KC 311 Calls

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Outline

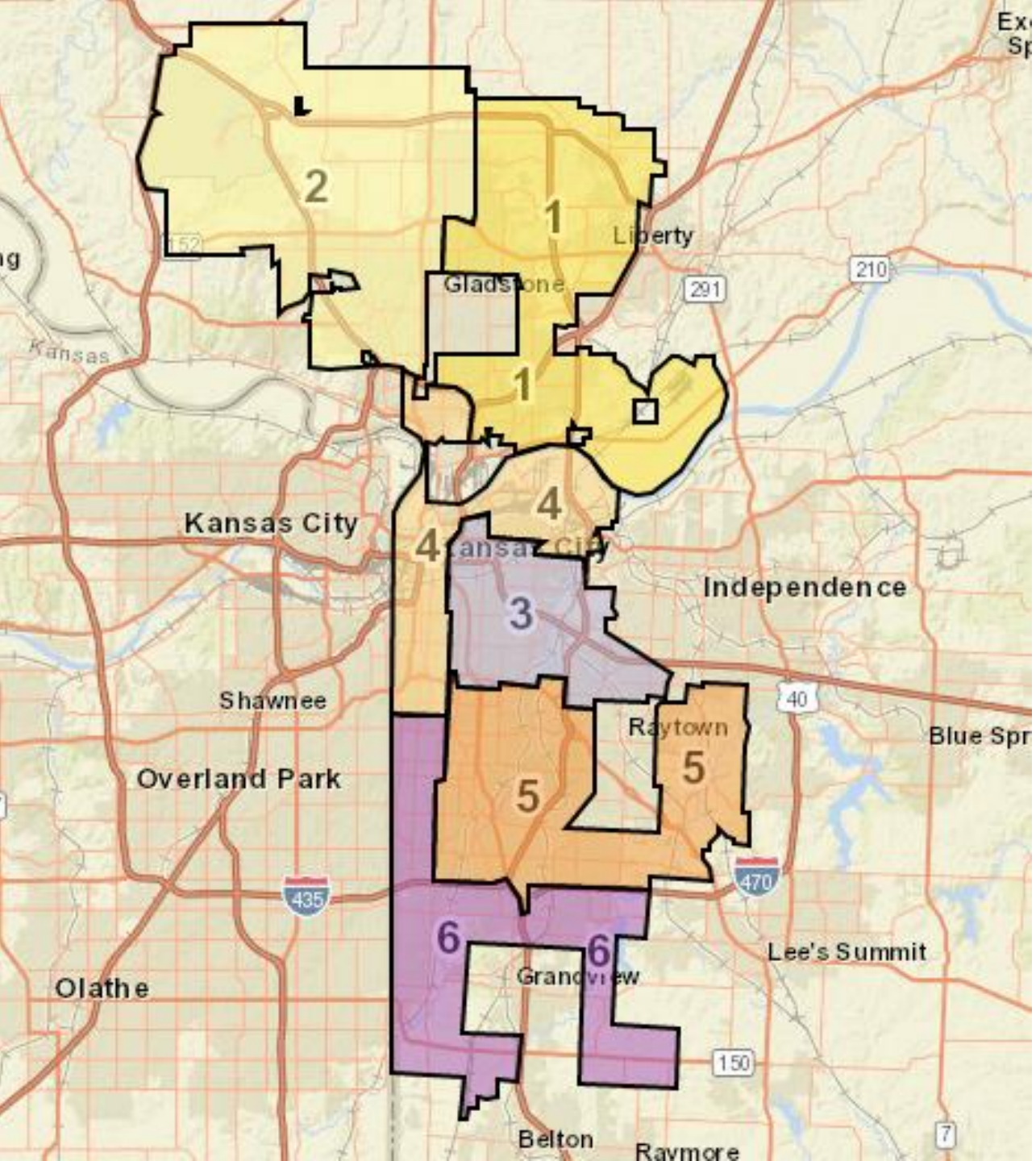
- Introductions about data set and what is our use cases
- KC demographics
- KC call volume break down by category/year; type of calls for KC
- How budget and department are correlated and how that relates to call volume for a time series
- SF compares to KC for ticket type breakdowns
- Appendix

Kansas City 311 Call Center Service Request Calls

- This data set contains call record data from the 311-call center in Kansas City, MO
- This is a very large data set, containing 1.4 million rows
- The columns of the dataset are case id, source, department, work group, request type, category, type and detail

Problem Statement

- The research question is can we predict Kansas City's 311 service center's budget allocation for the year 2020?
  - Is there a correlation between service calls and budget allocation?
  - What is the budgeting prediction for each department?

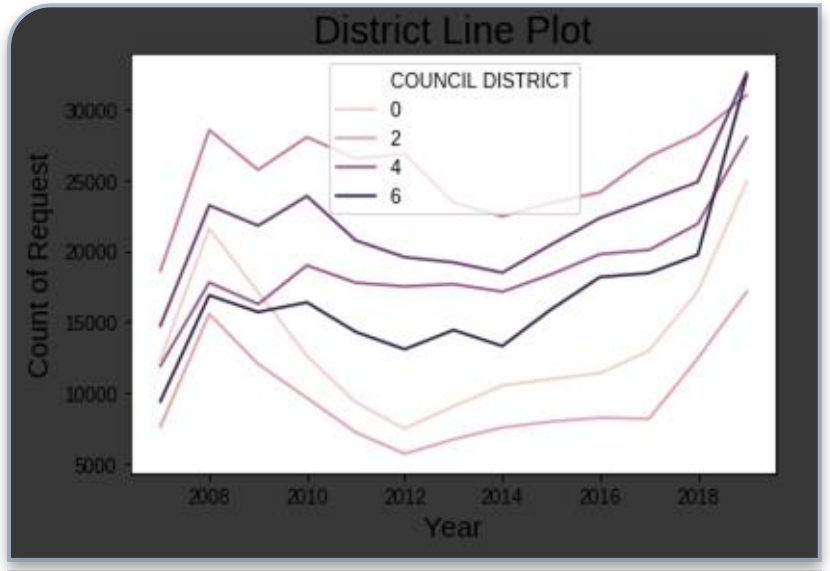


KC Districts

- North South Oriented
- 311 is only for the Missouri Side of Kanas City
- 6 Total Districts
  - 13 Council members 2 per district and Mayor

District Request's overtime

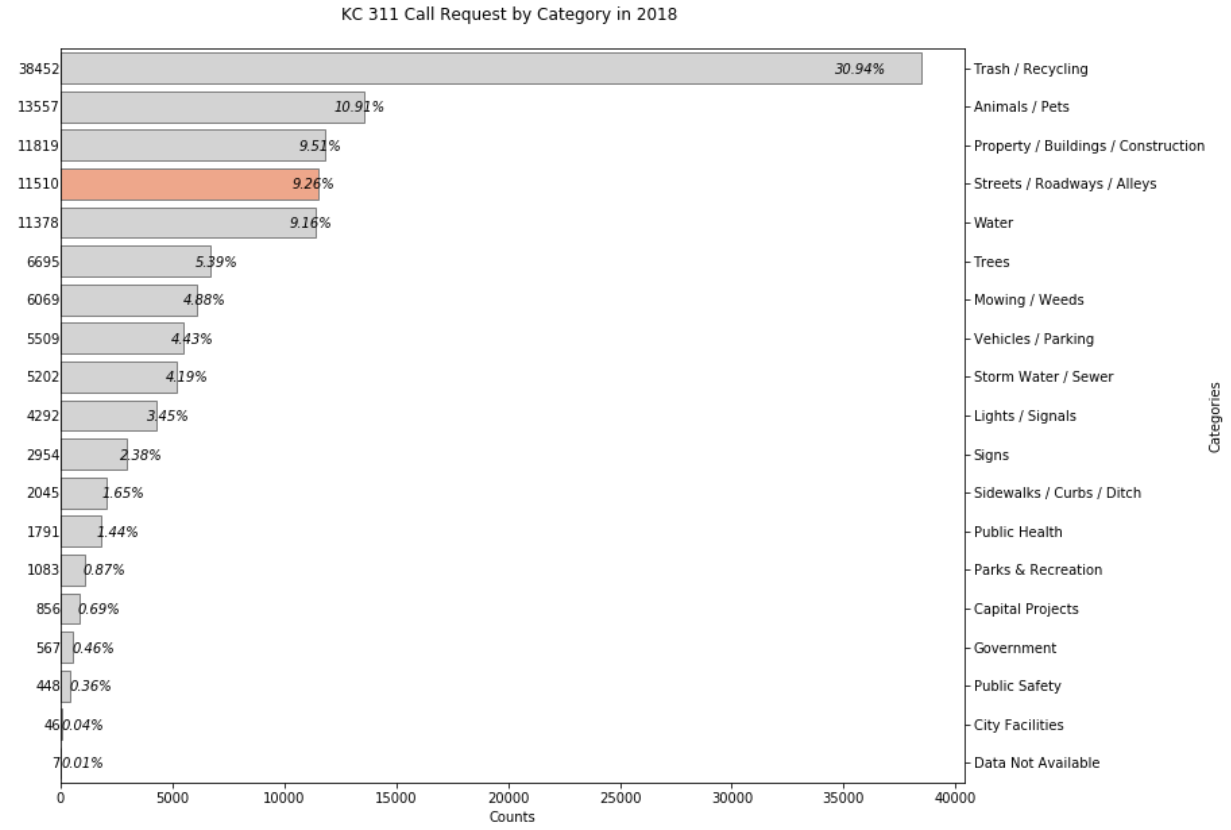
- Districts 3, 4, 5 have traditionally been the top requestors.
- However district 6 is requesting the most in 2019
- District 6 growth is around, Trash/Recycling needing to be picked up, and Pot Holes

