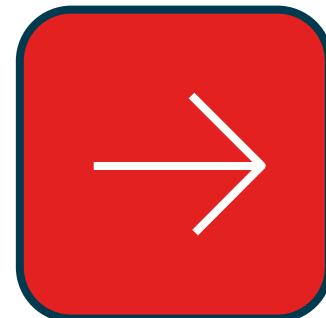
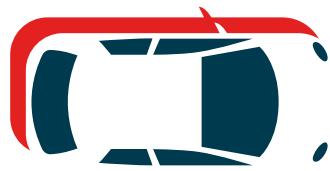


# NYC PARKING Strategy





# Presenters

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[Tableau Dashboard](#)

# The Challenge of Scarce Parking in NYC

- High Population Density
- Limited Infrastructure
- Complex Street Layout
- Stringent Regulations
- Other:
  - Rising vehicle ownership, public transportation gaps, economic impacts, seasonal variations, etc.



# Preparing the Ground: Data Cleaning

**Starting point:** four huge files.

Download: change data types (object > category) and parse dates or use parquet.

Total: 13+ GB of data in 51 columns 42339438 rows (tickets)

**Issues to address:**

- duplicated rows in data 2015 (7%) - dropped
- missing values:
  - 11 columns are empty (100 - 99.9% mv) - dropped
  - 5 columns have more than 68% missing values - dropped
  - 2 columns - 43% mv, 9 columns - 11-26% mv - restored where possible
- irrelevant columns (for our task) which make files heavy - dropped
- errors, inconsistent values in remaining columns - need cleaning.

# Data Preprocessing: getting Final Dataset

## Cleaning relevant columns:

- date and time preprocessing:
  - filtering dates by fiscal year, then **4 datasets merged in one**
  - proper formatting
- counties, precincts, vehicle body types, street names are edited
- missing counties (9.6%) were filled with counties corresponding to precincts (1-34 Manhattan, 40-52 Bronx , 60-94 Brooklyn, 100-115 Queens, 120-123 Staten Island)
- missing violation descriptions (about 10%) were filled with most common values for the corresponding description code
- filtering descriptions : tickets with descriptions not related to parking/standing were filtered out.

Now our clean, precise and relevant data on parking issues can ensure accurate and reliable insights about parking in NYC.

**Final data :** 1.5+ GB

33932135 tickets

(80% of initial tickets)

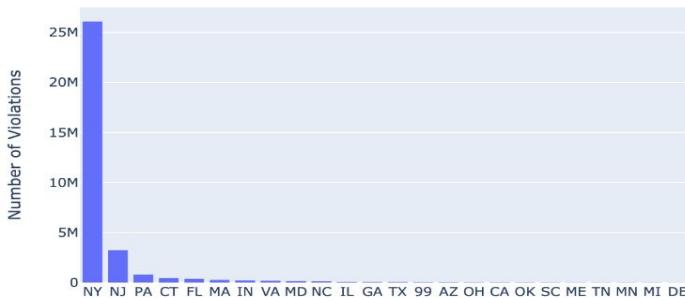
10 parameters:

1. plate\_id
2. plate\_type
3. registration\_state
4. vehicle\_body\_type
5. violation\_description
6. violation\_precinct
7. violation\_county
8. house\_number
9. street\_name
10. issue\_datetime

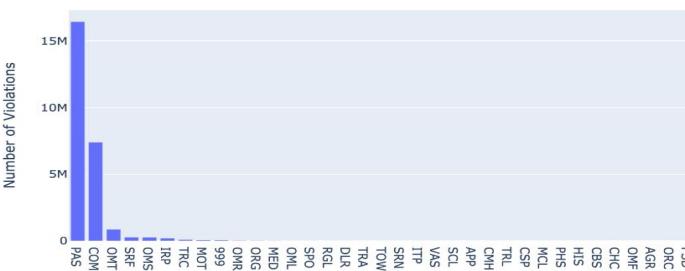
# Understanding the Parking Landscape



### Number of violations in NYC by vehicle registration state



## Number of violations in NYC by vehicles with different plate types

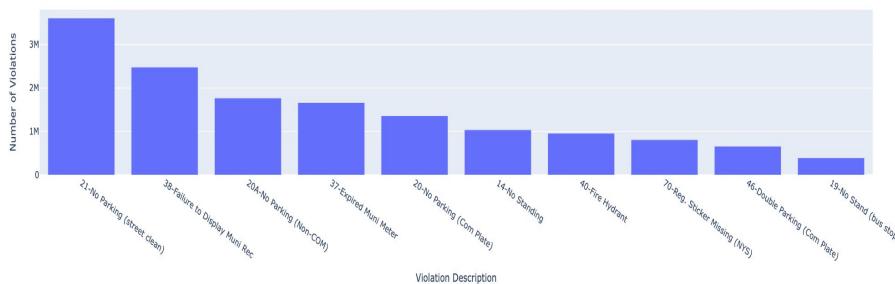


- 77% of the violations came from the vehicles with NY registration.
  - 63% of the total number of violations made by passenger vehicles.
  - Another 28% were made by commercial vehicles.

