



# **ARE POLICE IN THE BAY DOING THEIR JOB?**

## **IDS 702 : Final Project**

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Fall 2021, DUKE MIDS**



# Motivation

## Declining crime clearance rates in recent years



SAN FRANCISCO POLICE DEPARTMENT

### Clearance Rates

Comparing a Date Range within One Year to Its Prior Year

Please select:

#### District

- ☒ Bayview
- ☒ Central
- ☒ Ingleside
- ☒ Mission
- ☒ Northern
- ☒ Park
- ☒ Richmond
- ☒ Southern
- ☒ Taraval
- ☒ Tenderloin
- ☒ Courtesy Reports

#### Type Of Crime

- ☒ PART 1 PROPERTY CRIMES
- ☒ PART 1 VIOLENT CRIMES

Start Date (1/1/2017 onward)

1/1/2021

End Date

11/11/2021

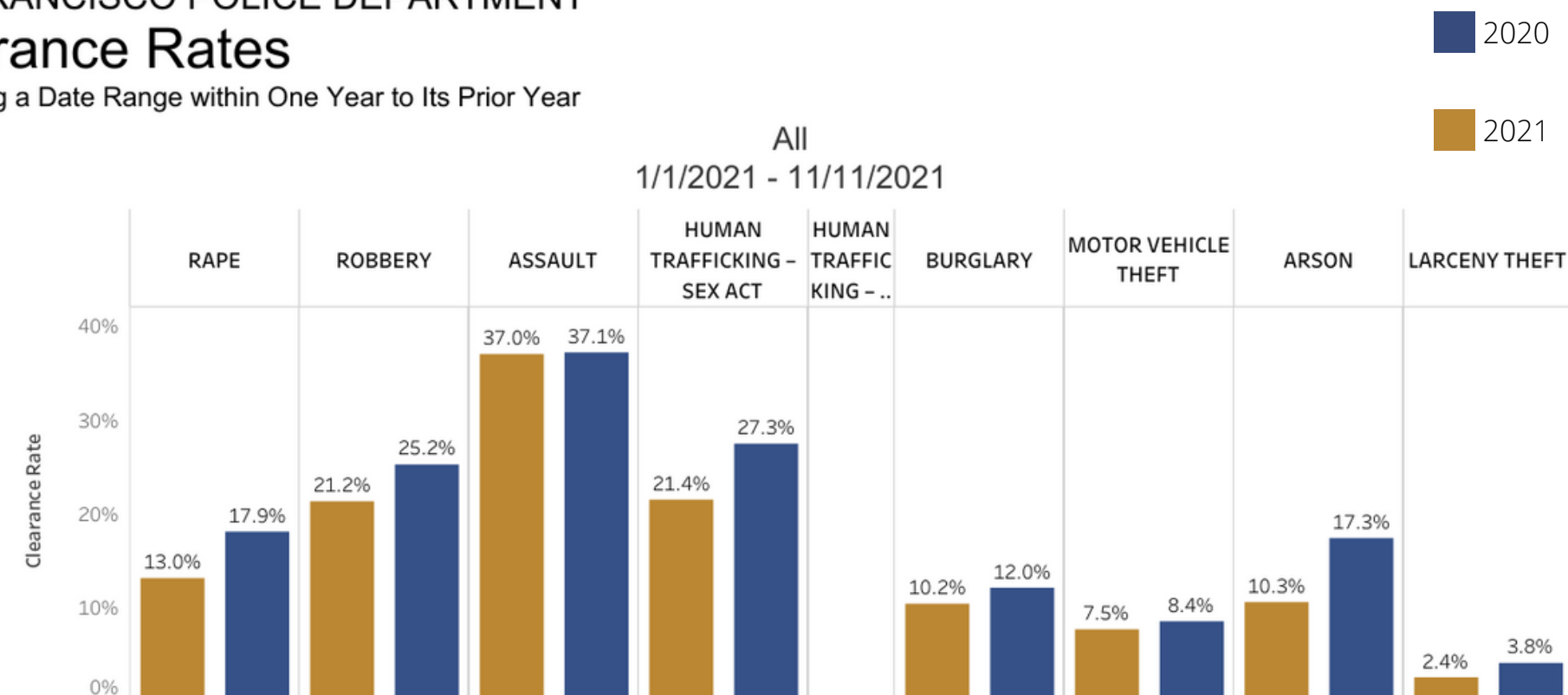
☒ Selected Date Range

☒ Selected Date Range, Prior Year

[See the Definition of Clearance](#)