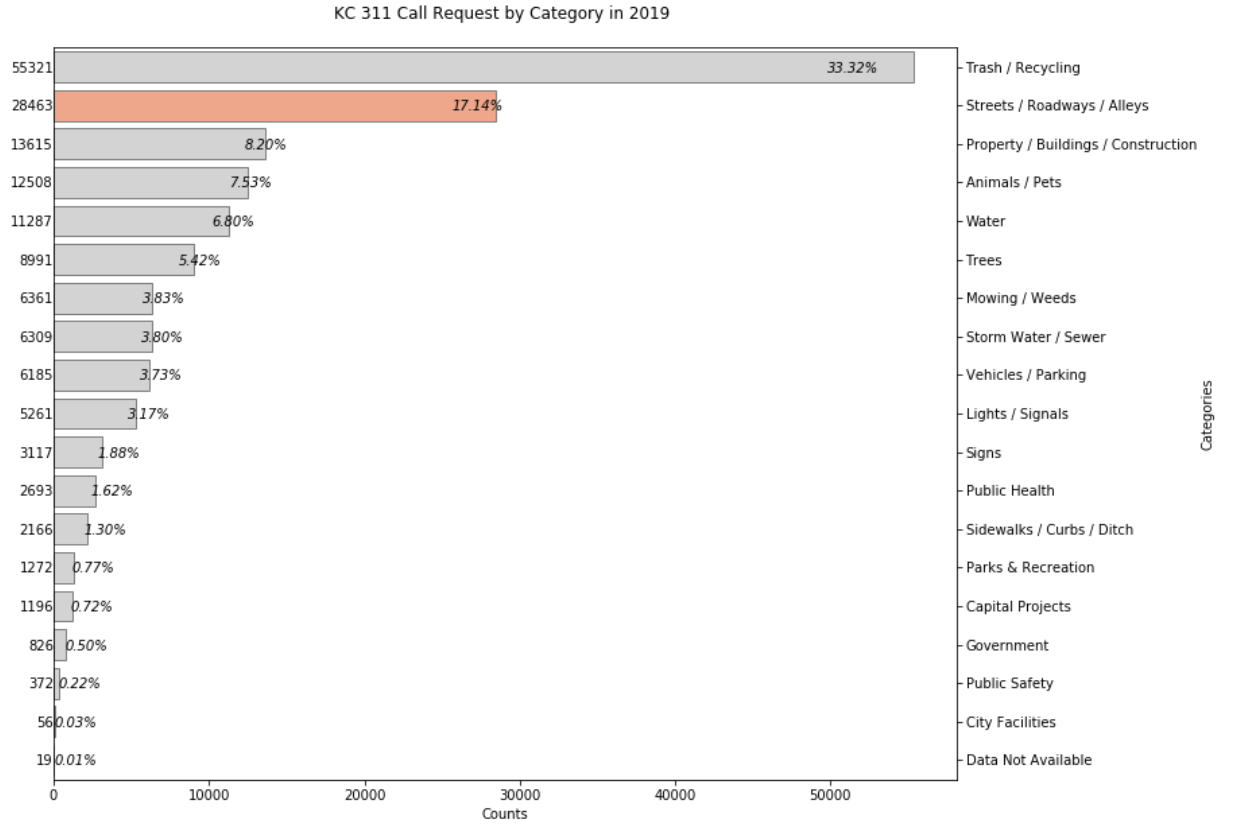


Huge amount of call requests

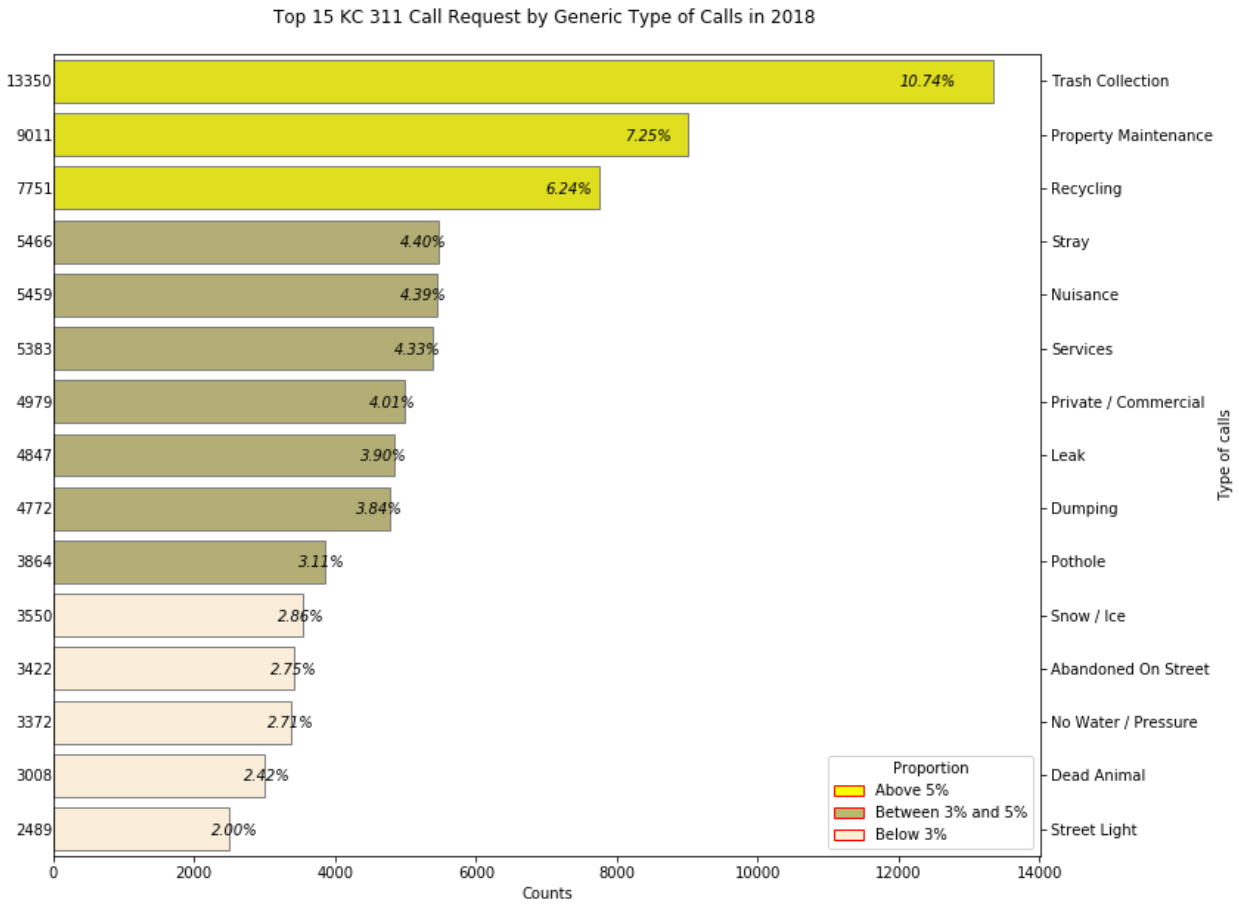
- 124,280 calls in 2018 and 166,018 calls in 2019
- Each call has 4 kind of descriptions that can categorize call requests
  - Category –
    - A generic category;
    - It consists of 19 categories;
    - Consistent
  - Type –
    - A generic type of calls;
    - Lower level of the category
    - It consists of more than 100 types;
    - Slightly different every year
  - Request Type – A combination of Category and Type
  - Detail – Brief detail summarizing the request type

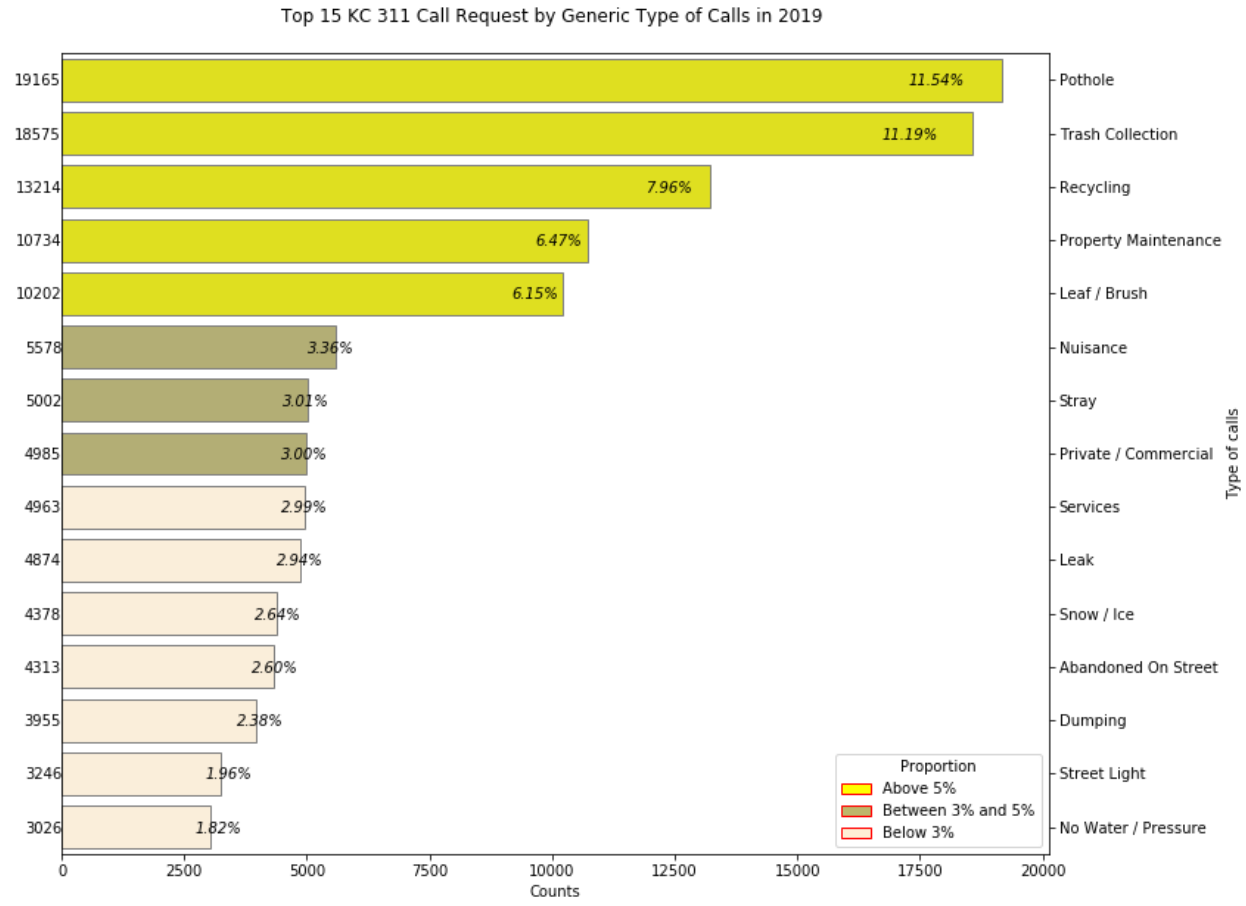
Road condition became bad!





What are the major causes ?





Department Works Breakdown

- 2018 call requests by category and type
- Based on the top 6 categories

CATEGORY	TYPE	DEPARTMENT	Count
Trash / Recycling	Bulky Pick Up	NHS	1971
	Dumping	NHS	4470
	Leaf / Brush	Water Services	1264
	Nuisance	NHS	5459
	Recycling	NHS	7751
	Services	NHS	3641
	Trash Collection	NHS	13345
Animals / Pets	Cruelty or Neglect	NHS	1594
	Dead Animal	NHS	3007
	Rat Treatment	Health	1381
	Stray	NHS	5466
Property / Buildings / Construction	Construction Issue/Concern	City Planning and Development	428
	Dangerous Building	NHS	1800
	Property Maintenance	NHS	7674
Streets / Roadways / Alleys	Pothole	Public Works	3851
	Snow / Ice	Public Works	3240
Water	Leak	Water Services	4847
	No Water / Pressure	Water Services	3372
	Pipeline Referral	Water Services	2159
Trees	Removal	Parks and Rec	2101
	Storm Damage	Parks and Rec	855
	Trimming	Parks and Rec	2218