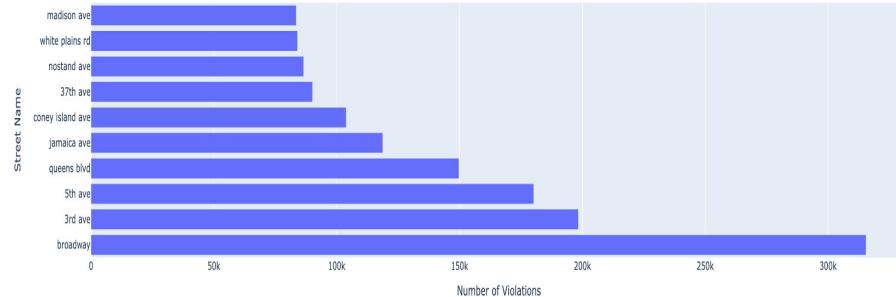


# Insights into Passenger Vehicles

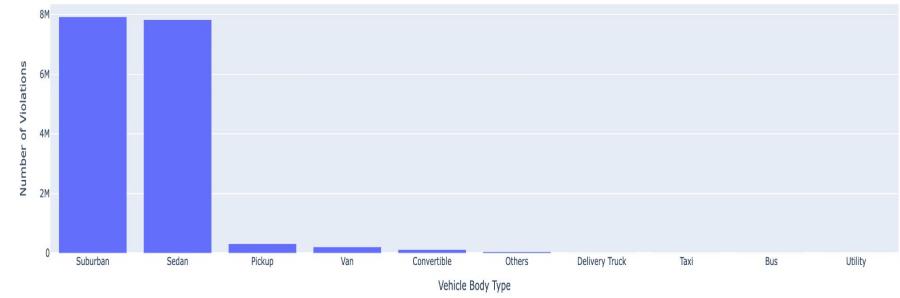
Popular violations in NYC made by vehicles with passenger plates



Streets with most number of violations for passenger vehicles in NYC



Passenger type vehicle body types that had the most violations in NYC

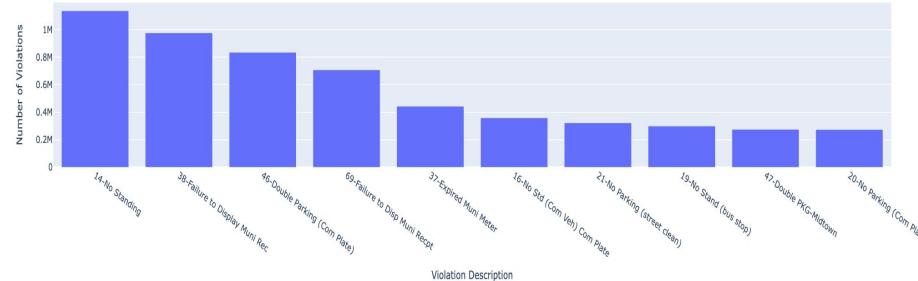


- Most popular violations are: Parking during street cleaning hours, failure to display receipt and no parking.
- Vehicle body types that had the most violations are Suburbans and Sedans.
- Majority of violations in NYC were made on Broadway, 3rd Ave and 5th Ave.

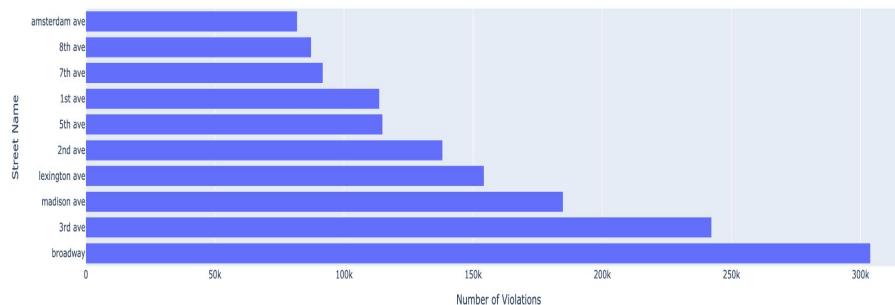


# Navigating Commercial Vehicle Challenges

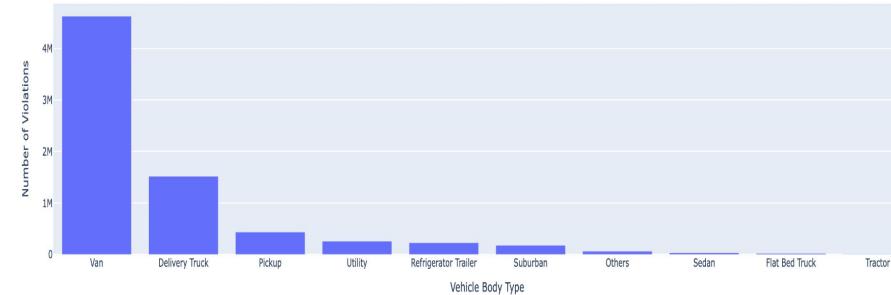
Popular violations in NYC made by vehicles with commercial plates



Streets with most number of violations for commercial vehicles in NYC



Commercial type vehicle body types that had the most violations in NYC



- Most popular violations are: No standing violation, failure to display receipt and double parking.
- Vehicle body types with the most violations are Vans, Delivery trucks and Pickups.
- Majority of violations in NYC were made on Broadway, 3rd Ave and Madison Ave.