Crime data updated weekly and  
valid through November 14, 2021

All  
1/1/2021 - 11/11/2021



Crime	Selected Date Range	Selected Date Range, Prior Year	Year-to-Year % Decrease or Increase
RAPE	13.0%	17.9%	-27.3%
ROBBERY	21.2%	25.2%	-15.8%
ASSAULT	37.0%	37.1%	-0.5%
HUMAN TRAFFICKING - SEX ACT	21.4%	27.3%	-21.4%
HUMAN TRAFFICKING - INV SERV	0.0%	0.0%	
BURGLARY	10.2%	12.0%	-14.5%
MOTOR VEHICLE THEFT	7.5%	8.4%	-11.1%
ARSON	10.3%	17.3%	-40.2%
LARCENY THEFT	2.4%	3.8%	-37.3%

# What are we trying to answer?

*What factors influence the clearance rates of crimes?*

## Response Variable

Clearance Rate : Proportion of all crimes that are cleared\*

## Predictor Variables

Season, isHoliday, isWeekend, Month of Year, Time of Day

## Hierarchical Grouping

Police Districts

## The Data

**San Francisco Police Department  
(SFPD)**

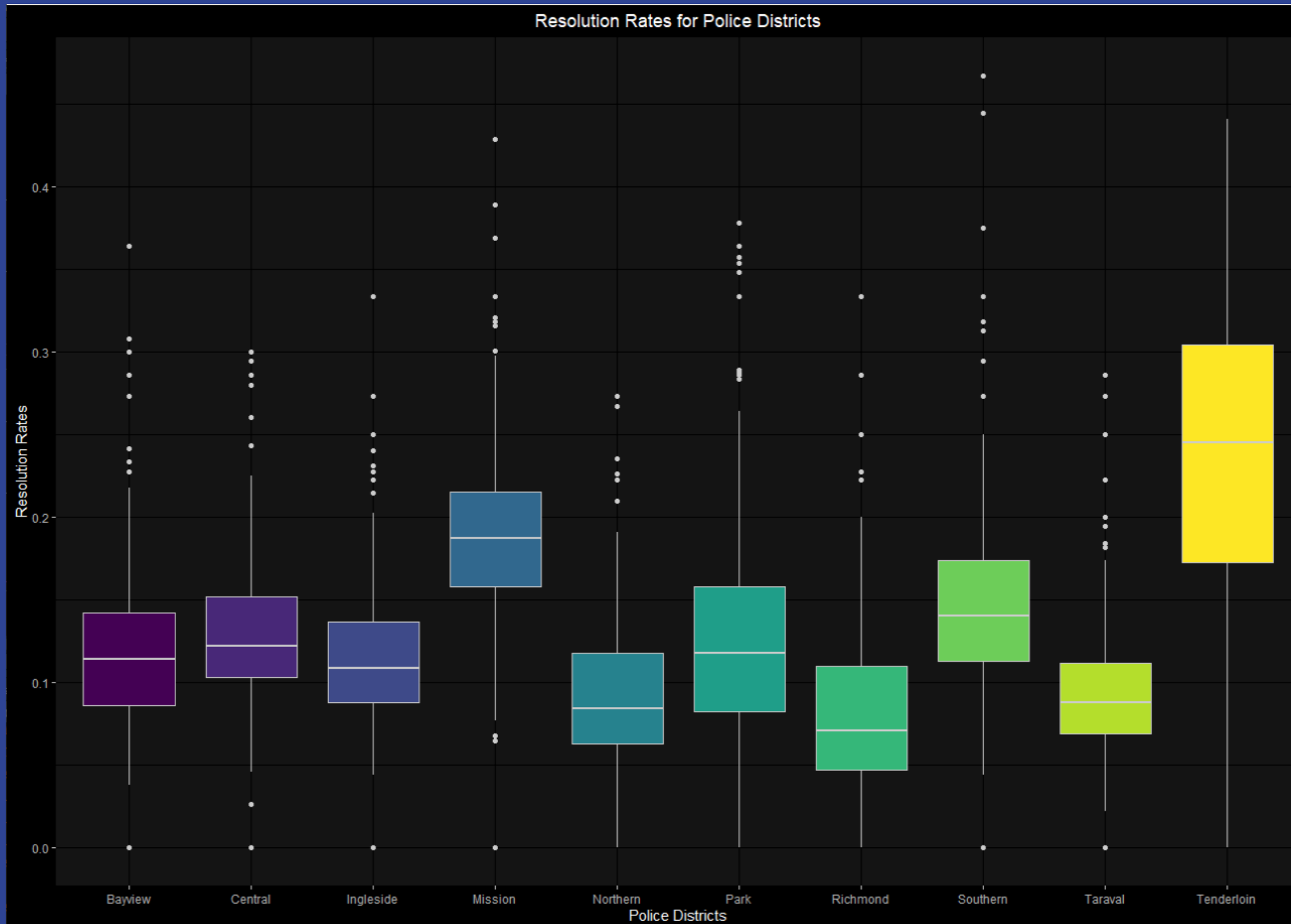
**Incidents Report Dataset**

Jan 1, 2018 - Nov 11, 2021

*Compiled from Crime Data Warehouse*

*\*A crime is "cleared" once there's been an arrest, the alleged offender dies, the alleged offender is charged with a crime in another jurisdiction, or the victim decides to drop (or not press) charges.*

# Exploratory Analysis



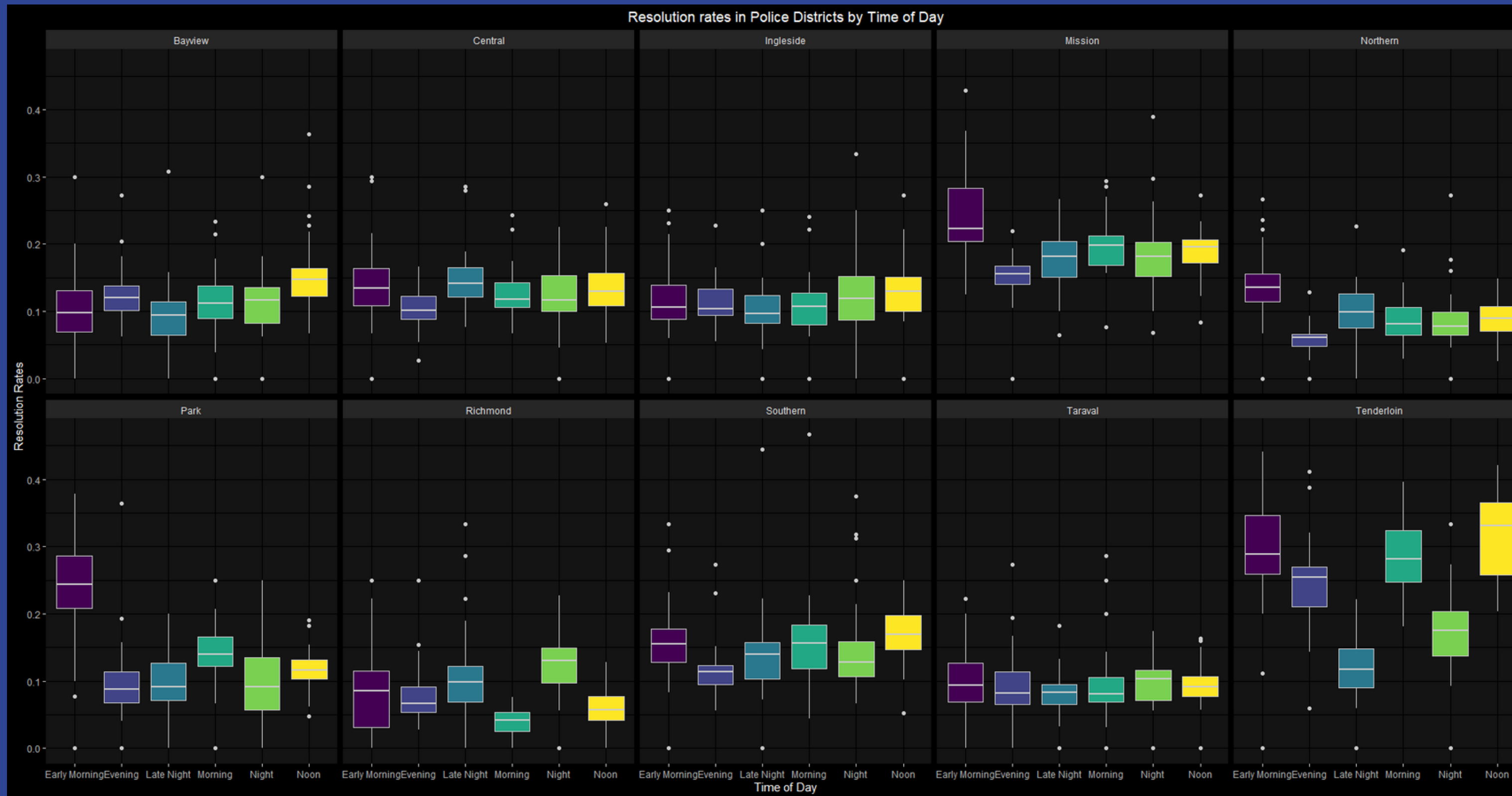
## Checking the distribution of response in different districts