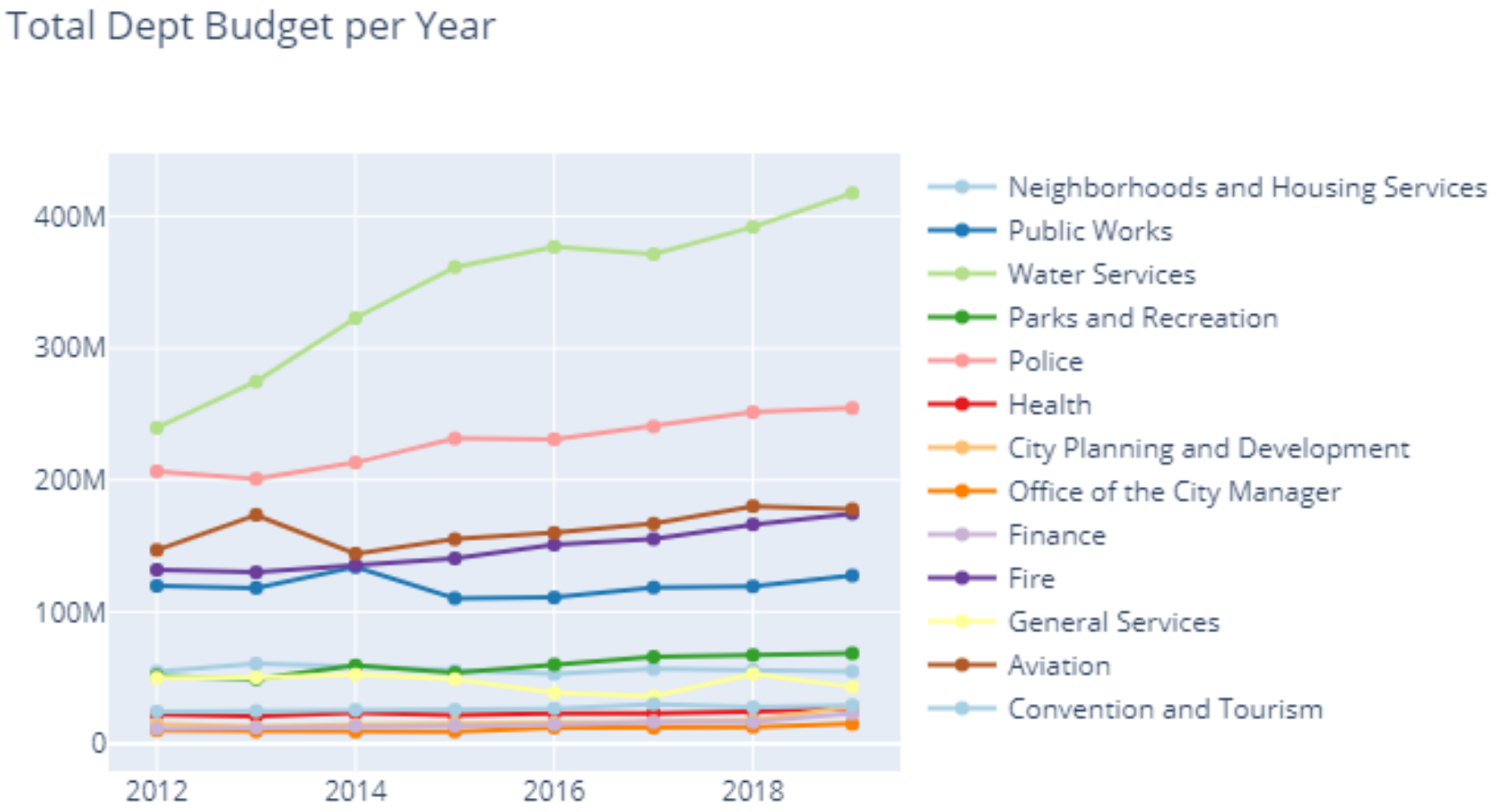
Department Works Breakdown

- 2019 call requests by category and type
- Based on the top 6 categories

CATEGORY	TYPE	DEPARTMENT	Count
Trash / Recycling	Bulky Pick Up	NHS	1448
	Dumping	NHS	3705
	Leaf / Brush	NHS	8792
		Water Services	1410
	Nuisance	NHS	5578
	Recycling	NHS	13214
	Services	NHS	2116
	Trash Collection	NHS	18575
Streets / Roadways / Alleys	Pothole	Public Works	19156
	Snow / Ice	Public Works	3734
Property / Buildings / Construction	Construction Issue/Concern	City Planning and Development	492
	Dangerous Building	NHS	1728
	Property Maintenance	NHS	8062
Animals / Pets	Cruelty or Neglect	NHS	1558
	Dead Animal	NHS	2961
	Rat Treatment	Health	1035
	Stray	NHS	5002
	Wildlife	NHS	1003
Water	Leak	Water Services	4873
	No Water / Pressure	Water Services	3025
	Pipeline Referral	Water Services	1984
Trees	Removal	Parks and Rec	2505
	Storm Damage	Parks and Rec	2197
		Parks and Rec	2548

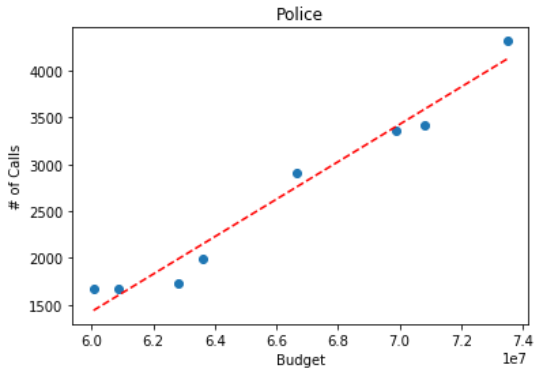
Budget vs Calls

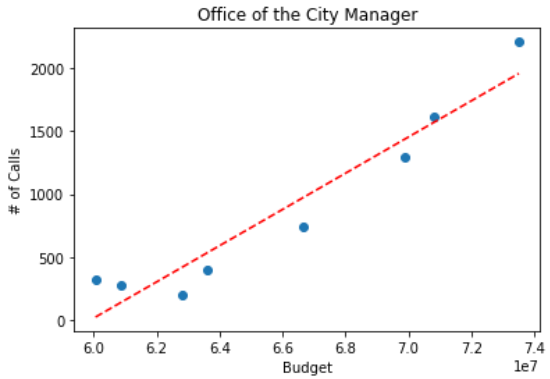
- Yearly budget 2012-2019 obtained from https://data.kcmo.org/Budget

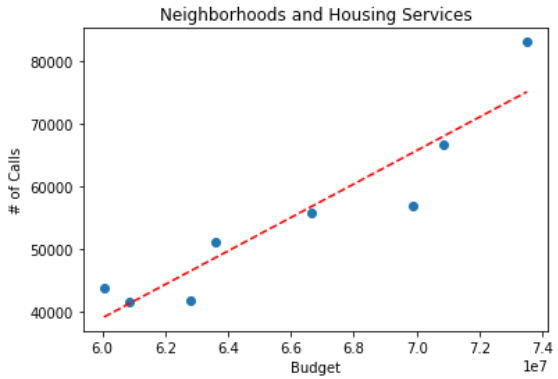


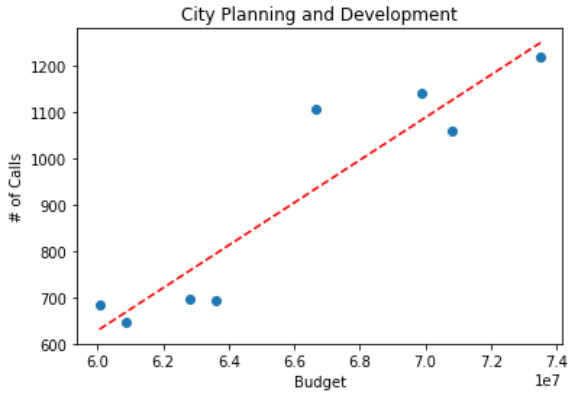
Budget vs Calls

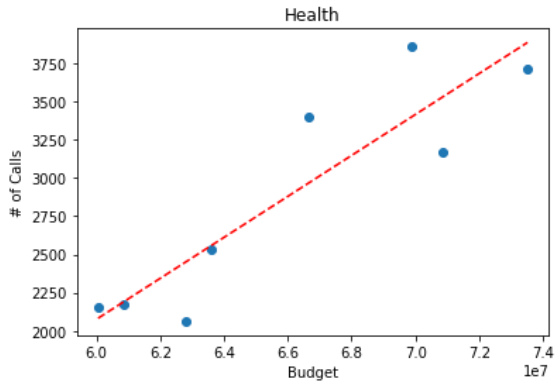
- Vendor Payments Calendar Year 2010-2019 obtained from https://data.kcmo.org/Budget.
- Each vendor payment recorded, broke down into monthly sums.
- Correlation calculated for each department to call frequency.

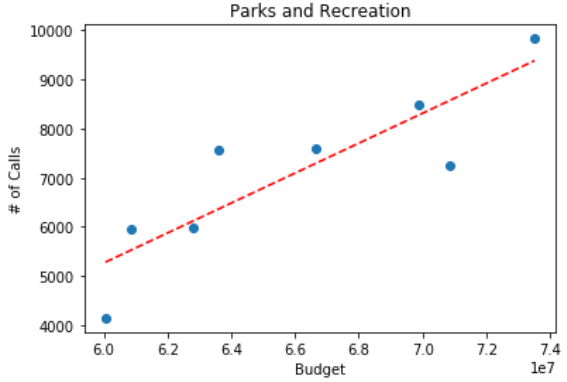










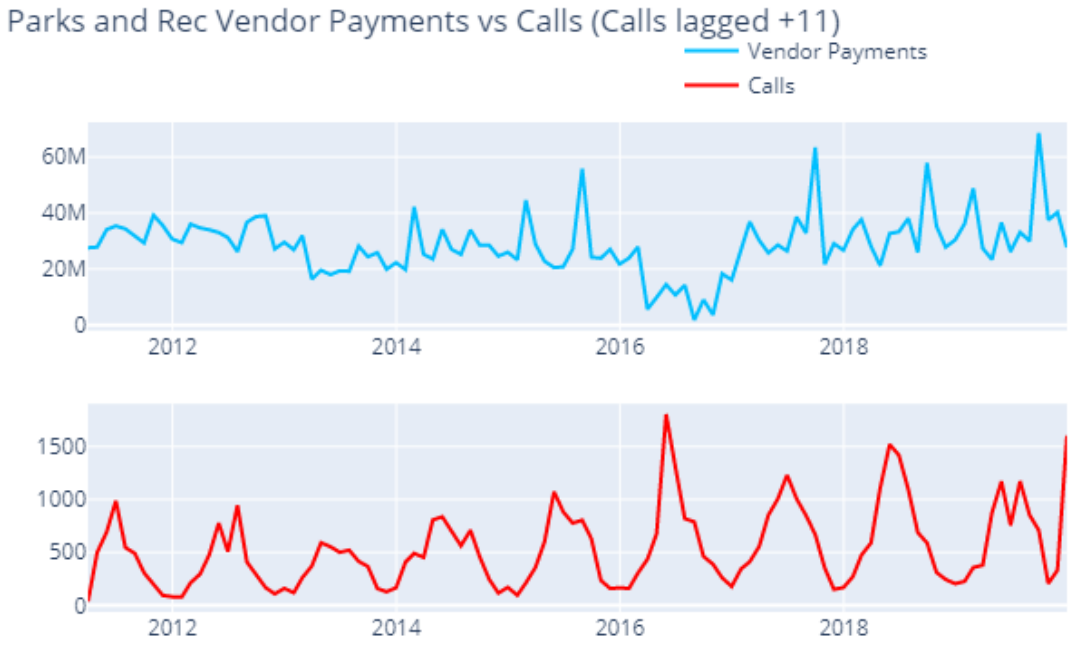


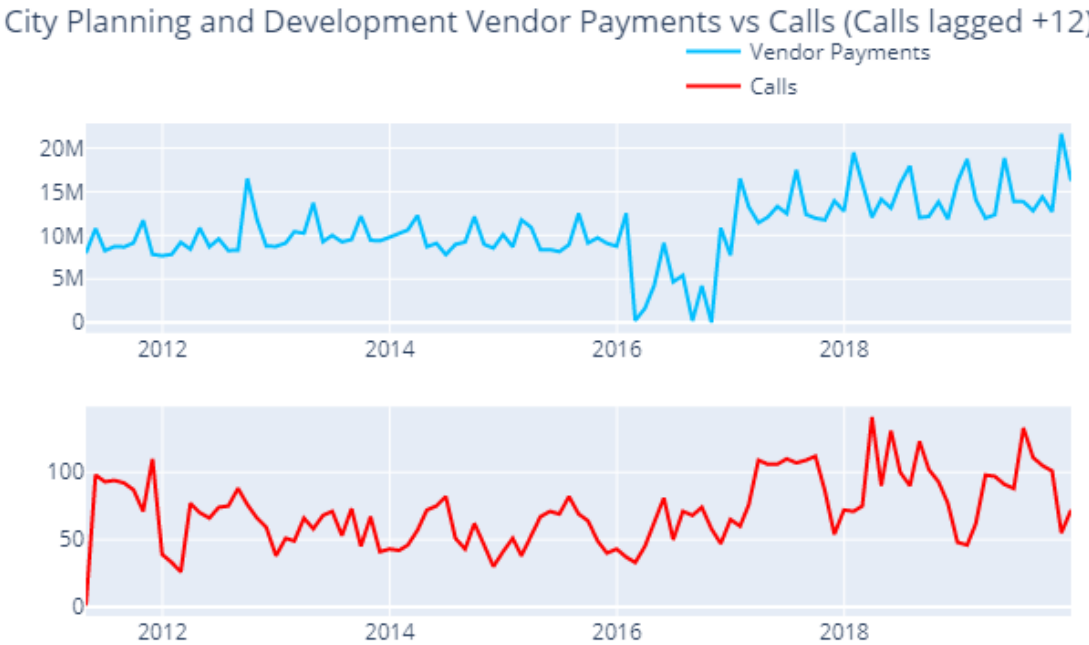
DEPARTMENT	R-SQUARED
KCPD	0.98
City Managers Office	0.96
NHS	0.93
City Planning and Development	0.93
Health	0.9
Parks and Rec	0.87
General Service	0.77
Finance	0.76
Water Services	0.73
Convention and Entertainment Center	0.71
Public Works	0.39
Aviation	0.3
Fire	0.15