## Per County Analysis

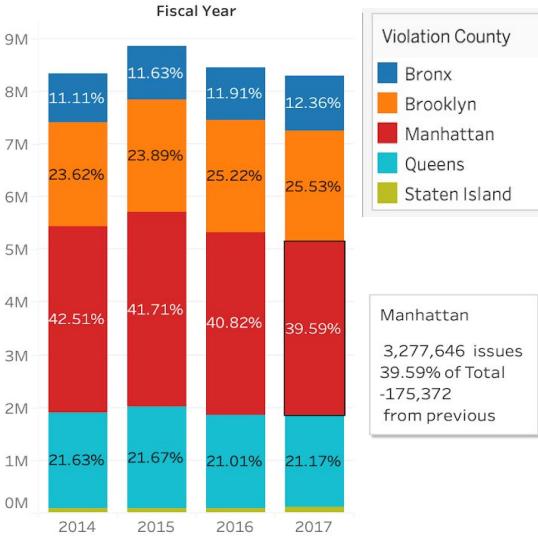
- Most of the violations in every county were made by local vehicles.
- The majority of violations were made in Manhattan.
- Majority of violations across counties were made by vehicles with passenger plates.
- **Exception is Manhattan** - vehicles with commercial plates made the most violations.



## Per County Analysis

- Top 2 violations for vehicles with passenger plates were for parking during street cleaning hours and failure to display receipt.
- Popular violations for vehicles with commercial plates are failure to display receipt, no standing and double parking.
- Streets with most violations differ per county due to different street names .
- Precincts that gave most number of violations vary across counties except Queens and Staten Island.

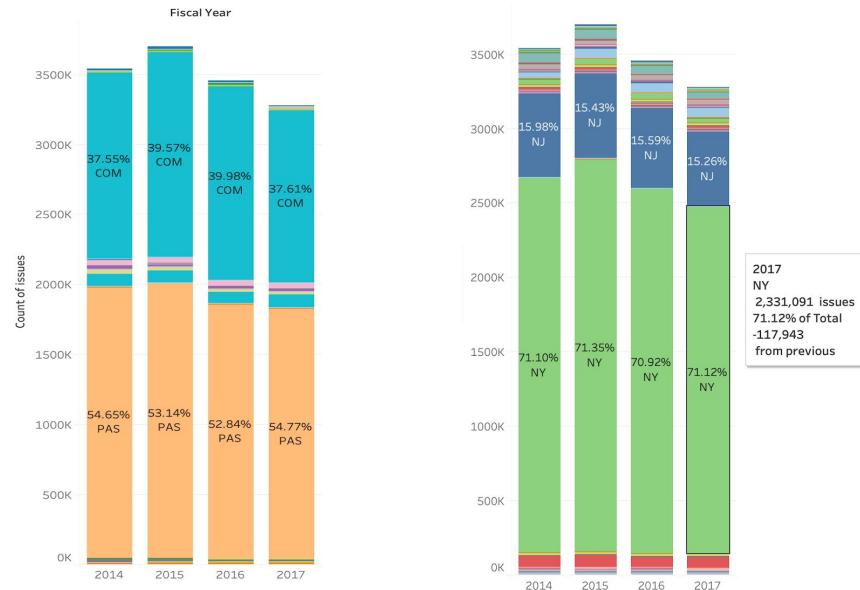
# Yearly Dynamics: 2014 -2017 fiscal years



- **Total number** of parking violations is gradually decreasing: 2016 -4.6%, 2017 -2.1%, but is still very high in 2017: 827948 issues.
- **Share per county** from 2015 to 2017 :
  - Manhattan: decreasing
  - Bronx, Staten Island : growing

The distribution of violations per **Plate Type** and **Registration State** is the same across all years (changes within 2%), but it differs per county.

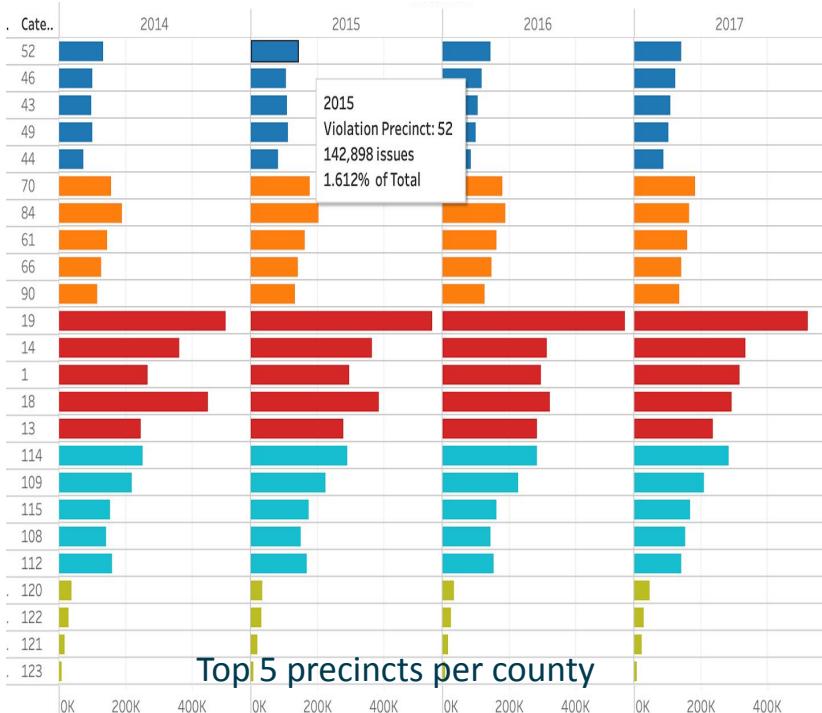
Manhattan:Plate Type and Registration State by year



