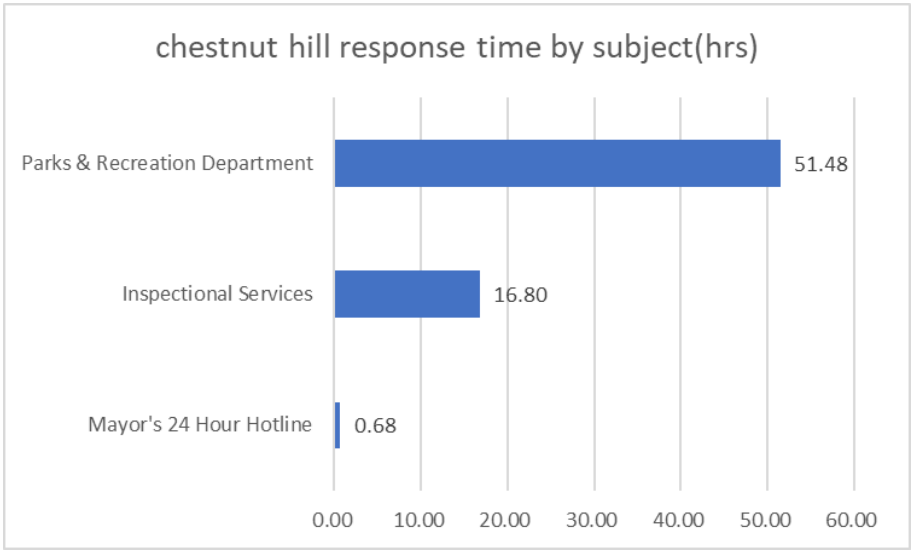
Conclusion of top 3 and bottom 3 neighborhoods in terms of average service requests' response time:

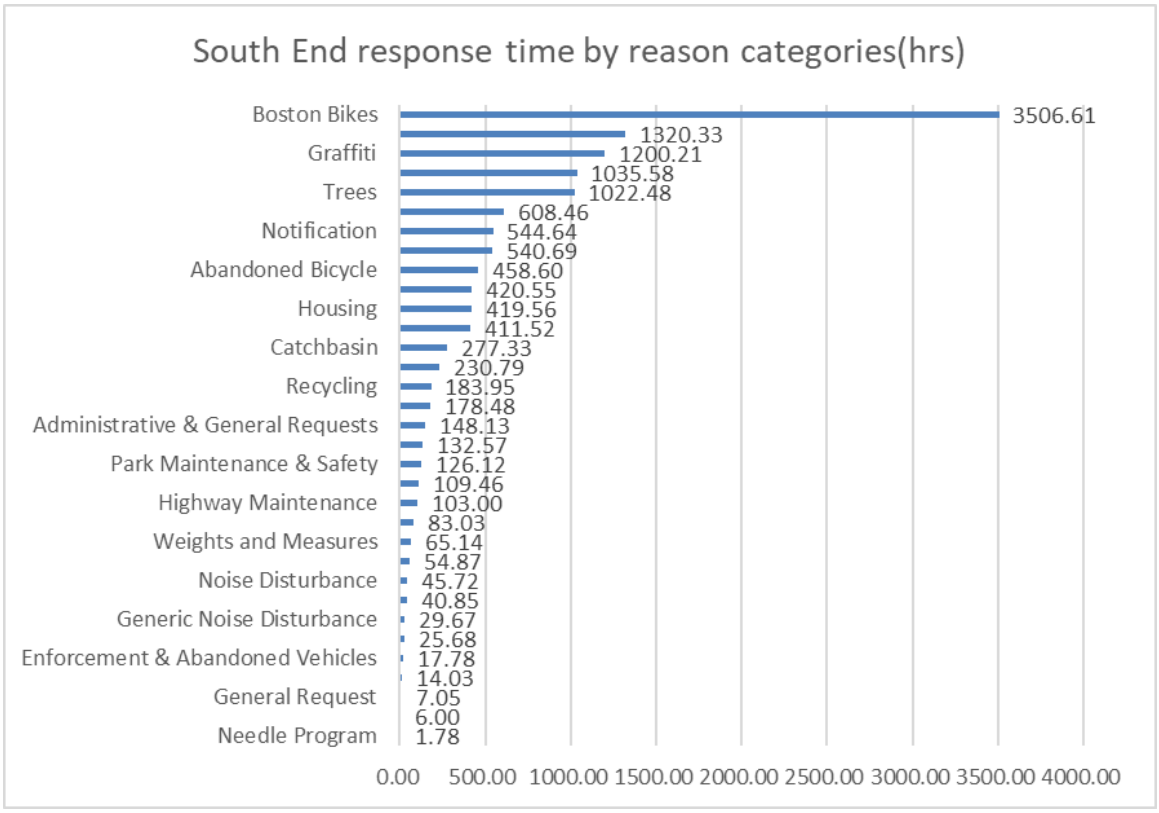
From the above graph, Chestnut Hill, South End and South Boston are the top 3 neighborhoods that are responded the most quickly, Hyde Park, Mattapan and Fenway/Kenmore are the 3 neighborhoods that are responded the slowest.

Breakdown analysis of average response time in the top 2 and bottom 2 neighborhoods in the ranking of response time:

Top 2 most quickly responded neighborhoods group by reason and by subject categories:




chestnut hill response time by subject(hrs)
Parks & Recreation Department
51.48
Inspectional Services
16.80
Mayor's 24 Hour Hotline
0.68
0.00
10.00
20.00
30.00
40.00
50.00
60.00