Budget vs Calls

- Granger Test for Causality: Does 311 call volume affect monthly expenses?
- Parks & Rec, and Planning & Development significant lags.
- SARIMAX models created to predict dept monthly expenses
  - Predictor: Lagged 311 call volume dataset
  - Trained 2010-2018, Tested 2019

	PARKS & REC	CITY PLANNING & DEV
Call Lag	11	12
Model AIC	3330	3085
Call p-value	p<0.05	p<0.05

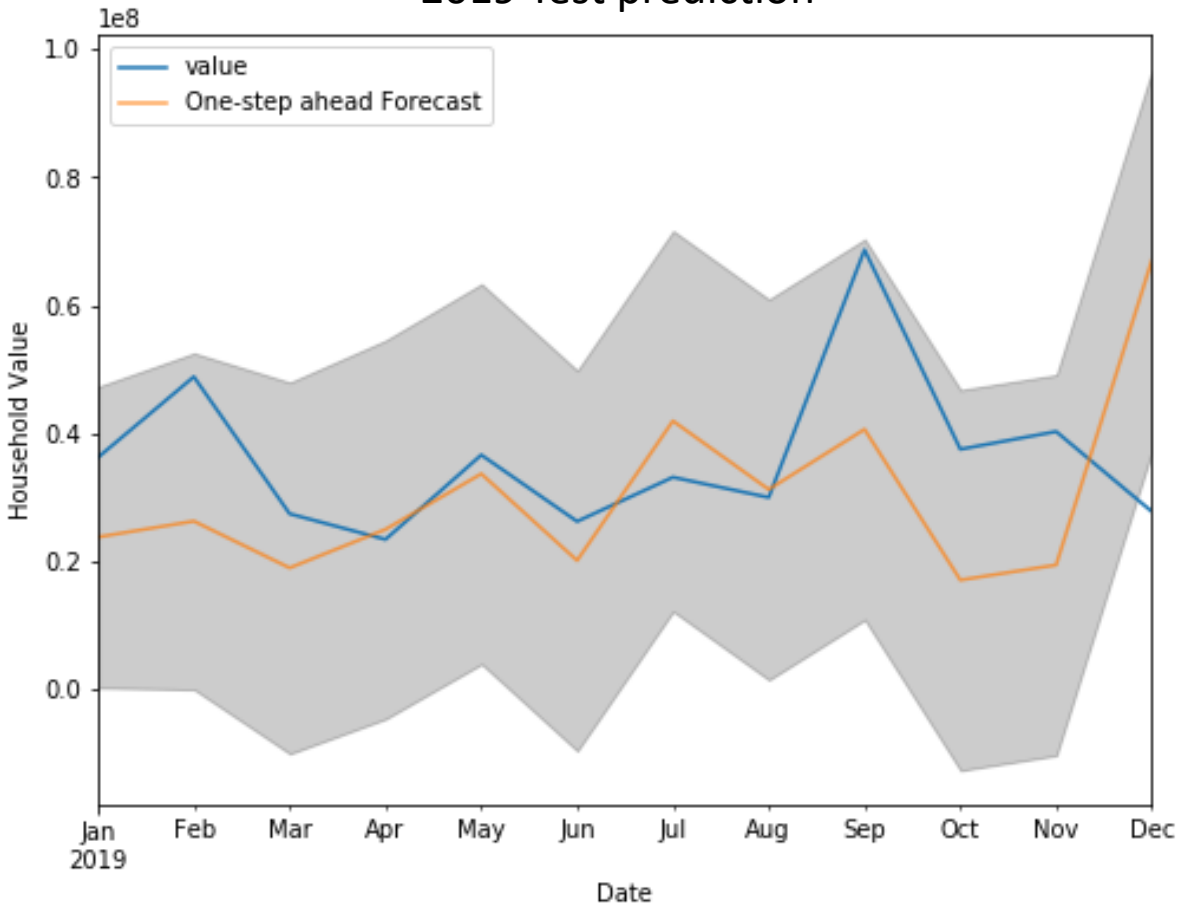




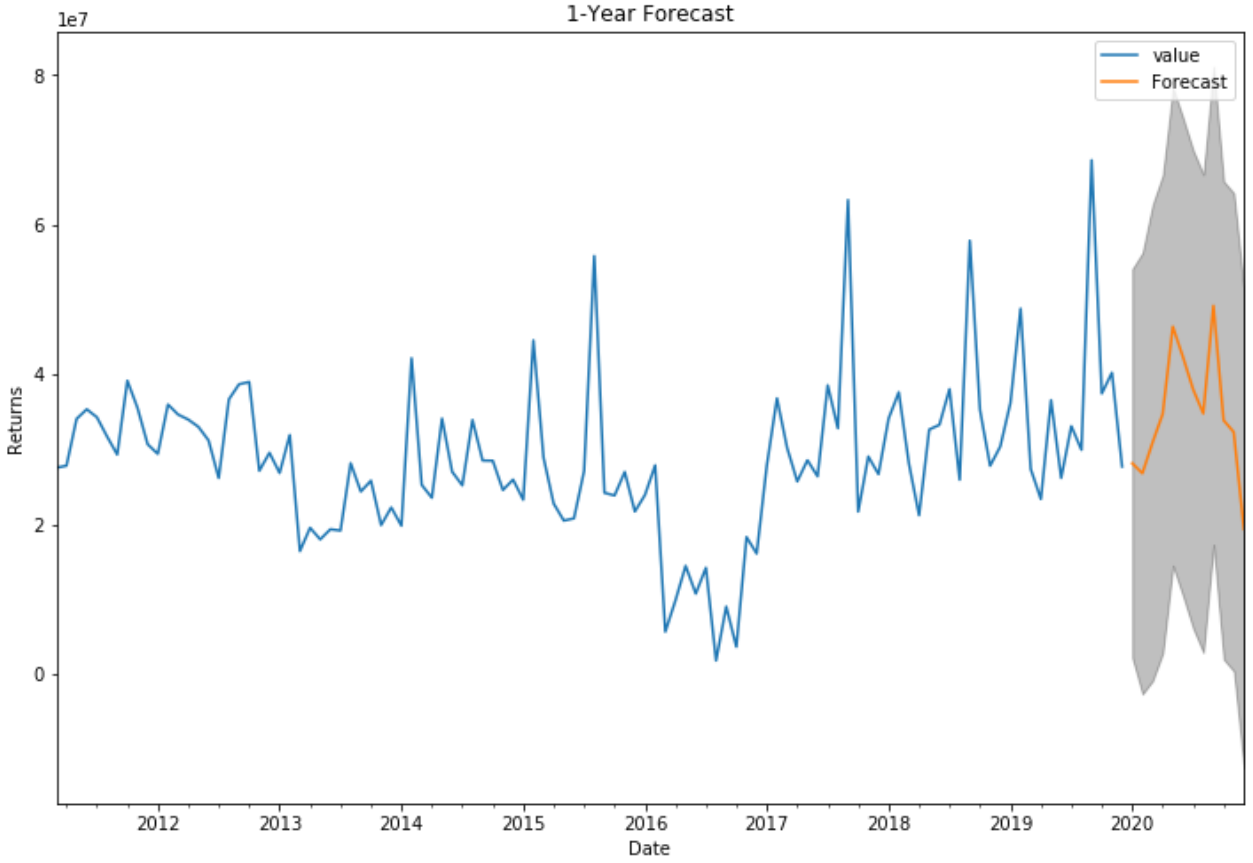
Budget vs Calls

- Parks & Rec 1-YR forecast

2019 Test prediction



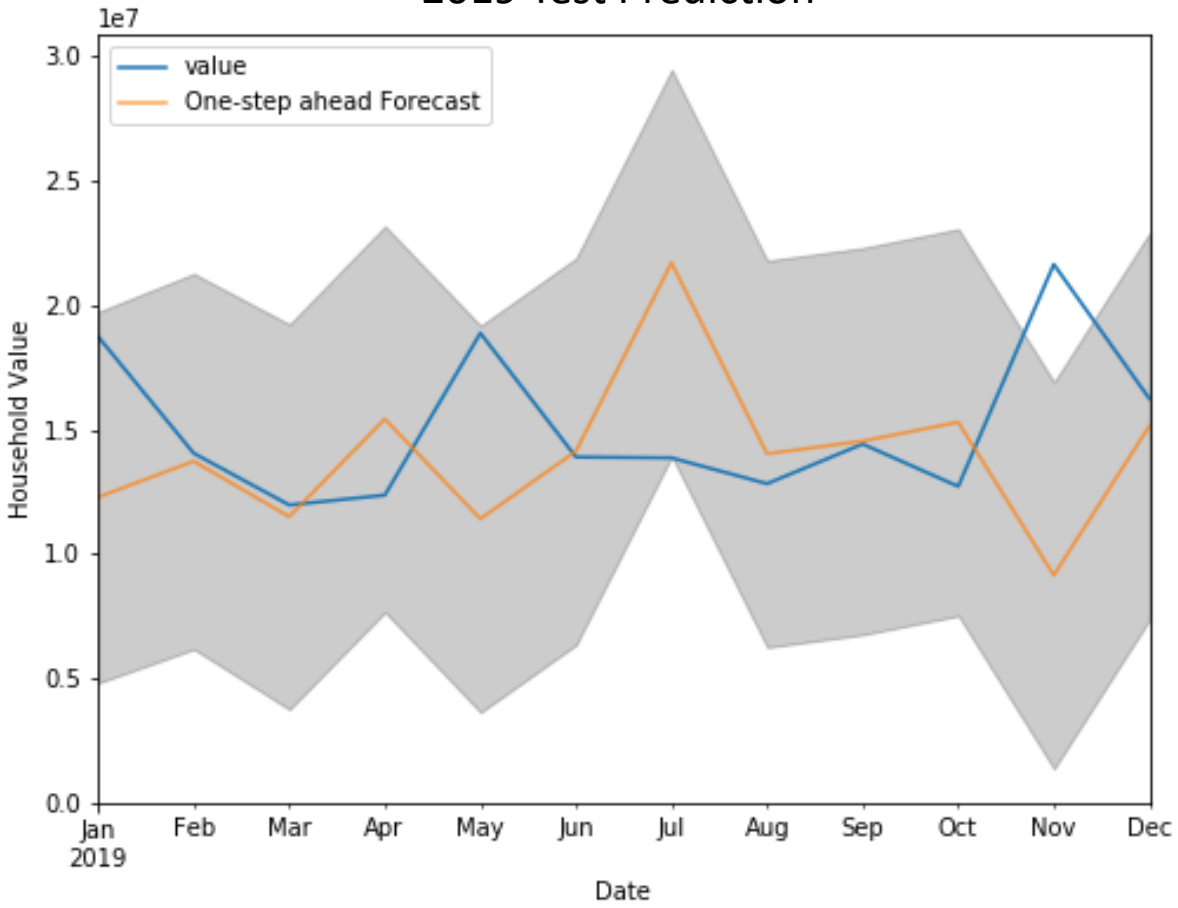
311 Call volume decrease: -42.4%, Expense decrease: -30.2%