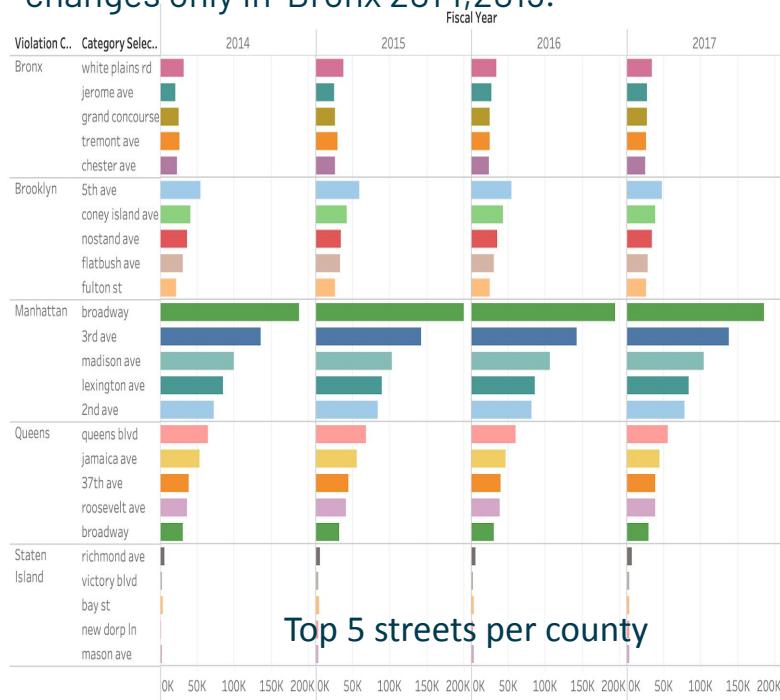
# Violations per Precinct And per Street by year

**'Hot' VS 'Quiet'** precincts/streets are the same across all years, but their order in ratings may vary.

Top 5 hottest precincts ordered by 2017.



Top 5 Streets are the same, their order changes only in Bronx 2014,2015.

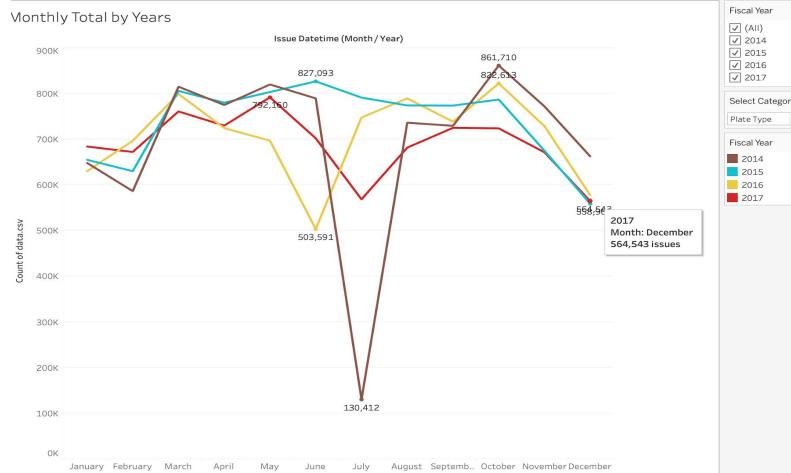


# Monthly Distribution of violations

## Total

- Small number of violations in December and February in all years.
- Spring rise in March and/or May and Autumn rise in October.
- June is the most contrasting month.