The clearance rates vary by police districts. The highest clearance rate is observed in Tenderloin.

## Mixed effect model

Model separate intercepts for each group.

# Exploratory Analysis



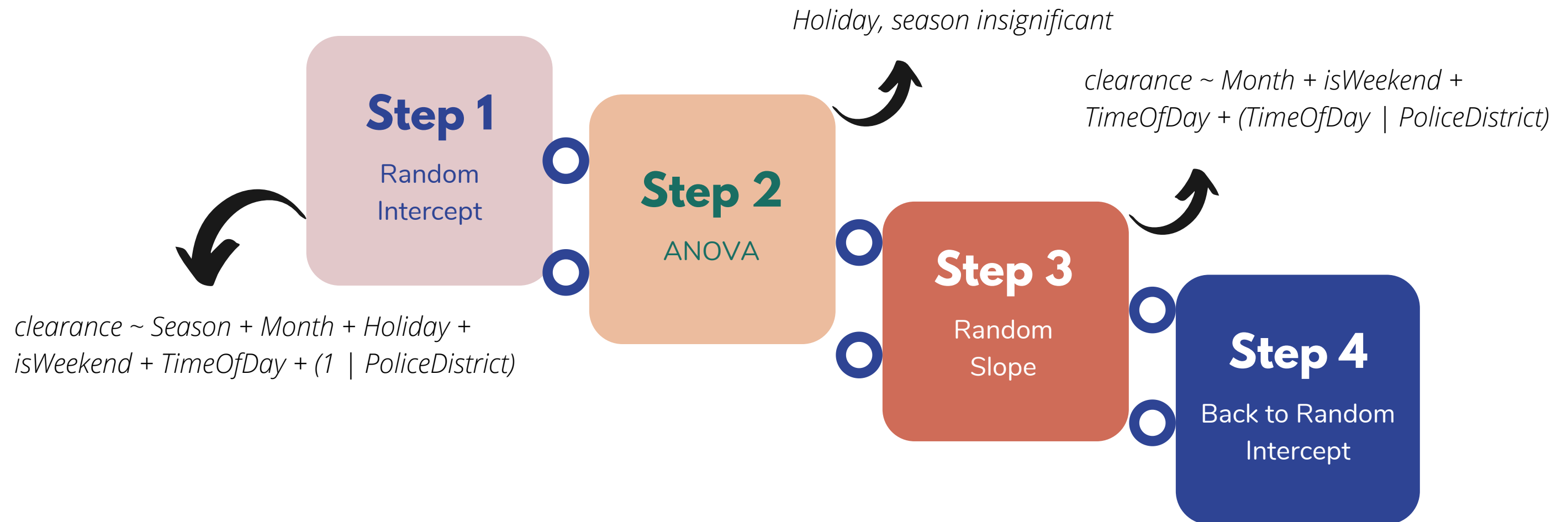
## Checking the distribution of predictors in different districts

The clearance rates vary by time of day for different police districts. The trends as well as magnitude differs greatly.

## Mixed effect model

Model separate slopes for each group.