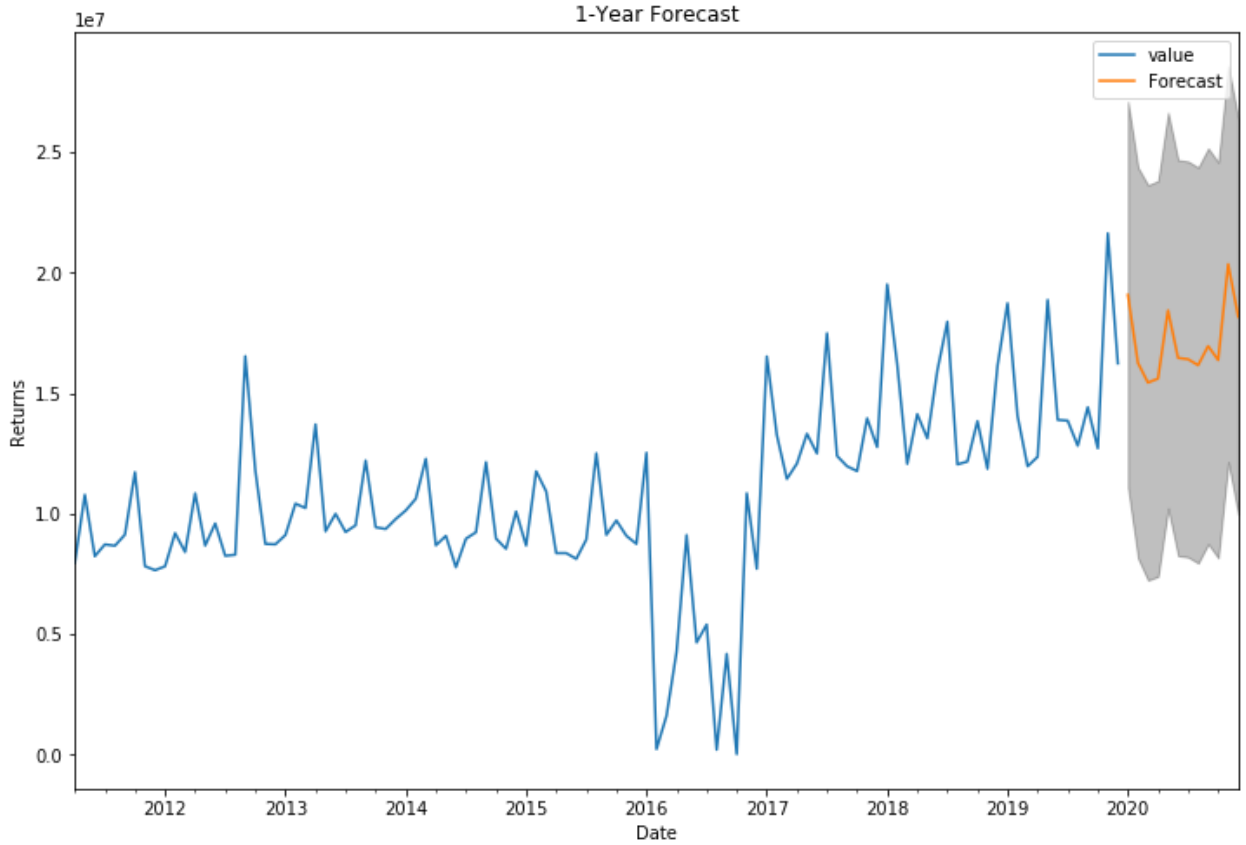
Budget vs Calls

- Planning & Development 1-YR forecast
- Results: 311 Call volume increase: 39.5%, Expense increase: 11.9%