South End response time by reason categories(hrs)
Boston Bikes
3506.61
Graffiti
1320.33
Trees
1200.21
Notification
1035.58
Abandoned Bicycle
1022.48
Housing
608.46
Catchbasin
544.64
Recycling
540.69
Administrative & General Requests
458.60
Park Maintenance & Safety
420.55
Highway Maintenance
419.56
Weights and Measures
411.52
Noise Disturbance
277.33
Generic Noise Disturbance
230.79
Enforcement & Abandoned Vehicles
183.95
General Request
178.48
Needle Program
148.13
132.57
126.12
109.46
103.00
83.03
65.14
54.87
45.72
40.85
29.67
25.68
17.78
14.03
7.05
6.00
1.78
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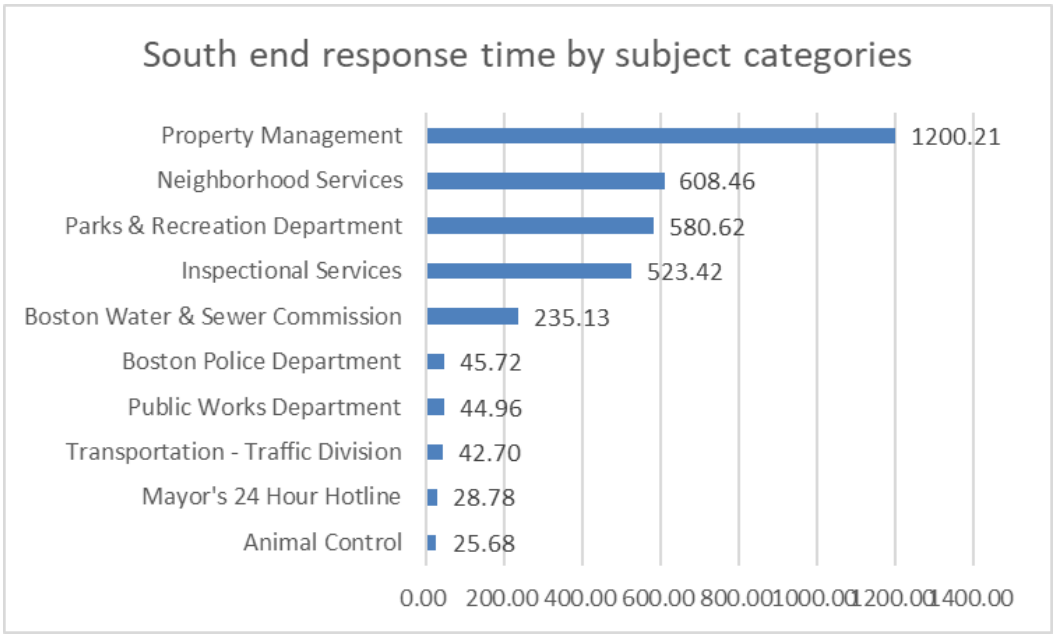
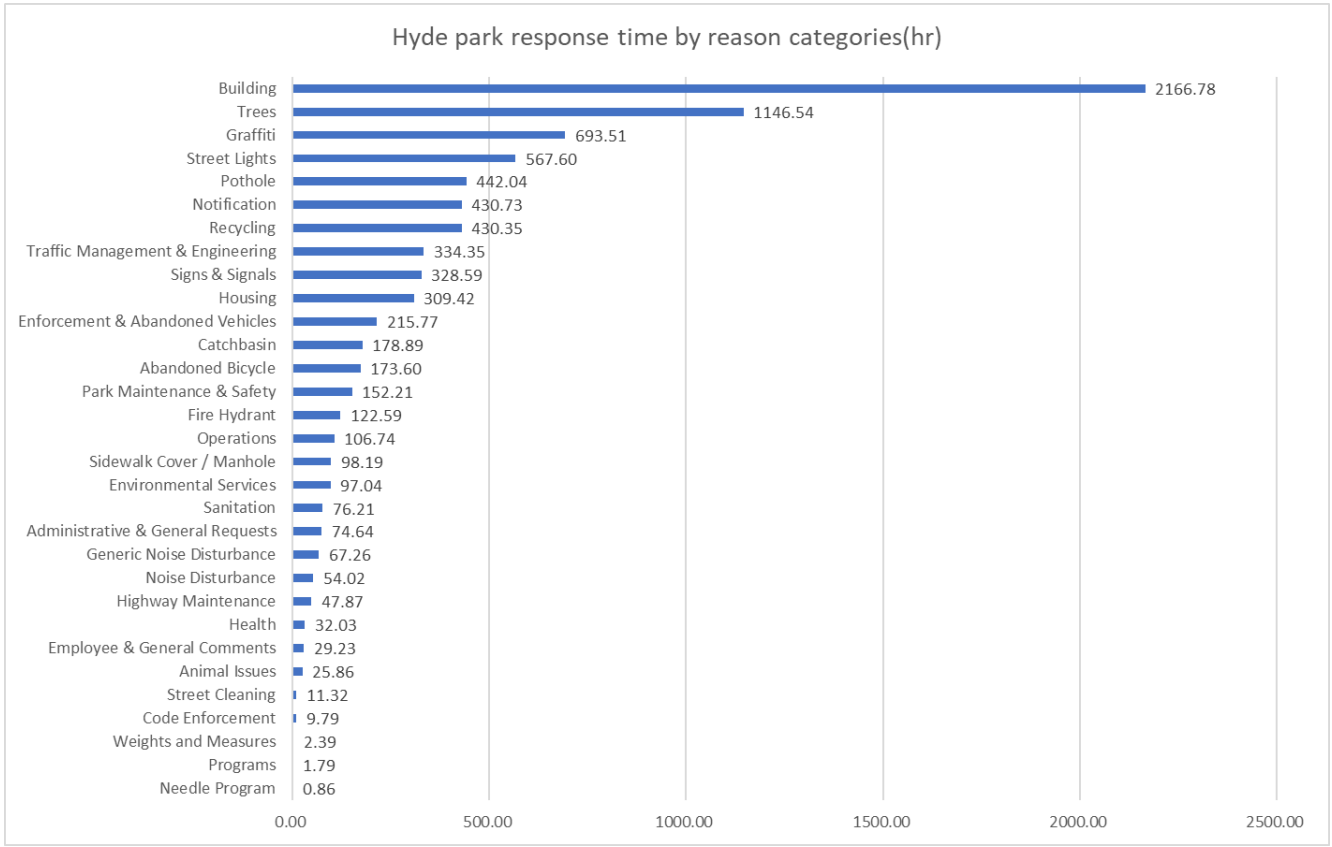
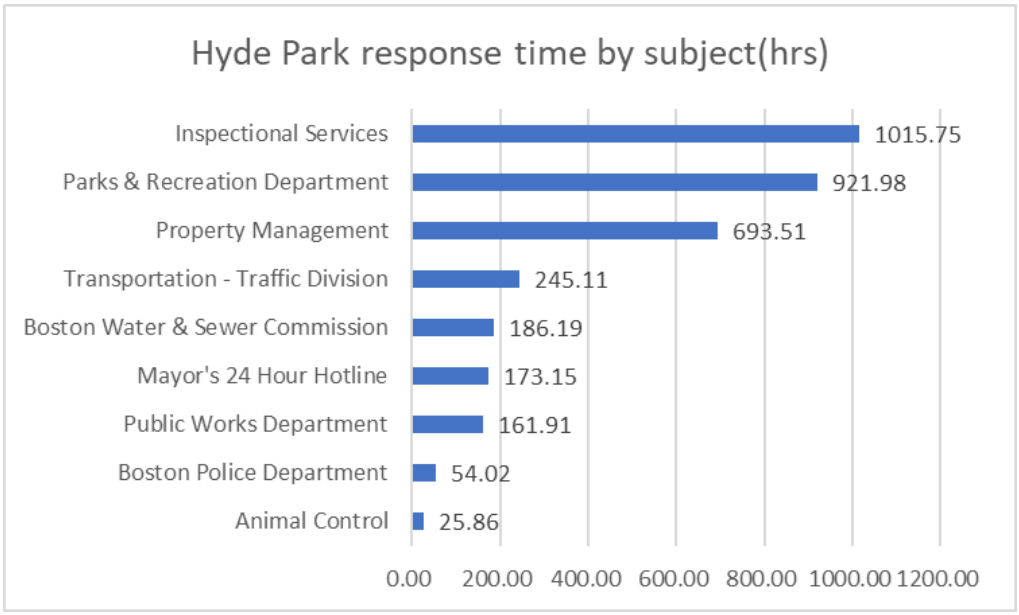
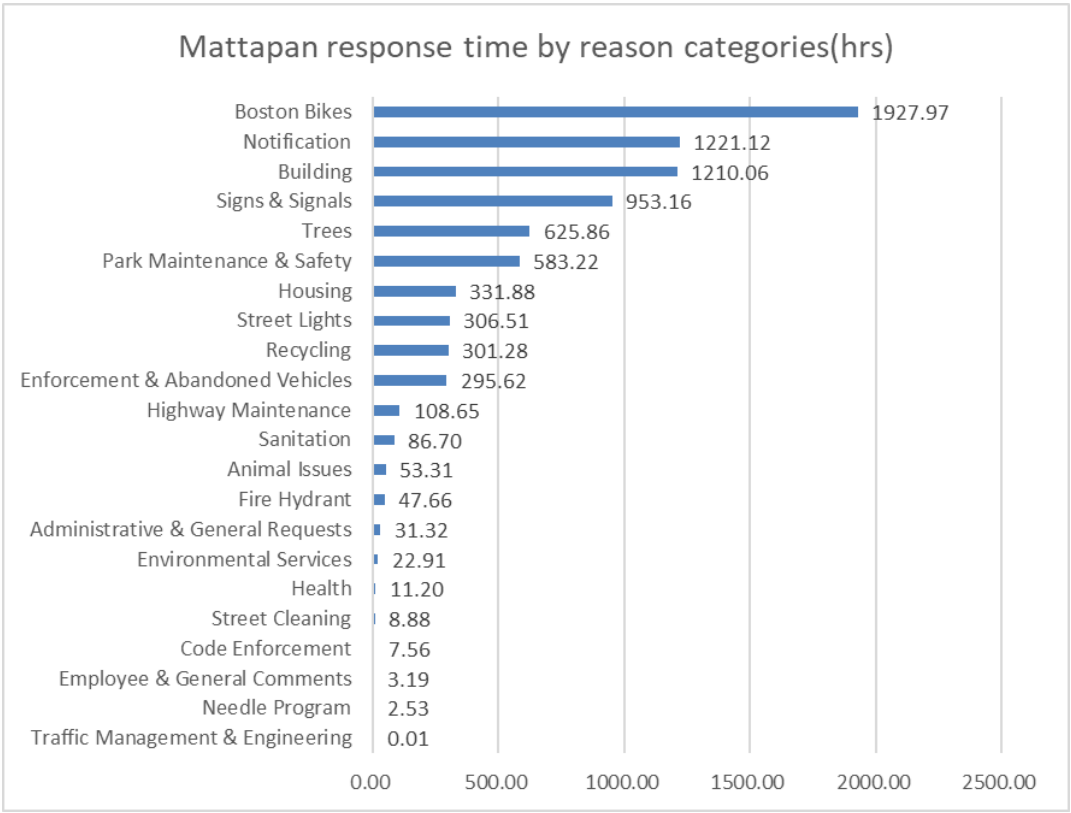
1000.00
1500.00
2000.00
2500.00
3000.00
3500.00
4000.00