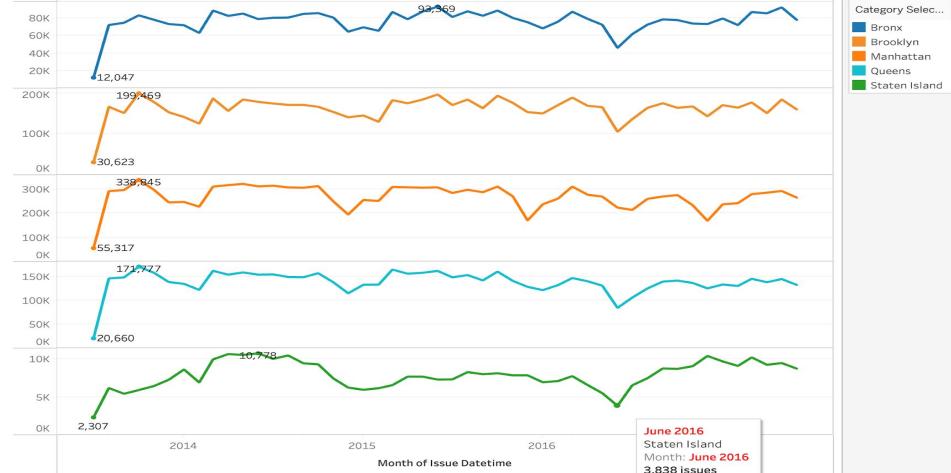
## Monthly Distribution of tickets



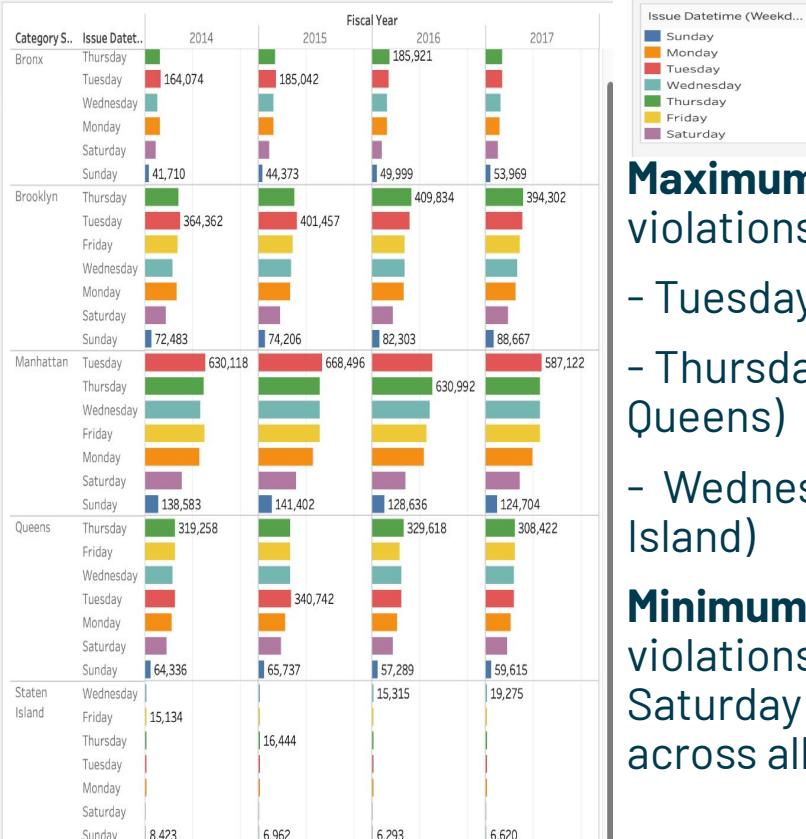
## Per county

- Monthly plots for counties are quite similar.
- But Manhattan's fluctuations make greater impact on total.

## Violations per county per month over years



# Distribution of violations by day of the week



**Maximum** number of violations in 2017 is on

- Tuesday (Manhattan)
- Thursday (Bronx, Brooklyn, Queens)
- Wednesday (Staten Island)

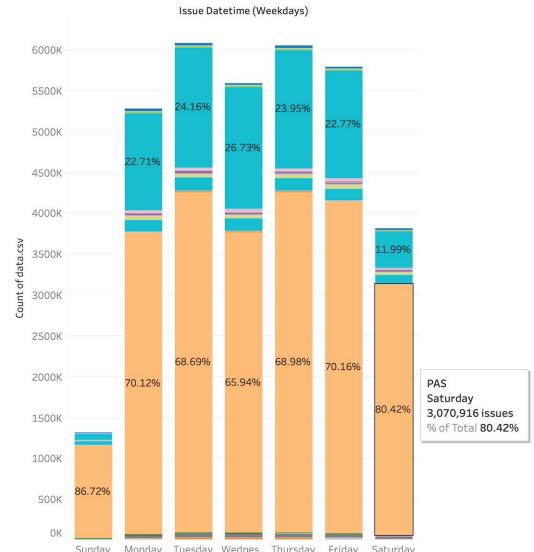
**Minimum** number of violations is on Sunday and Saturday for all **counties** across all years

Per plate distribution varies by day of the week .

PAS vehicles:

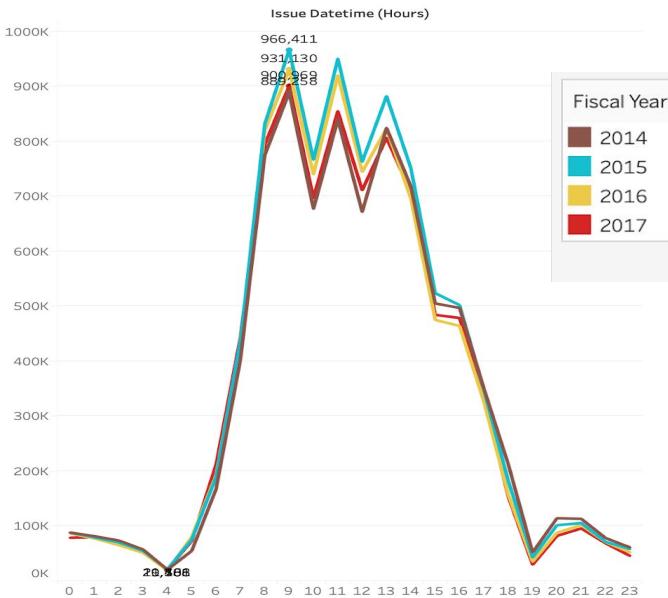
- Max share of issues is on Sunday, Saturday
- Min share on Wednesday