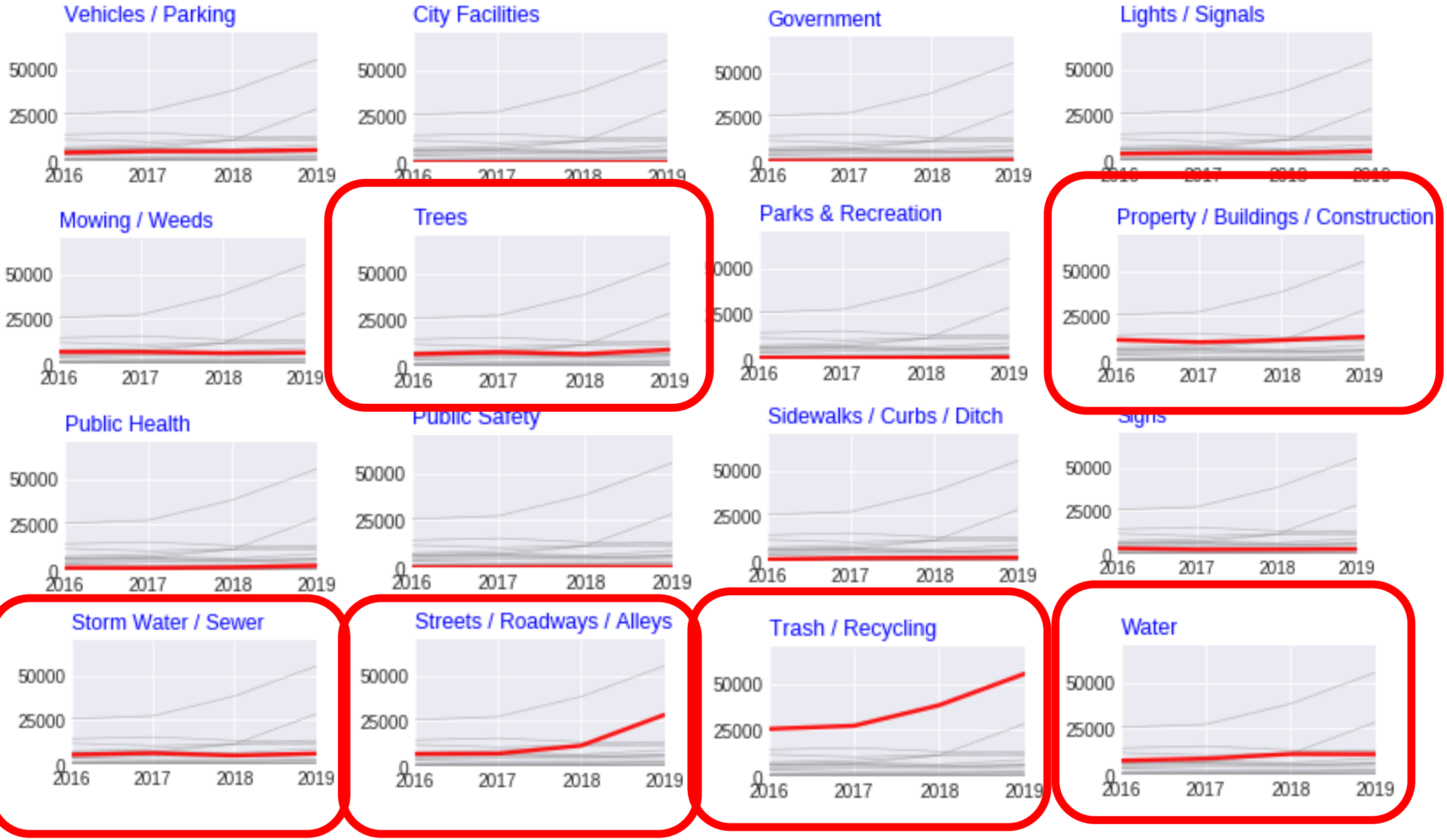
2019 Test Prediction



2020 Expenses Forecast

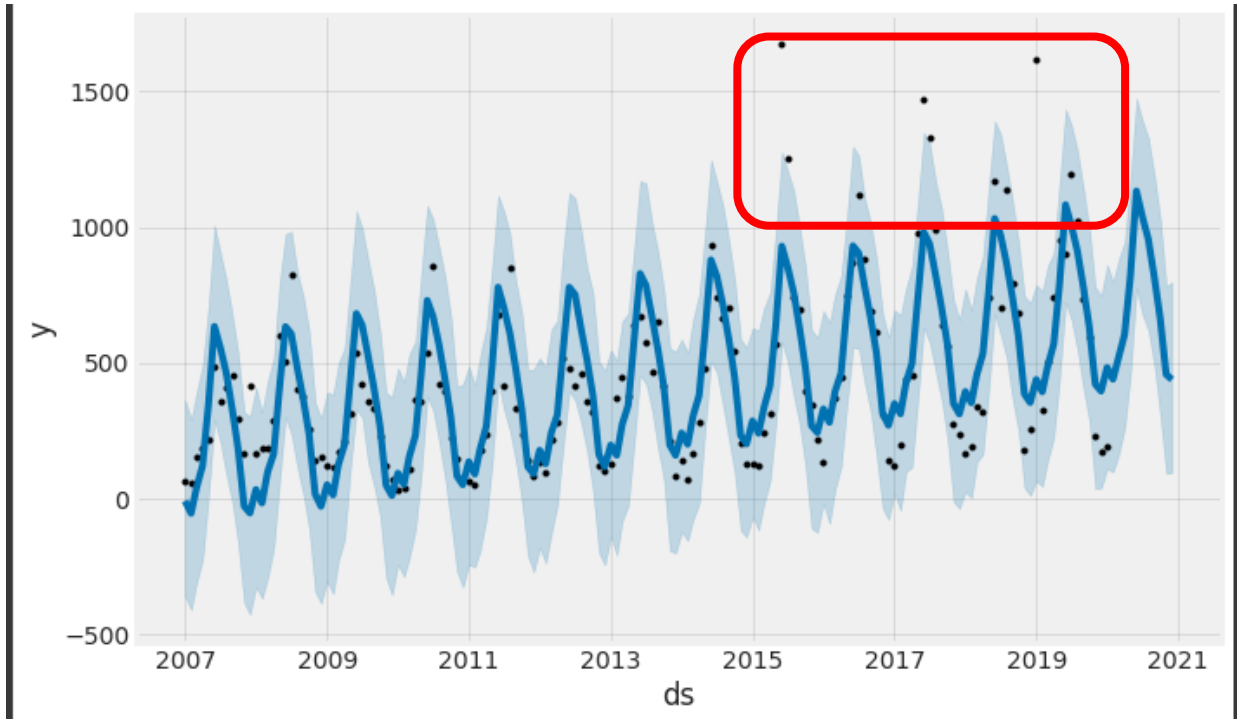


Requests by year: Category Breakdown

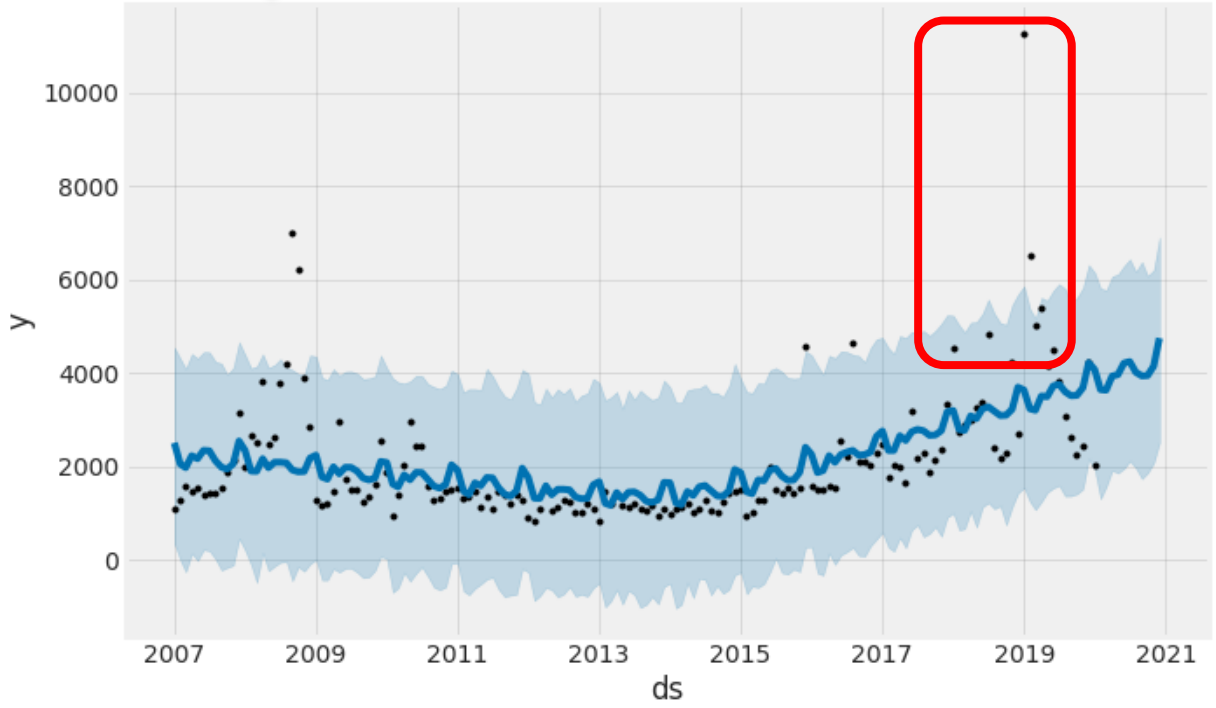


Time series forecast for tickets

Tree Requests



Trash Requests



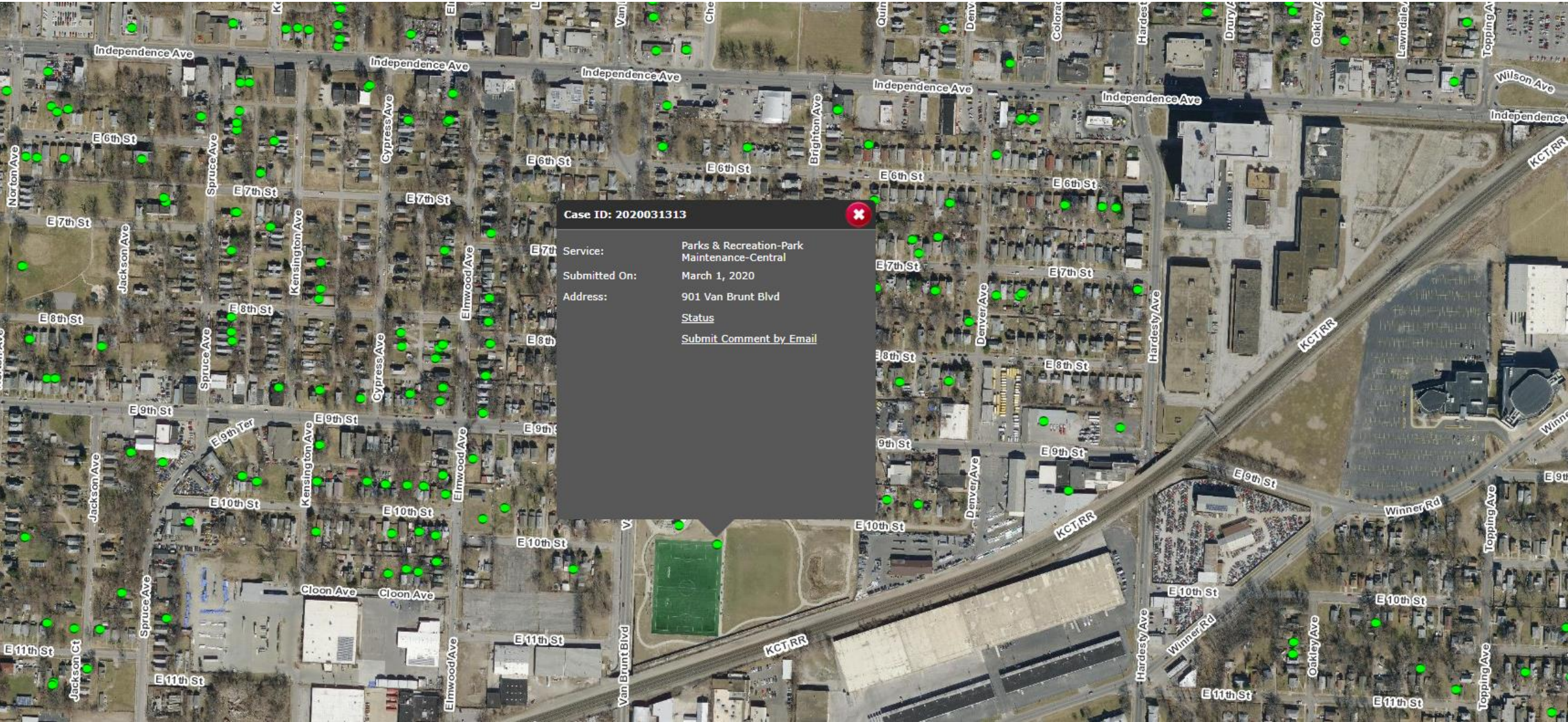
Recommendations:

- Keep Categories consistent year over year.
  - Document when they are changed, that way identifying growth drivers could be more easily found.
- Logistics for removing trashing and keeping powerlines clean makes up over 70% of all requested tasks.
- Harsh road conditions impact these areas, so road cleaning/infrastructure is another good potential.
- Budget drivers documented/between departments.

Appendix:


Trash Collection
Geo-Maps DEMO
North Kansas City
Kansas City
Independence
Buckner
Lake City Army Ammunition Plant
Shawnee
Merriam
Raytown
Blue Springs
Grain Valley
Prairie Village
Overland Park
Leawood
Lee's Summit
MO 291
US 24
MO 78
MO 350
MO 7
Fleming Park

Open Request Dashboard for KC requests

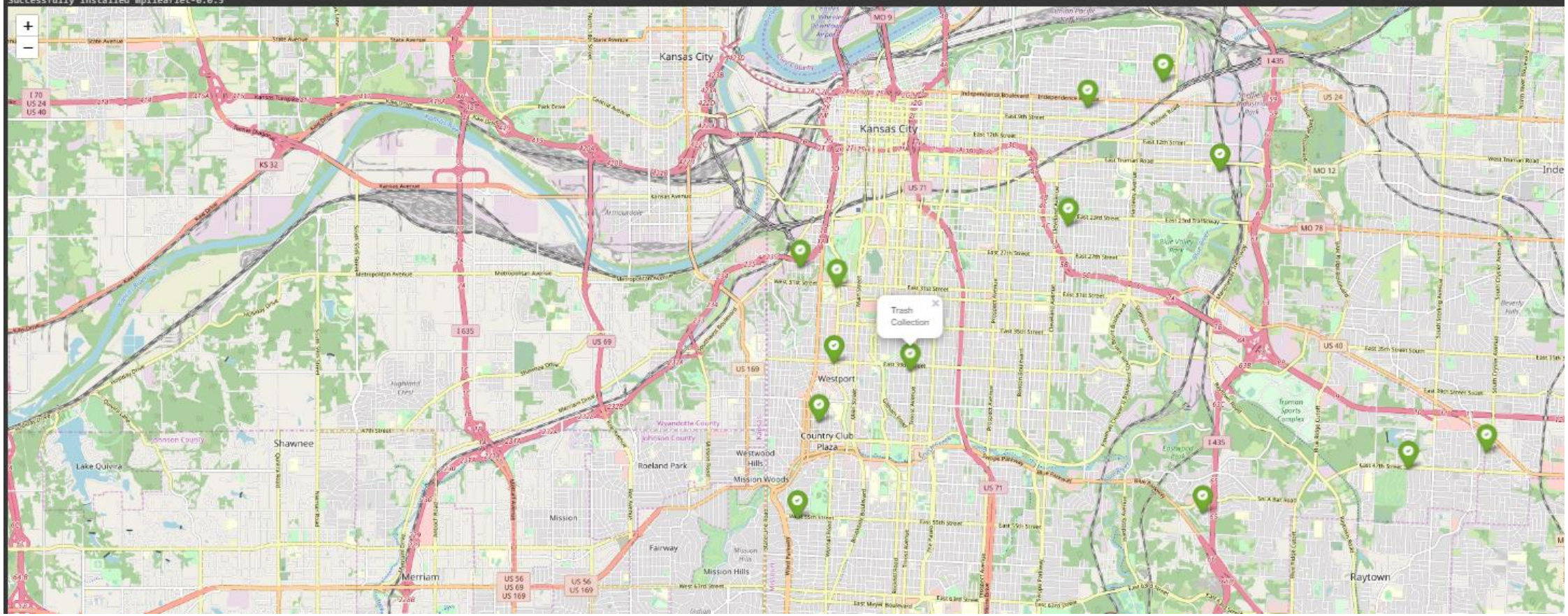


```
            popup=map_df.iloc[1]['TYPE'],
            icon=folium.Icon(color='green', icon='ok-sign')
            ).add_to(myMap)
```

```
  # name of the pub when  it is clicked
# marker type options, just didn't want the old map style
# adding those options to the map
```

```
# Display the map.
display(myMap)
```

```
  Stored in directory: /root/.cache/pip/wheels/bf/fd/0b/0513de62c339c4a56e2234aa42a5d06e6668a4446fdae7b796
Successfully built mplleaflet
Installing collected packages: mplleaflet
Successfully installed mplleaflet-0.0.5
```



KC to SF : Background Demographics

Kansas City

- Population: 491,918
- City size (Sq. Mi.): 319
- Median Age: 34.1
- Ave. Household Income: $45,376
- Medium Property Value: $125,301

San Francisco

- Population: 883,305
- City size (Sq. Mi.): 46.87
- Median Age: 38.3
- Ave. Household Income: $112,376
- Medium Property Value: $1,204,899