Top 2 most slowly responded neighborhoods group by reason and by subject categories:




Hyde Park response time by subject(hrs)
Inspectional Services
Parks & Recreation Department
Property Management
Transportation - Traffic Division
Boston Water & Sewer Commission
Mayor's 24 Hour Hotline
Public Works Department
Boston Police Department
Animal Control
1015.75
921.98
693.51
245.11
186.19
173.15
161.91
54.02
25.86
0.00
200.00
400.00
600.00
800.00
1000.00
1200.00


Mattapan response time by reason categories(hrs)
Boston Bikes
Notification
Building
Signs & Signals
Trees
Park Maintenance & Safety
Housing
Street Lights
Recycling
Enforcement & Abandoned Vehicles
Highway Maintenance
Sanitation
Animal Issues
Fire Hydrant
Administrative & General Requests
Environmental Services
Health
Street Cleaning
Code Enforcement
Employee & General Comments
Needle Program
Traffic Management & Engineering
1927.97
1221.12
1210.06
953.16
625.86
583.22
331.88
306.51
301.28
295.62
108.65
86.70
53.31
47.66
31.32
22.91
11.20
8.88
7.56
3.19
2.53
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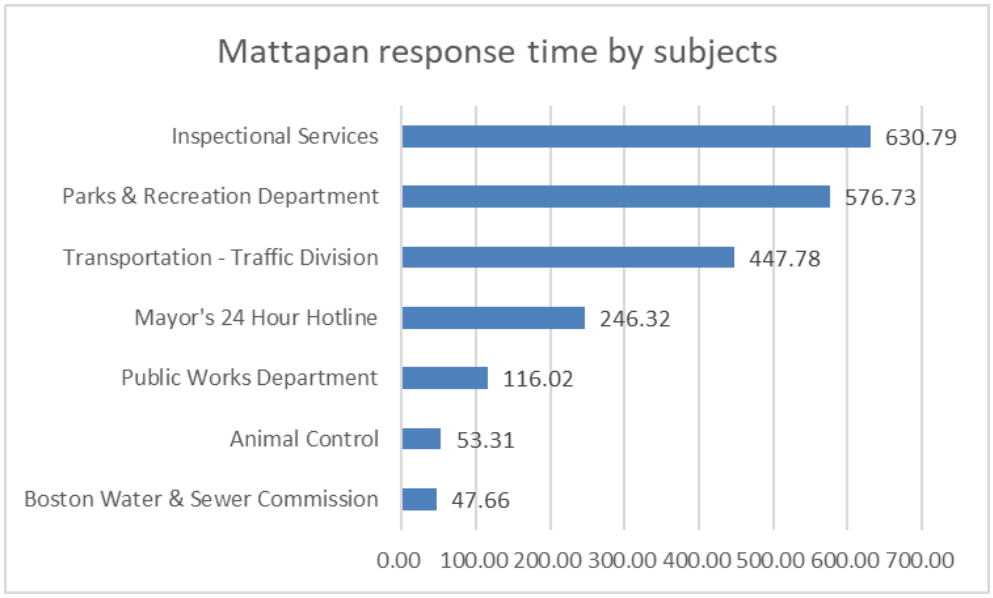
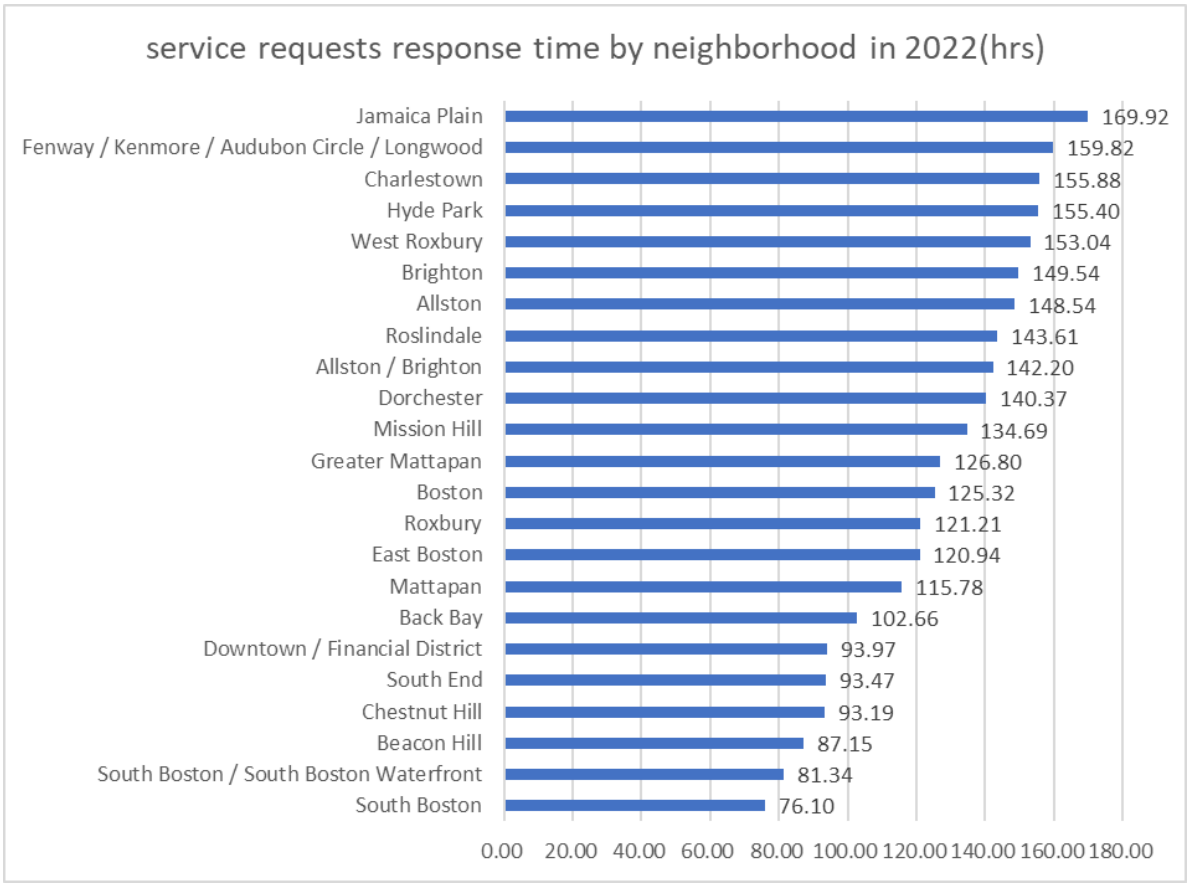
500.00
1000.00
1500.00
2000.00
2500.00



2. Analysis of 311 service requests dataset in 2022:

The below graph is the average service requests' response time in each neighborhood:

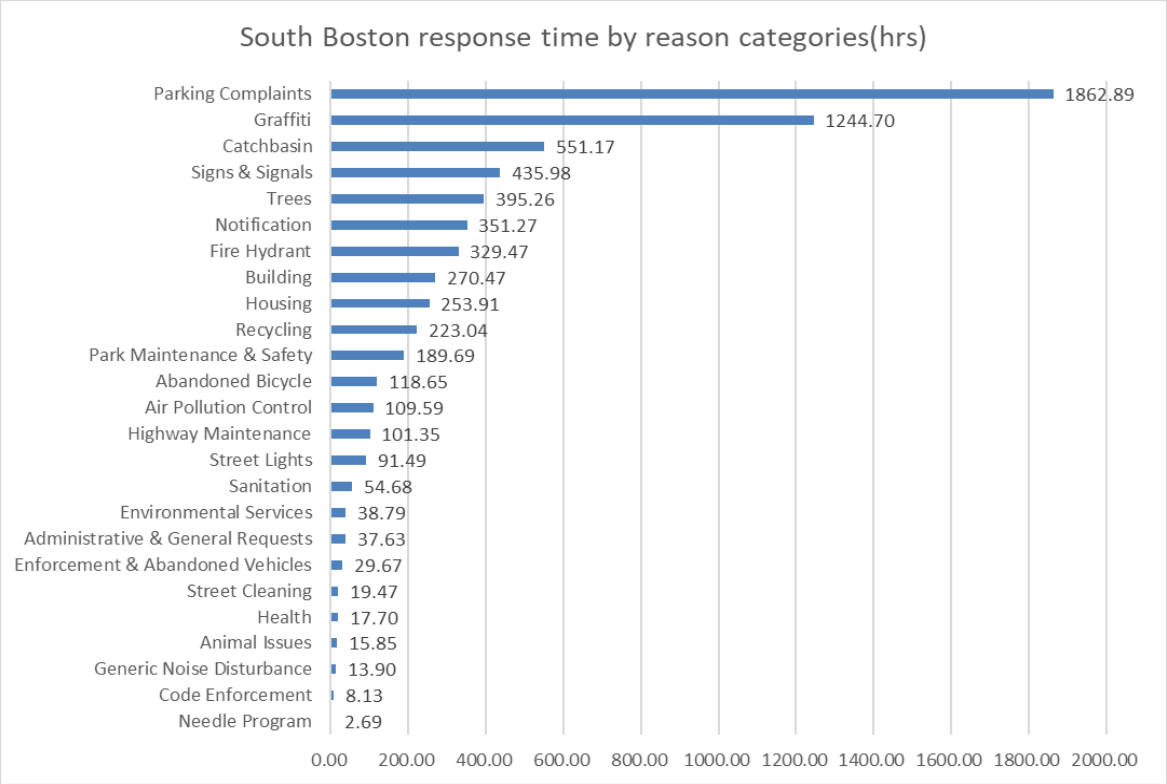


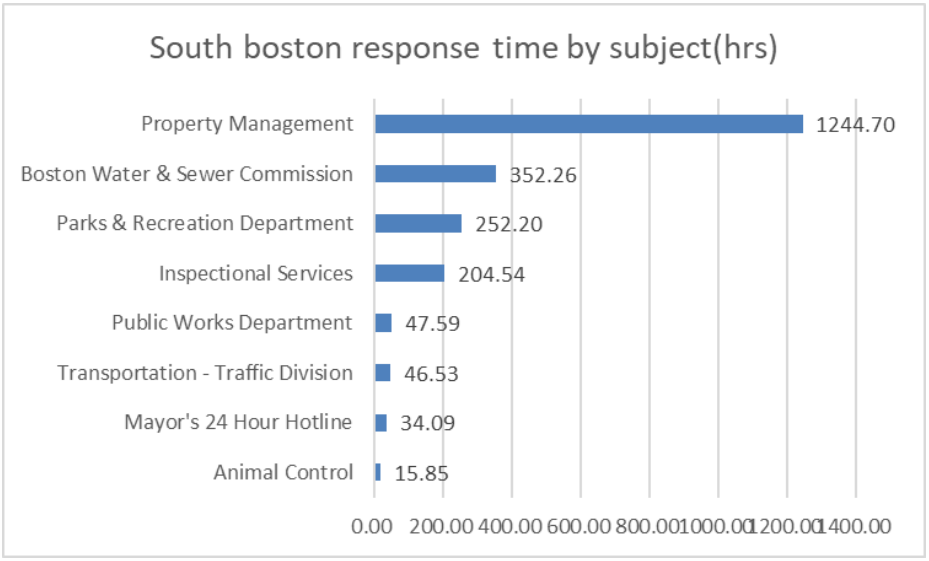
Conclusion of top 3 and bottom 3 neighborhoods in terms of average service requests' response time:

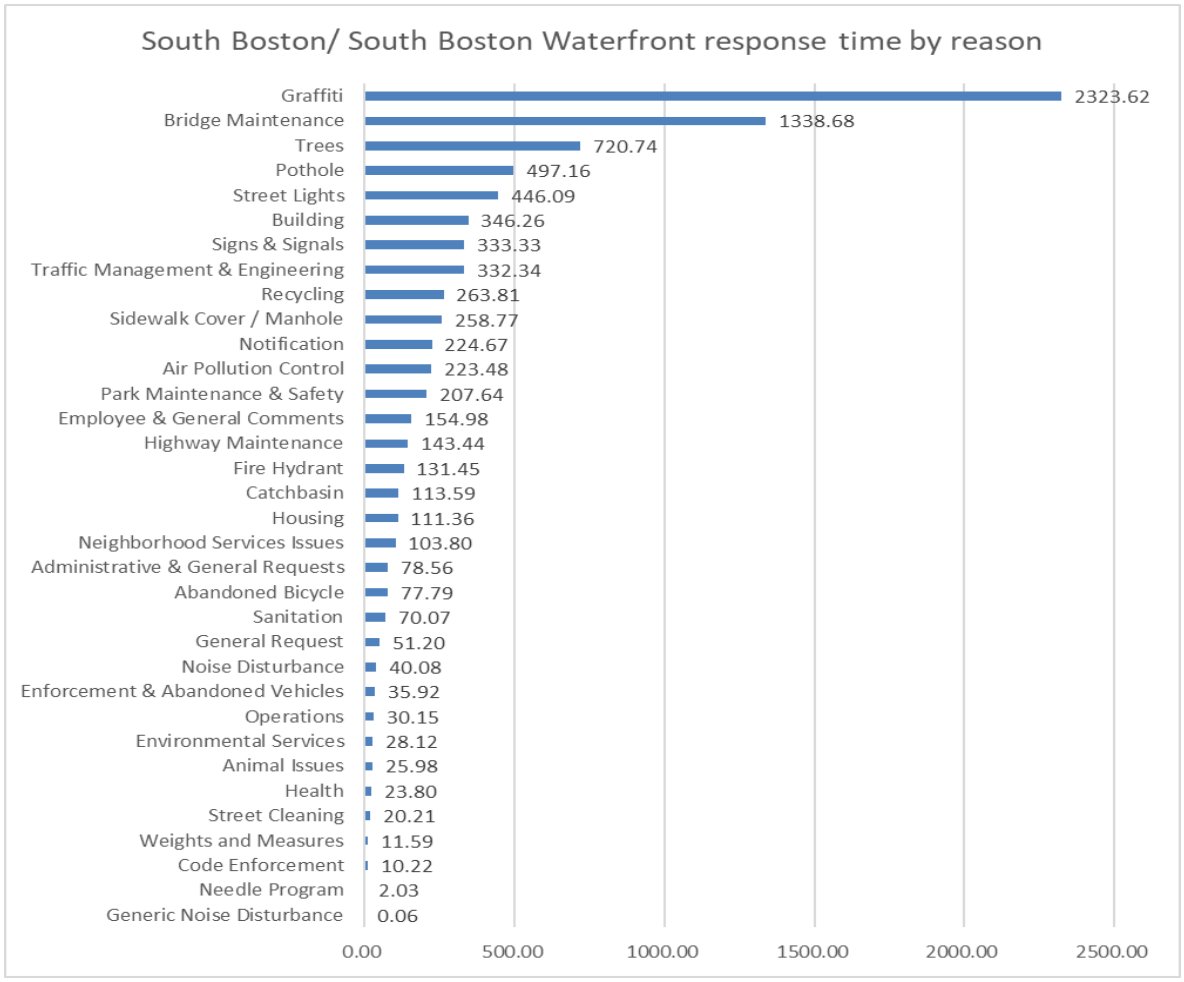
From the above graph, South Boston, South Boston / South Boston Waterfront and Beacon Hill are the top 3 neighborhoods that are responded the most quickly, Jamaica Plain, Fenway/Kenmore and Charleston are the 3 neighborhoods that are responded the slowest.

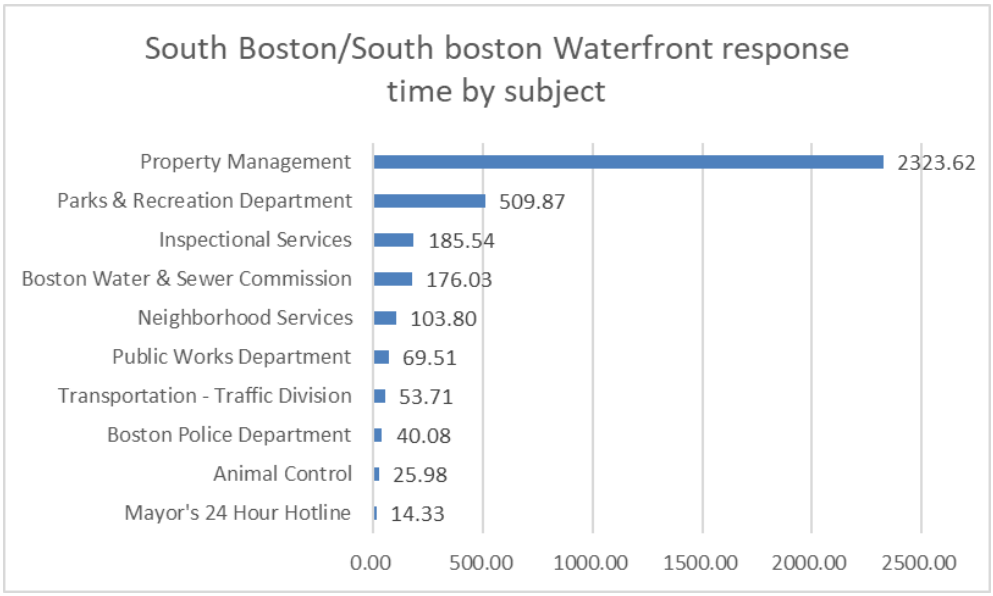
Breakdown analysis of average response time in the top 2 and bottom 2 neighborhoods in the ranking of response time:

Top 2 most quickly responded neighborhoods group by reason and by subject categories:

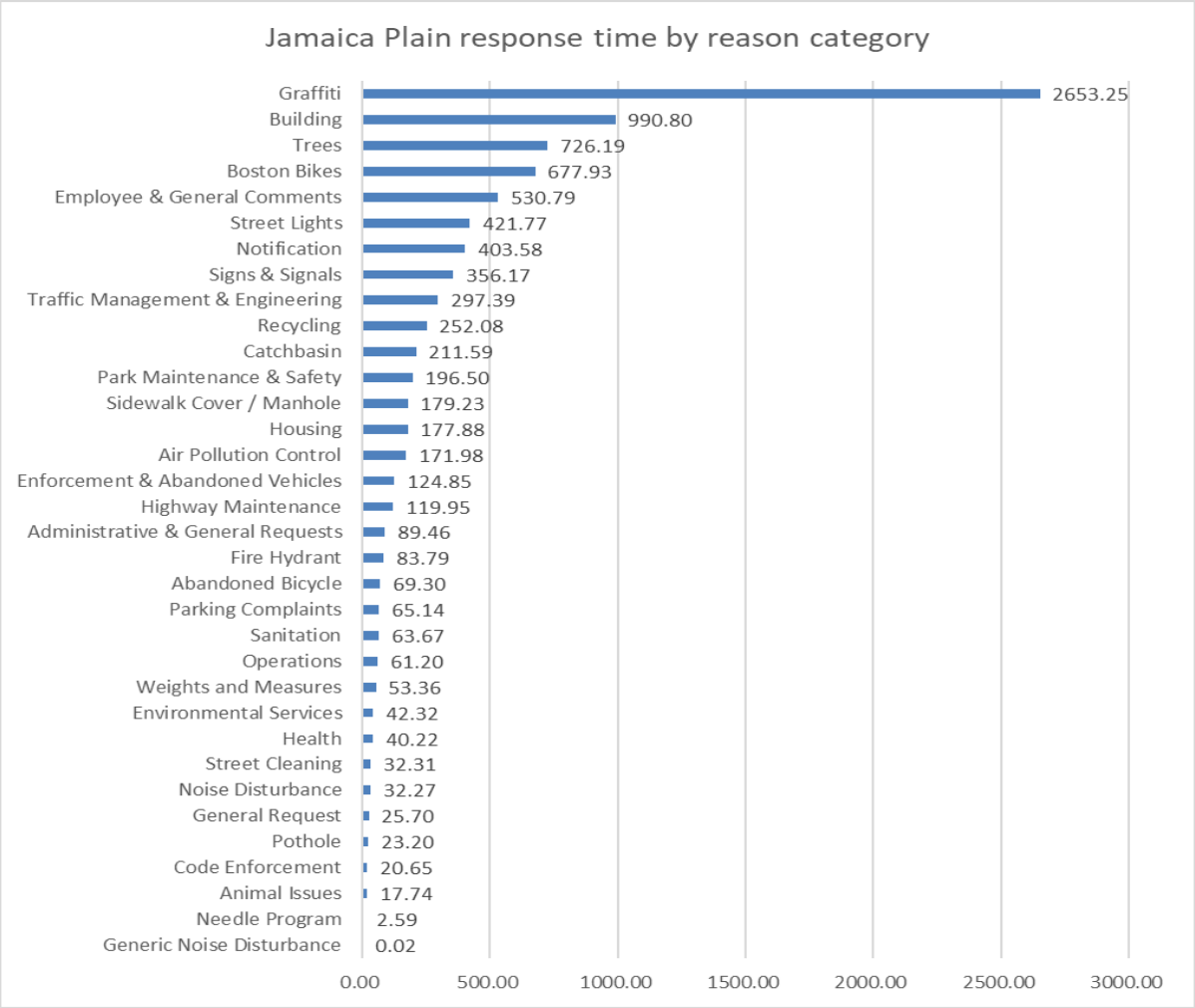


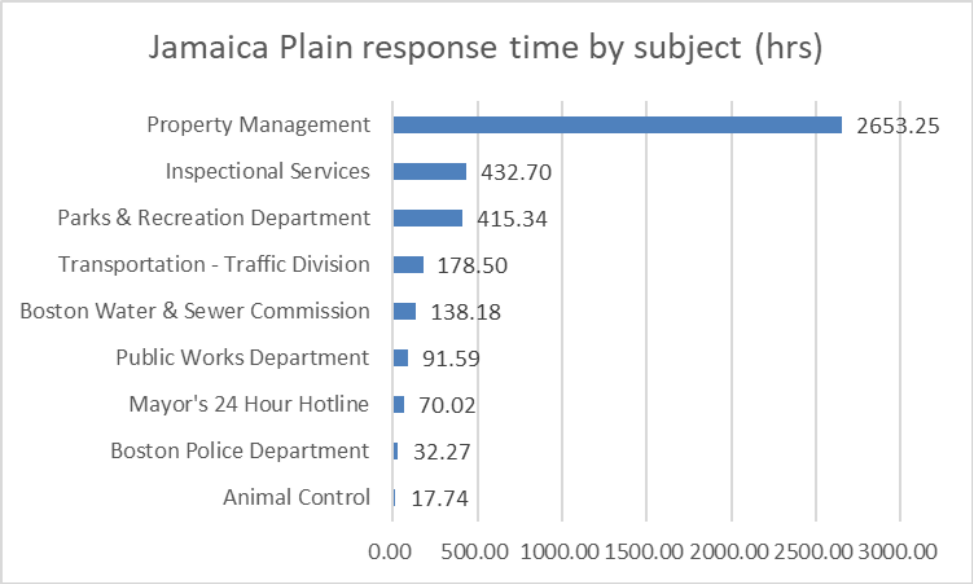


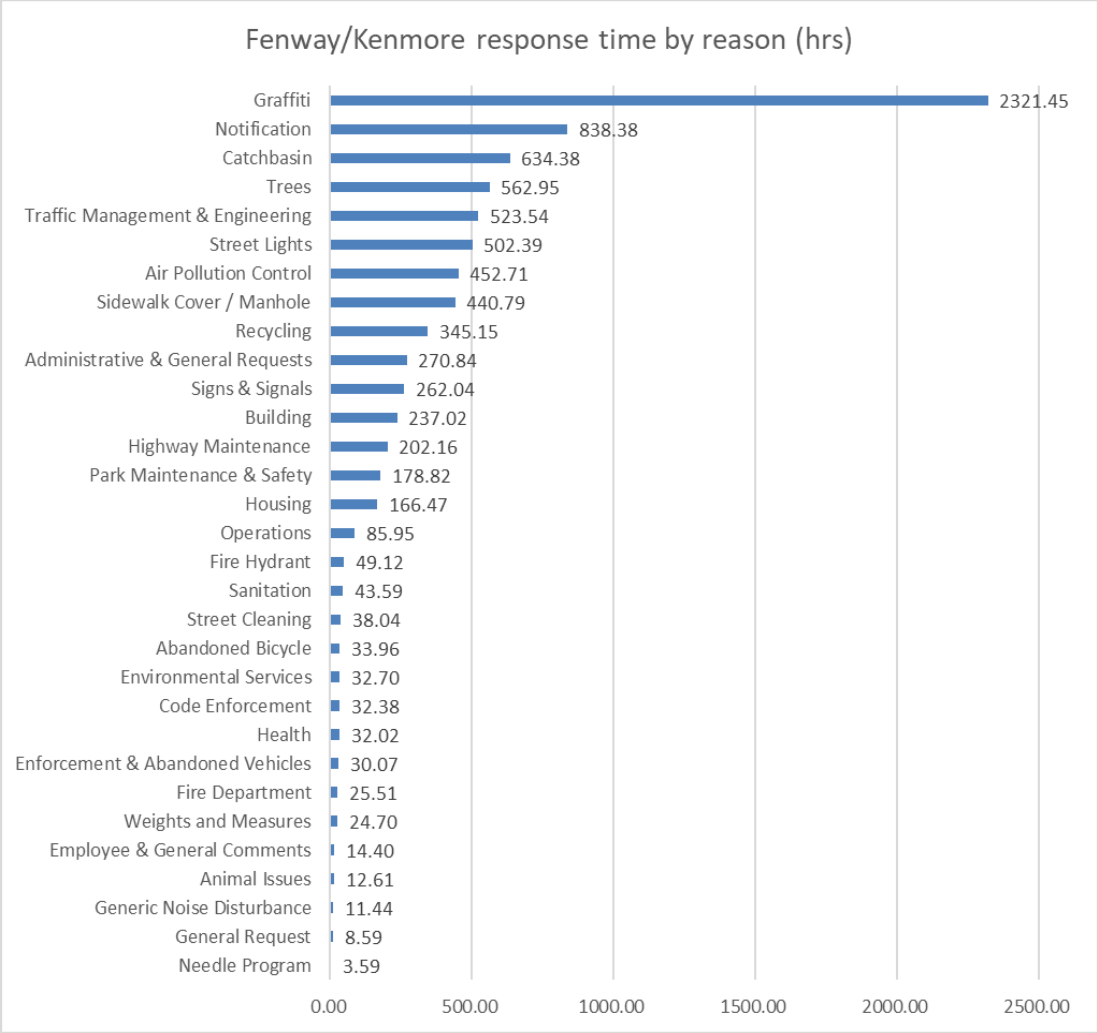

South Boston/ South Boston Waterfront response time by reason
Graffiti 2323.62
Bridge Maintenance 1338.68
Trees 720.74
Pothole 497.16
Street Lights 446.09
Building 346.26
Signs & Signals 333.33
Traffic Management & Engineering 332.34
Recycling 263.81
Sidewalk Cover / Manhole 258.77
Notification 224.67
Air Pollution Control 223.48
Park Maintenance & Safety 207.64
Employee & General Comments 154.98
Highway Maintenance 143.44
Fire Hydrant 131.45
Catchbasin 113.59
Housing 111.36
Neighborhood Services Issues 103.80
Administrative & General Requests 78.56
Abandoned Bicycle 77.79
Sanitation 70.07
General Request 51.20
Noise Disturbance 40.08
Enforcement & Abandoned Vehicles 35.92
Operations 30.15
Environmental Services 28.12
Animal Issues 25.98
Health 23.80
Street Cleaning 20.21
Weights and Measures 11.59
Code Enforcement 10.22
Needle Program 2.03
Generic Noise Disturbance 0.06
0.00 500.00 1000.00 1500.00 2000.00 2500.00


South Boston/South boston Waterfront response time by subject
Property Management 2323.62
Parks & Recreation Department 509.87
Inspectional Services 185.54
Boston Water & Sewer Commission 176.03
Neighborhood Services 103.80
Public Works Department 69.51
Transportation - Traffic Division 53.71
Boston Police Department 40.08
Animal Control 25.98
Mayor's 24 Hour Hotline 14.33
0.00 500.00 1000.00 1500.00 2000.00 2500.00

Top 2 most slowly responded neighborhoods group by reason and by subject categories:







3. **Comparison between average service requests' response time in 2021 and 2022:**
South Boston and South Boston Waterfront are among the top 3 most quickly responded neighborhoods in both 2021 and 2022, and Fenway/Kenmore is among the top 3 slowest responded neighborhoods in both 2021 and 2022. Although Mattapan is among the top 3 slowest responded neighborhoods in 2021, its average response time gets improved a lot in 2022, which makes it rank in the middle in 2022.

- **Documentation of the files in our github repo (also check our README):**