Plate Type by Weekdays

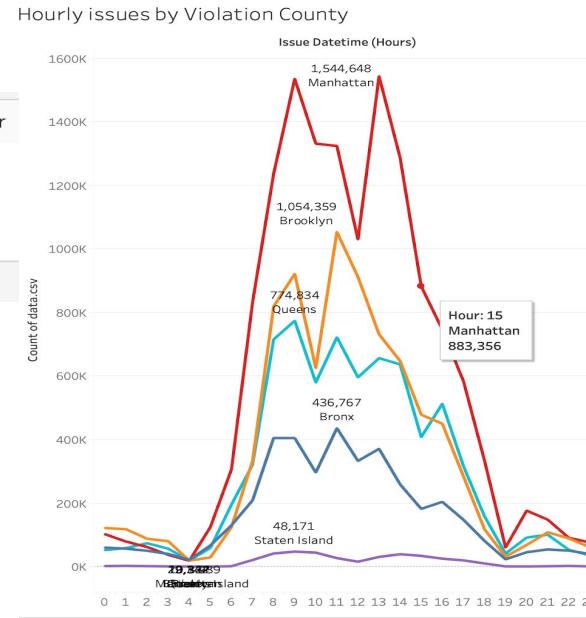


# Distribution of issues by time of day(hours)

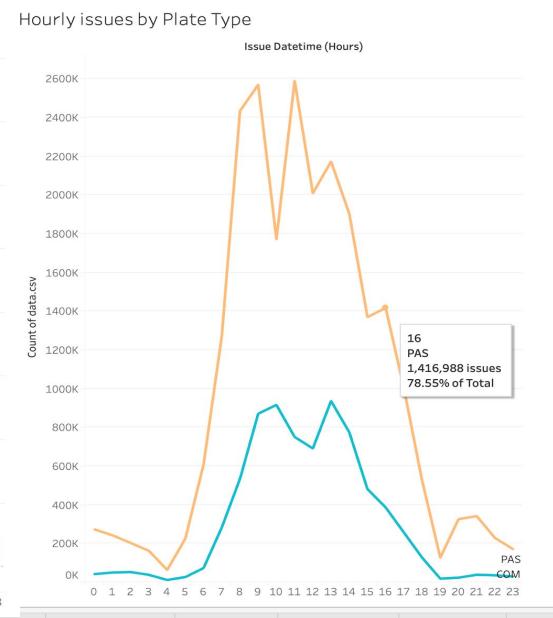
- No difference in the distribution of **total** violations **by hours across years**:
- Peaks at 9.00, 11.00, 13.00
- Drops at 4.00, 19.00
- after 20.00 increased activity.



- ### Per County:
- Manhattan: peaks at 9, 13.
  - Brooklin: peaks at 9, 11
  - Queens, Bronx: 3 peaks at 9, 11, 13 and a small rise at 4.00



- ### Per Plate Type:
- PAS vehicles have 3(4) peaks at 9, 11, 13
  - COM vehicles have only 2 peaks at 10 and 13