KC to SF : 311 Data

Kansas City

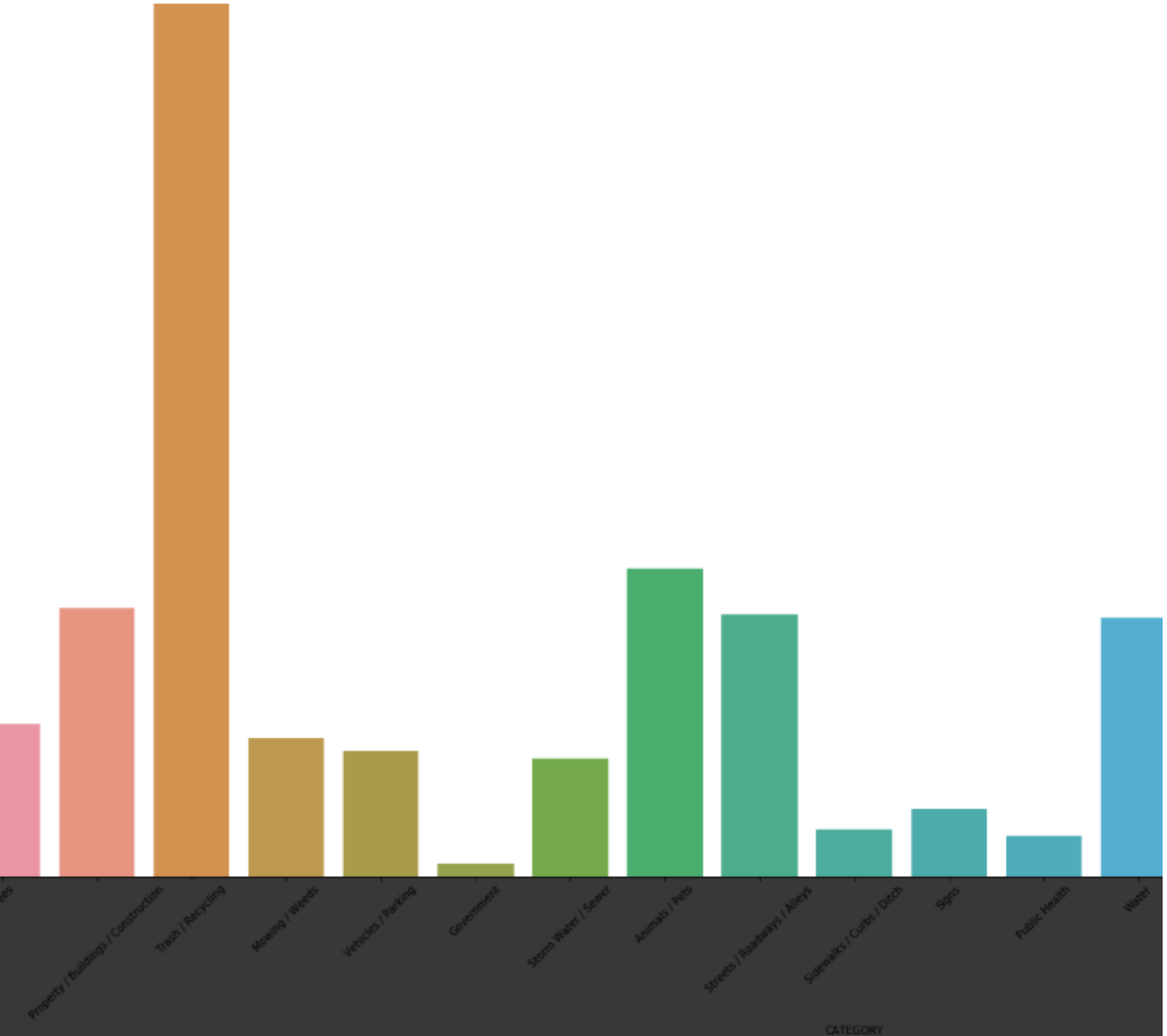
- Data Size: 348 Megabytes
- Shape of data:
  - Rows: 1.4 million and growing
  - Columns: 30

San Francisco

- Data Size: 1.99 Gigabytes
- Shape of Data:
  - Rows: 4.4 Million and growing
  - Columns: 47 columns*

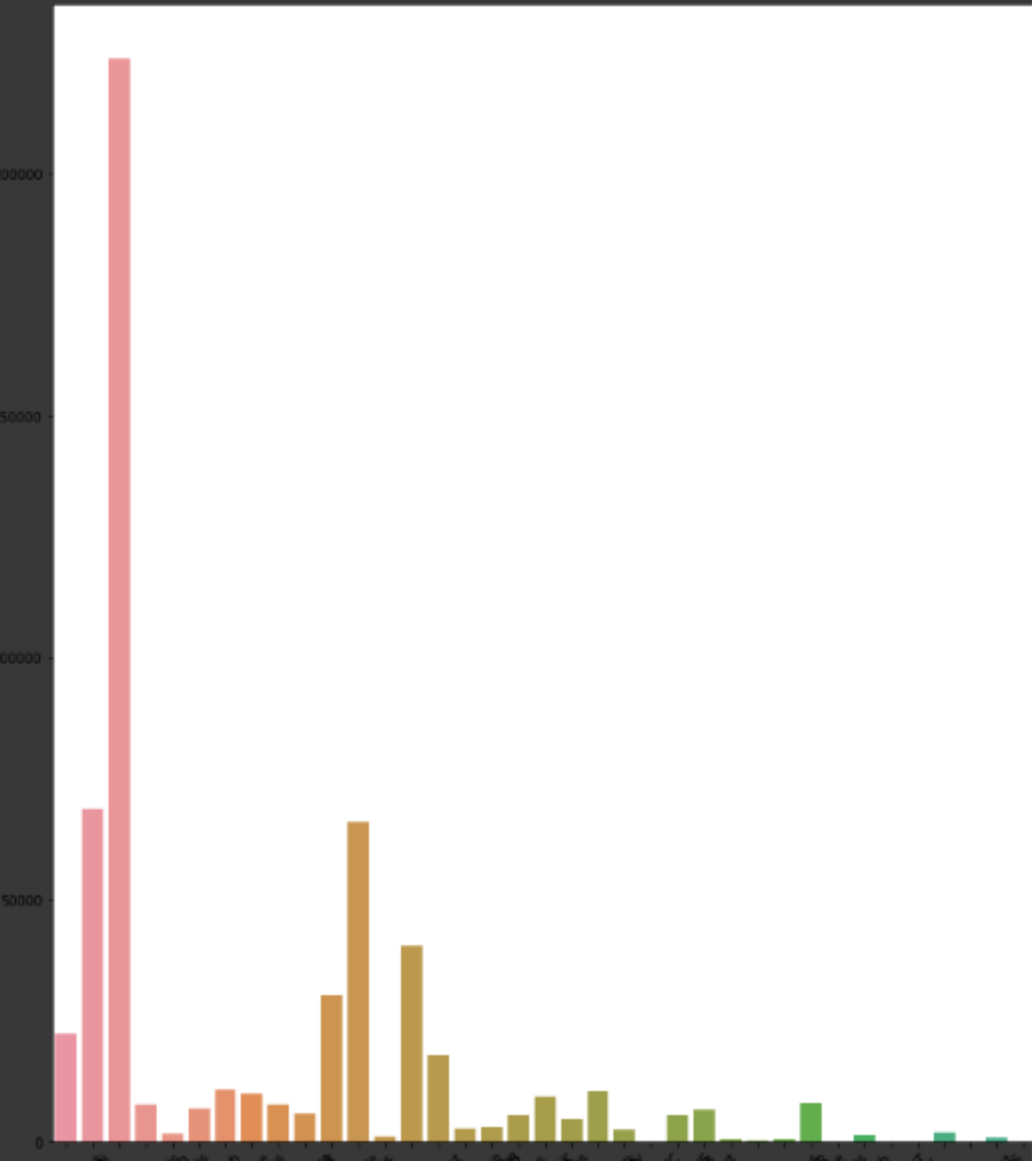
Data Issues:

- SF: Has a bunch of columns that only tracked started in 2018 on.
- SF: Switches categories around 2018 from prior
- KC and SF have different Categories and Departments
- KC also relabels the request depending on responding party.



KC- 2018 Breakdown

- 'Trees'
- 'Property / Buildings / Construction'
- 'Trash / Recycling'
- 'Mowing / Weeds'
- 'Vehicles / Parking'
- 'Government'
- 'Storm Water / Sewer'
- 'Animals / Pets'
- 'Streets / Roadways / Alleys'
- 'Sidewalks / Curbs / Ditch'
- 'Signs'
- 'Public Health'
- 'Water'
- 'Public Safety'
- 'Parks & Recreation'
- 'Capital Projects'
- 'Lights / Signals'
- 'City Facilities'

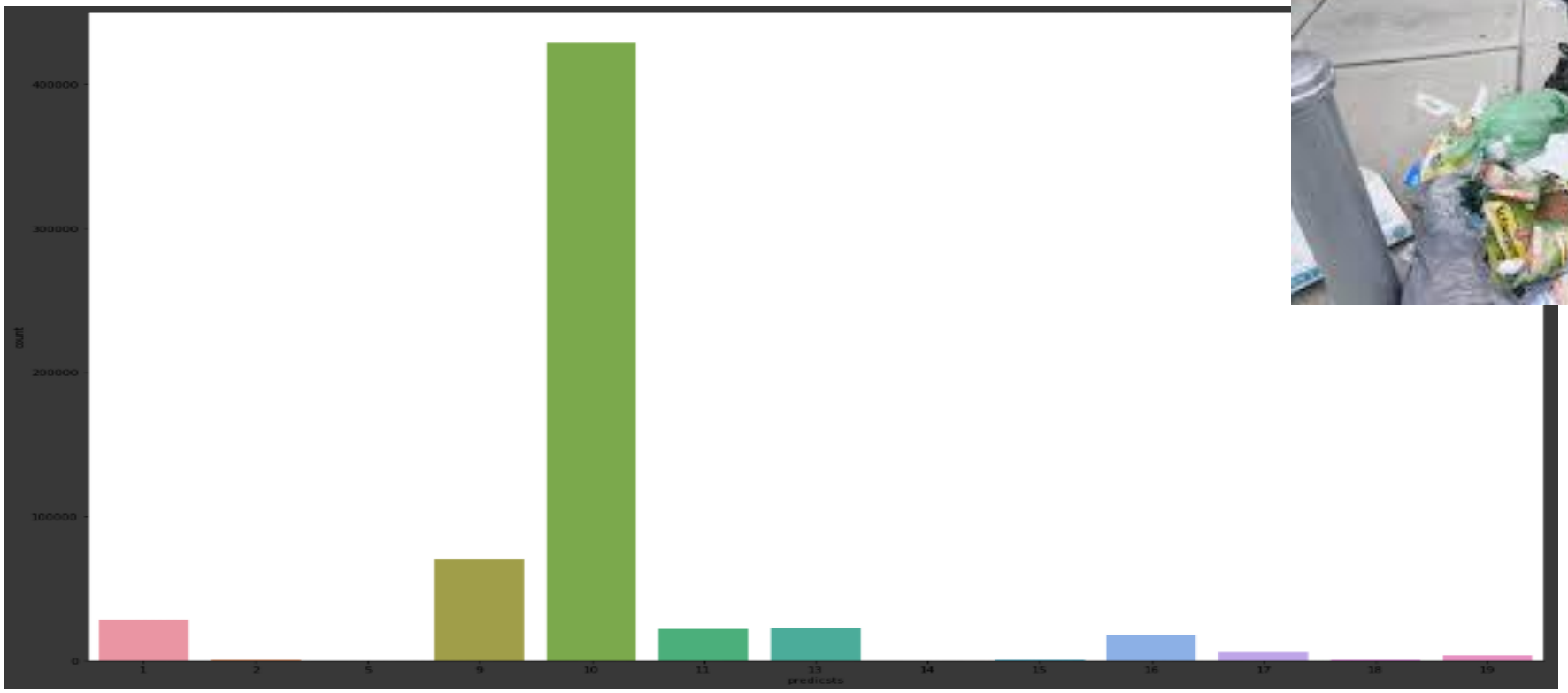


SF- 2018 Breakdown

- 'MUNI Feedback'
- 'Graffiti'
- 'Street and Sidewalk Cleaning'
- 'Street Defects'
- 'SFHA Requests'
- 'Sidewalk or Curb'
- 'Tree Maintenance'
- 'Sewer Issues'
- 'General Request - MTA'
- 'Sign Repair'
- 'Abandoned Vehicle'
- 'Encampments'
- 'General Request - 311CUSTOMERSERVICECENTER'
- 'Parking Enforcement'
- 'General Request - PUBLIC WORKS'
- 'General Request - DPH'
- 'General Request - COUNTY CLERK'
- 'Streetlights'
- 'Litter Receptacles'