  Fund summary per neighborhood.xlsx: summary statistics of business fund per license category in each neighborhood, I use excel pivot table to aggregate those statistics
  licenses summary group by neighborhood.xlsx: summary statistics of business license in each neighborhood, I use excel pivot table to aggregate those statistics
  RRF_funds_summary and analysis.xlsx: summary of rental assistance fund of individual applicant in each neighborhood, I use excel pivot table to aggregate those statistics
  boston-neighborhood-summary and analysis.xlsx: summary statistics of demographic profiles such as race, housing size, income in each neighborhood, I use excel pivot table to aggregate those statistics

  RRF.ipynb:

  In this file we processed the data of RRF funds (RRF_funds.csv).

  For RRF fund we only take approved fund into consideration, so the approved funds are filtered out and processed to the new csv file Approved_update.csv. We get the histogram of fund amount for each ethnicity by using value_counts method in pandas. From the chart, the top three ethnicity are black, Latino and white.

  To make it more explicit, we convert it into a pie chart. Apparently, black/African American ethnicity takes nearly a half, while Latino takes about a quarter, and white takes about one fifth.

  Then we draw the heatmap of the fund distribution, saved as Approved_heatmap.html. Obviously, Dorchester has the largest amount of fund among all districts, which is reasonable according to population distribution and income level.

  MAR.ipynb:

  First I renamed some columns, change some data types, numbering, and fill missing numbers, etc, data cleaning work. I also calculated the monthly average RRF. Then, I append the location information based on each neighborhood's numbers to generate heat maps for the number of RRF to each neighborhood, the total owed and the average owed.

  SEP.ipynb:

  This one also starts with renaming, changing data type, filling empties, etc, and data cleaning work and also calculating the monthly average RRF. Then added associated locations, to generate the total number of RRFs to each neighborhood, the total owed and the average owed.