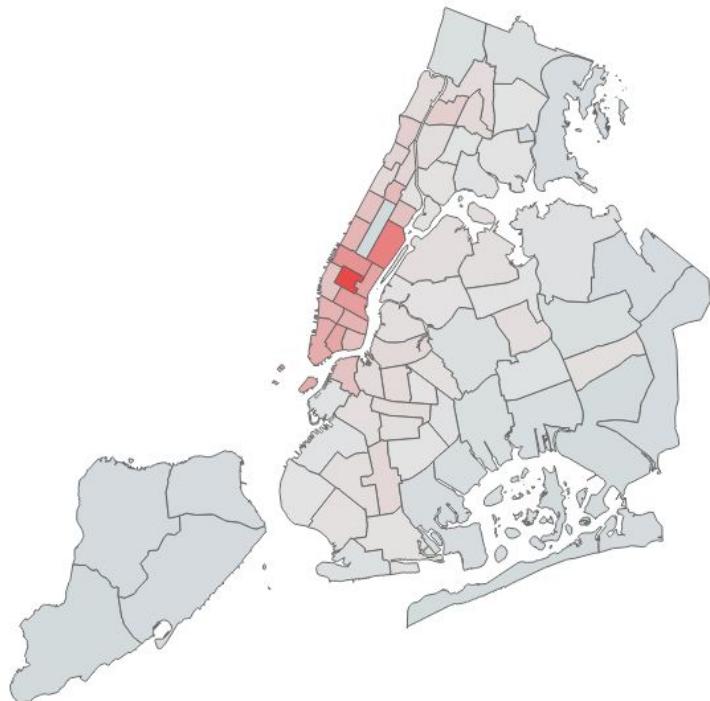


# Tableau Dashboard Insights

Decoding NYC Parking

# Focus

Precincts and spatial  
visualization



# Period

Jul 2016 to Jun 2017

# Tools

Polars and Tableau



# Aggregations

7 primary groups of violations  
and Top 15 streets for each  
precinct

# How to use

1

Choose an area of interest and period

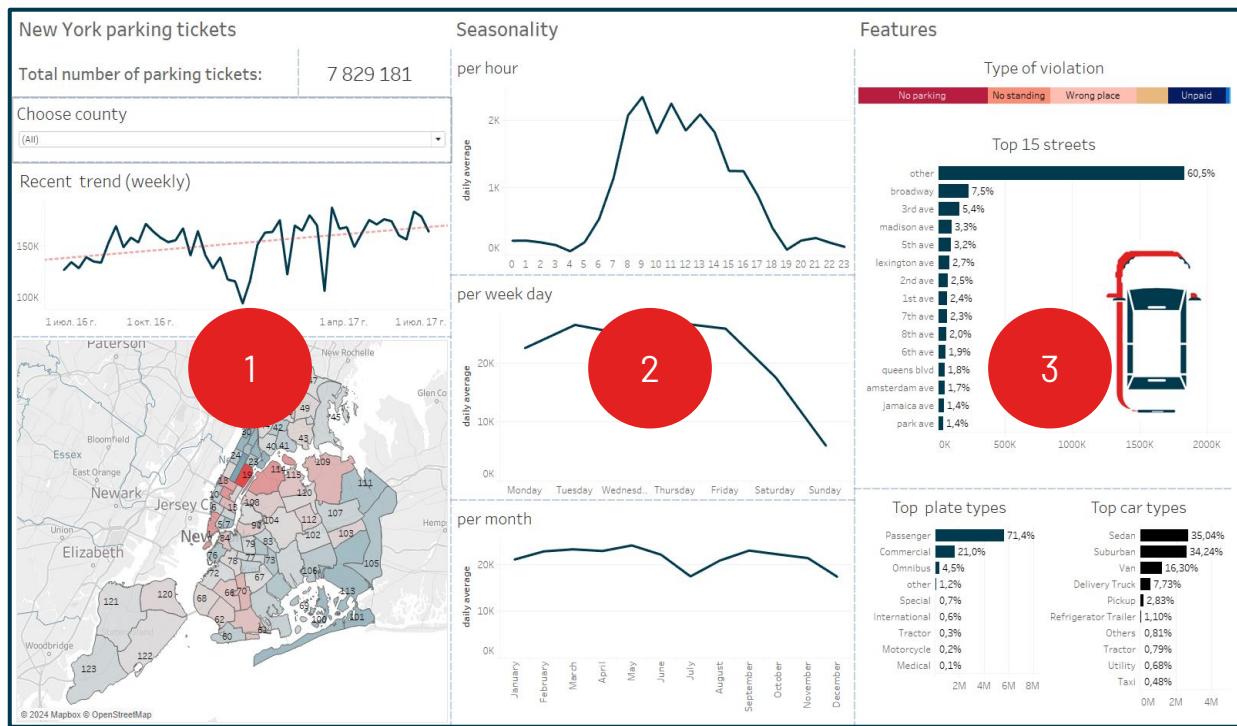
2

Evaluate trends and the significance of seasonality.

3

Identify locations and target specific vehicle profiles.

Dashboard is available [here](#)

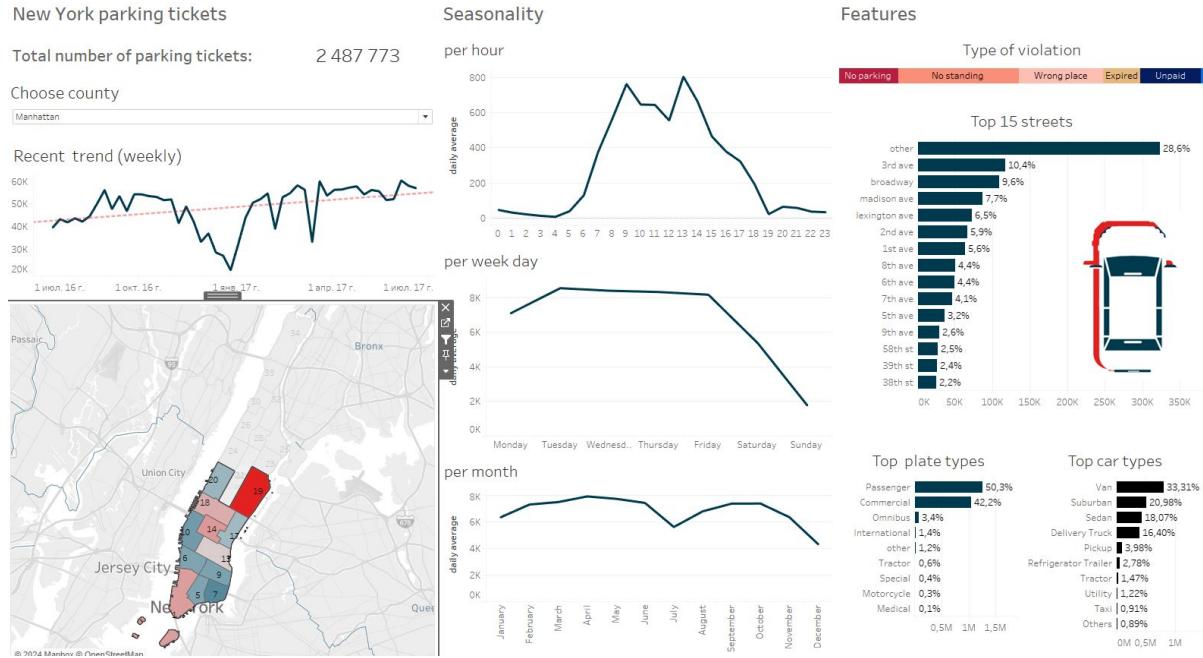


# Manhattan: Downtown and Midtown

- High demand for parking commercial vehicles
- 'No Standing' violations
- Violations peak notably at 9 AM and 1 PM.
- Relatively high level of expired meters

**Key focus:** locations for short-term truck unloading along 3rd ave, Broadway, Madison ave in the 1st and 19th Precincts as well as 39th and 38th st in the 14th Precinct.