KC Natural Language Categorization

Method	Accuracy
Naïve Bayes (MultinomialNB)	0.9410202767943354
LinearSVC	0.9524460894753782
SGDClassifier	0.9410308767943250



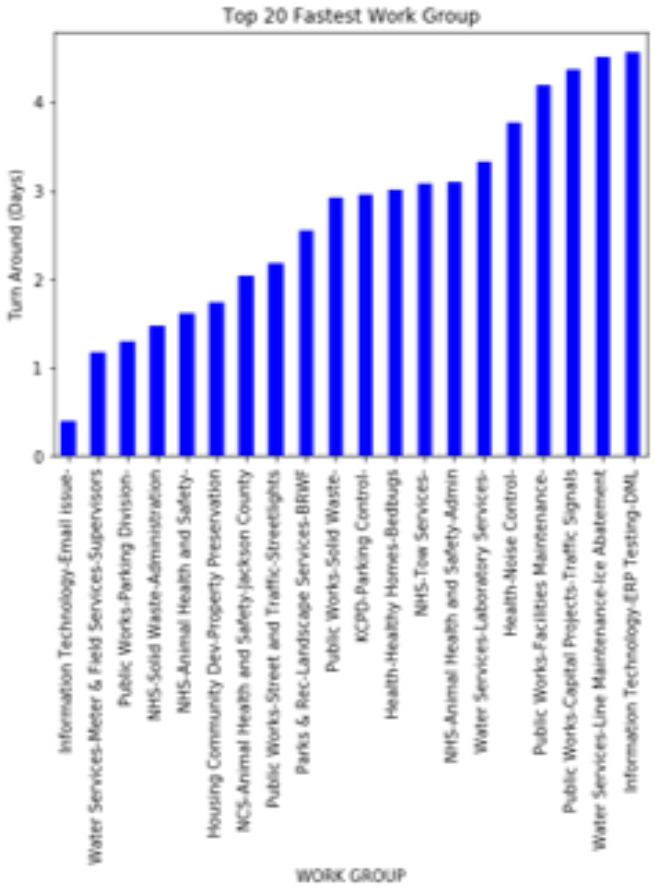
Data Dictionary

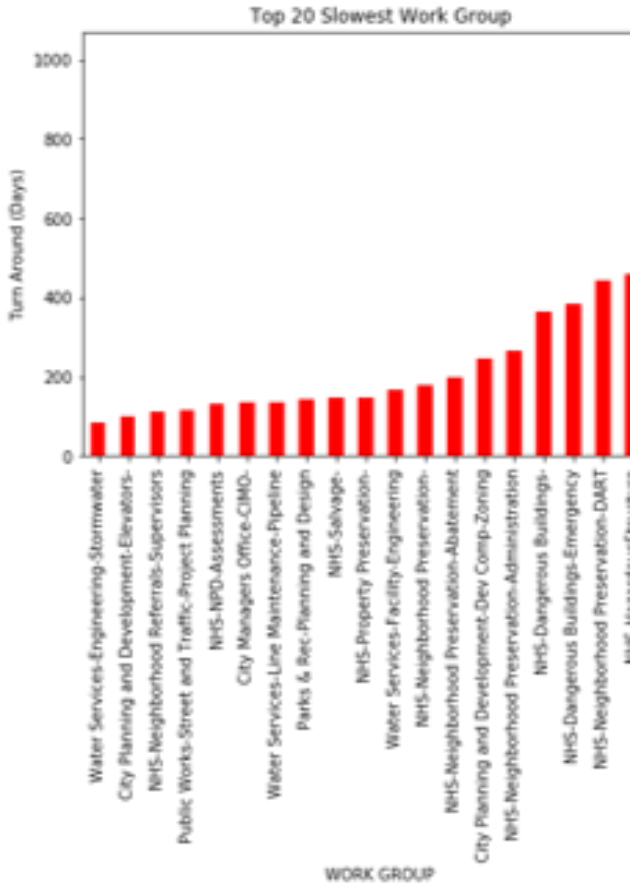
Field	Definition	Type
CASE ID	The unique identifier of the 311 call	String
SOURCE	A description of how the 311 call was received. (Phone, Email, Website, etc.)	String
DEPARTMENT	What department the 311 call is assigned too.	String
WORKGROUP	The workgroup within the department that works the call.	String
REQUEST Type	A category variable of different types of request. (Is a combination of Category and Type)	String
CATEGORY	A more generic category variable of the call.	String
TYPE	A more generic category variable of the call.	String
DETAIL	A brief detail summarizing the request type.	String
CREATION DATE	Date field of when the request was created. (MM/DD/YYYY)	Date
CREATION TIME	Time field stating when request was created.	String
CREATION MONTH	A numeric range form 1-12 signifying what month the request was created.	Numeric
CREATION YEAR	A numeric field, signifying what year the request was created.	Numeric
STATUS	A string category field, showing what the status of the ticket currently is.	String
EXCEEDED EST TIMEFRAME	A binary Y/N field that signifies if the request exceeds the estimated timeframe.	String
CLOSED DATE	Date field of when the request was closed. (MM/DD/YYYY)	Date
CLOSED MONTH	A numeric range form 1-12 signifying what month the request was closed.	Numeric
CLOSED YEAR	A numeric field, signifying what year the request was closed.	Numeric
DAYS TO CLOSE	A numeric field showing the data difference between created and closed rounded to the next whole int.	Numeric
STREET ADDRESS	A string field containing the address of the requested incident.	String
ADDRESS WITH GEOCODE	A string field containing the address and geocodes of the requested incident.	String
ZIP CODE	The zip code of the address of the request.	Numeric
NEIGHBORHOOD	If the requested address is found within a registered neighborhood, the name of the neighborhood.	String
COUNTY	The count of the address for the request.	String

COUNCIL DISTRICT	A numeric field showing what district the complaint comes from.	String
POLICE DISTRICT	What police district does the complaint fall under.	String
PARCEL ID NO	If a stolen package, what parcel ID number was the package.	Numeric
LATITUDE	The geocode for the address signifying latitude.	Numeric
LONGITUDE	The geocode for the address signifying longitude.	Numeric
CASE URL	A URL to the case that contains the work logs and comments for the call.	String
30-60-90 DAYS OPEN WINDOW	No idea of this field it is either blank or all zeroes.	String

Turn-Around Time

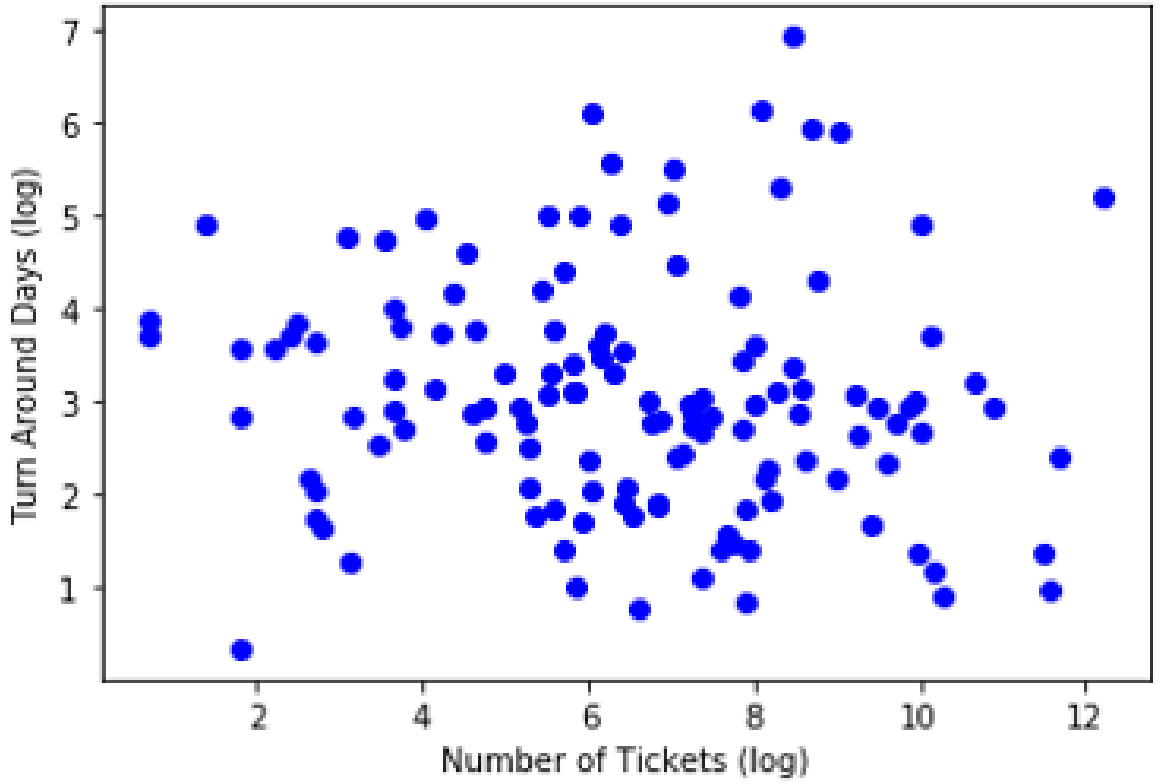
- Work groups which take less time to resolve get addressed first – health, technology, safety
- Work groups requiring more time and thorough decision making get addressed in longer order





Turn-Around Time

- Turn-around time for work groups showed no distinct pattern.
- Work groups with



	A	B	C	D
1	year_mon	CATEGORY	Counts	
621	2014M3	Trash / Recycling	32	
673	2014M4	Trash	1168	
674	2014M4	Trash / Recycling	23	
729	2014M5	Trash	1001	
730	2014M5	Trash / Recycling	32	
784	2014M6	Trash	1049	
785	2014M6	Trash / Recycling	61	
841	2014M7	Trash	1270	
842	2014M7	Trash / Recycling	29	
897	2014M8	Trash	1014	
898	2014M8	Trash / Recycling	37	
953	2014M9	Trash	996	
954	2014M9	Trash / Recycling	43	
011	2015M1	Trash	1450	
012	2015M1	Trash / Recycling	48	
036	2015M10	Trash / Recycling	1451	
054	2015M11	Trash / Recycling	1561	
072	2015M12	Trash / Recycling	4575	
118	2015M2	Trash	904	
119	2015M2	Trash / Recycling	49	
176	2015M3	Trash	912	
177	2015M3	Trash / Recycling	100	
236	2015M4	Trash	1191	
237	2015M4	Trash / Recycling	87	
299	2015M5	Trash	1179	
300	2015M5	Trash / Recycling	96	
363	2015M6	Trash	981	
364	2015M6	Trash / Recycling	1002	
389	2015M7	Trash / Recycling	1517	
408	2015M8	Trash / Recycling	1443	
426	2015M9	Trash / Recycling	1554	
444	2016M1	Trash / Recycling	1598	
463	2016M10	Trash / Recycling	2104	
481	2016M11	Trash / Recycling	2038	
499	2016M12	Trash / Recycling	2291	
518	2016M2	Trash / Recycling	1500	
536	2016M3	Trash / Recycling	1513	

Data Issues for predicting

- Tickets are assigned to work groups. But workgroups are not always distinct to a department/nor category. Example, in 2019, Trash/Recycling pickup tickets, were worked in Parks and Rec./ NHS / Water Services.
- KC also does trash pickup as part of water services when it comes to billing. And these 311 tickets in 2018 was under the Water Services.
- Thus, hard to get a regression to predict, because the growth drivers are not always present/aligned to the budget.

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