**Additional parking service:**  
remotely extending parking duration if necessary

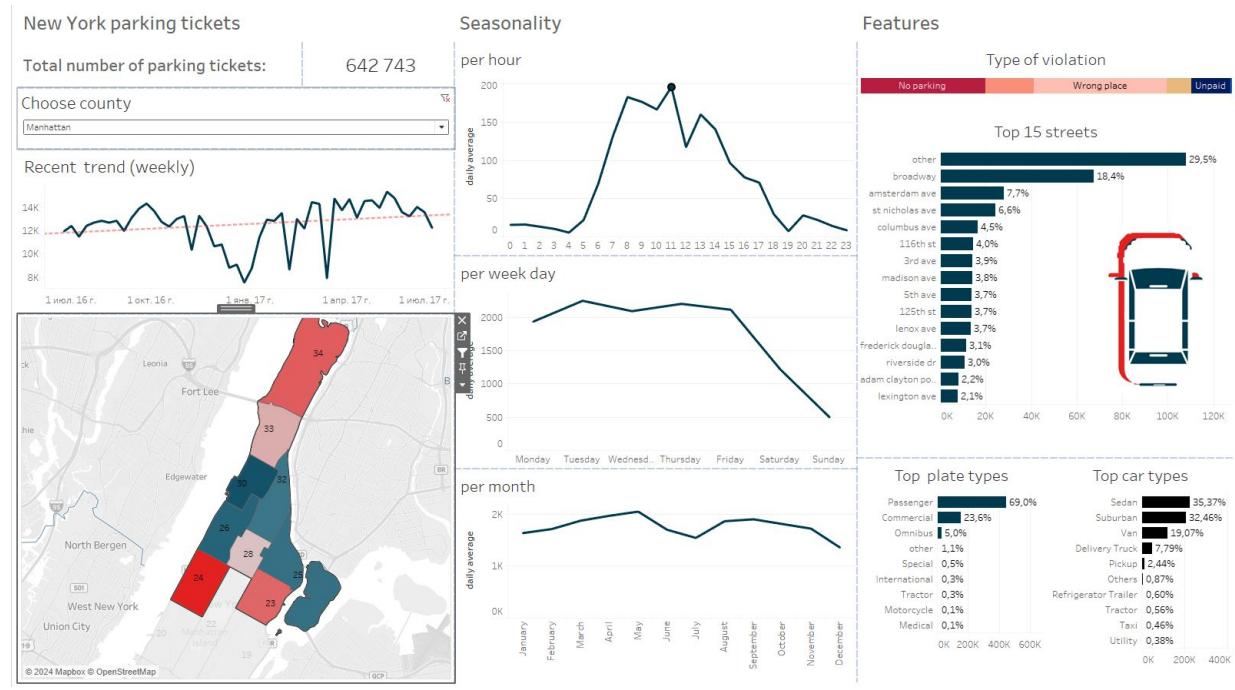


# Upper Manhattan

- 4 times lower frequency than downtown.
- Passenger sedans or suburbans (except for the 23rd and 24th Precincts)
- Peak violations occur between 9 AM and 11 AM, primarily involving improper parking.

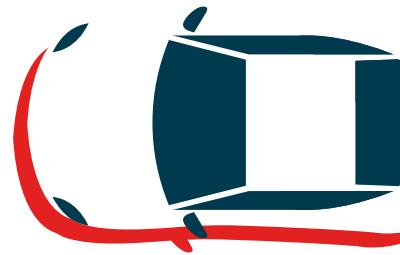
## Key focus:

- Typical parking infrastructure for residents
- The 23rd and 24th precincts to be analysed as Midtown.
- The 33rd Precinct indicates notable growth.



# Hypothesis Testing

- **Hypothesis test #1:** Are the observed violation counts in each county statistically different from each other?
- The **chi-squared test** was chosen due to the categorical nature of violation counts across different counties, providing a suitable method for analyzing discrete and distinct categories.
  - Tested for all counties and then all counties with just registration plates from NY
- There was no statistical difference between number of violations per county. For all counties, passenger vehicles have greater violations than commercial vehicles.
- **Hypothesis test #2:** Is there seasonality in the occurrence of violations?
  - The **Kruskal-Wallis** test was used because of its simple interpretation. Higher values indicate stronger evidence for difference between groups.
  - Both **Kruskal-Wallis and t-tests**, revealed no significant difference in violation counts across different months of the year. This conclusion was based on violation counts aggregated by county and month.



# General Conclusions

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- Most of the violations accounted for NY locals
  - Majority of the violations were made by passenger and commercial vehicles
  - Number of violations per street and precinct varied across all 5 counties
  - Number of violations increase in the middle of the week and decrease on the weekends
  - Average number of violations across all counties did not differ and there were more violations for passenger vehicles for all counties
-



# Transforming Parking in NYC: Recommendations

- 1** Build structure in downtown Manhattan
- 2** Build structure in street that has the most number of violations
- 3** Consider infrastructure (underground vs above ground)
- 4** Consider stacked parking or parking elevator structures
- 5** Consider short-term truck unloading along Broadway
- 6** Cater and market towards larger passenger vehicles
- 7** Do not build in Staten Island
- 8** Consider analysis on competition