# Model Process Flow



## Final Model Equation

$\text{clearance} \sim \text{Month} + \text{isWeekend} + \text{TimeOfDay} + (1 \mid \text{PoliceDistrict})$

# Model Results



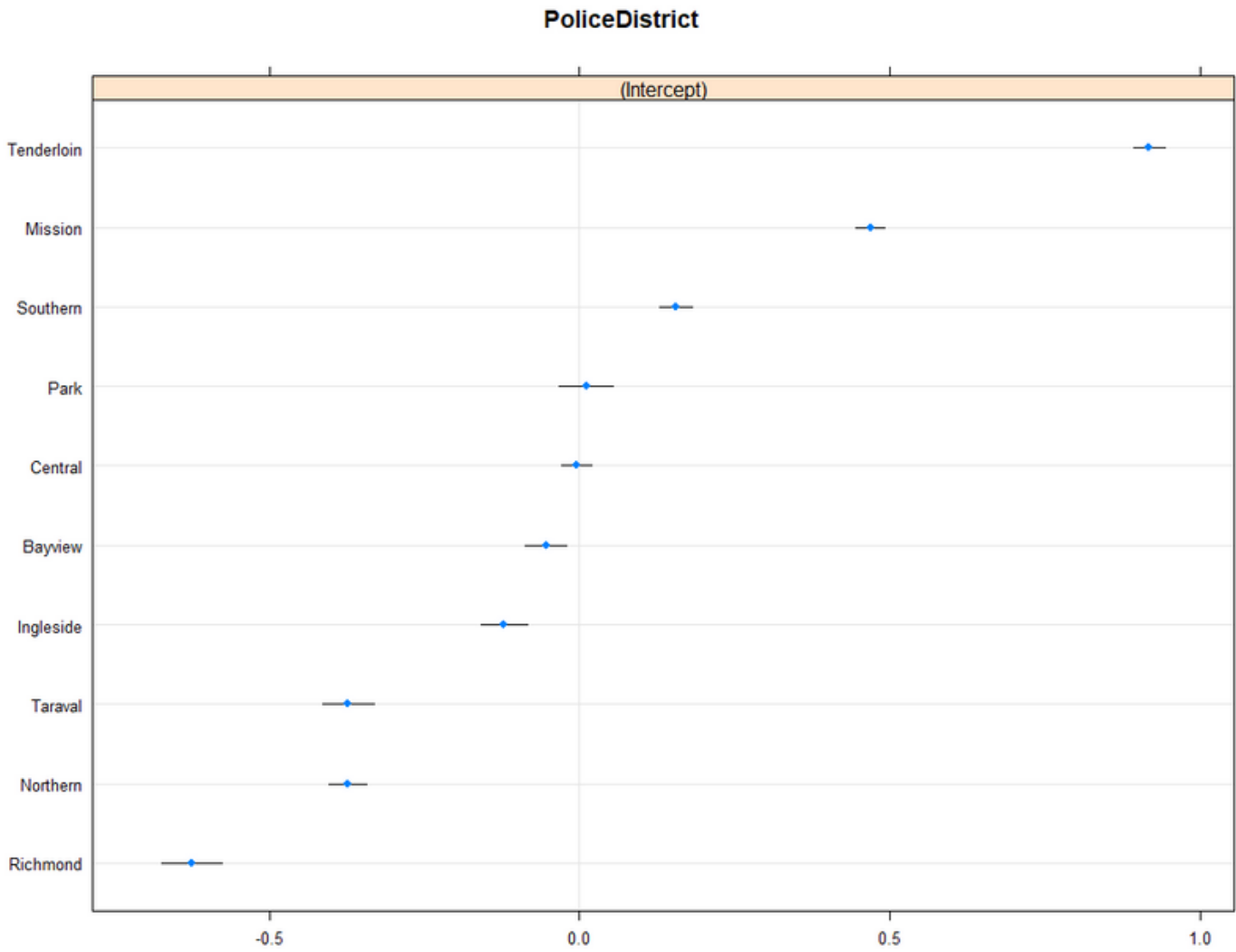
## Coefficients and statistical values

Dependent variable:	
cbind(Resolution_resp, countIncidents - Resolution_resp)	
Month2	0.051** (0.023)
Month3	-0.020 (0.023)
Month4	-0.014 (0.023)
Month5	-0.079*** (0.023)
Month6	-0.200*** (0.024)
Month7	-0.162*** (0.023)
Month8	-0.127*** (0.023)
Month9	-0.119*** (0.023)
Month10	-0.185*** (0.023)
Month11	-0.073*** (0.024)
Month12	-0.093*** (0.025)
isWeekend1	-0.098*** (0.011)
TimeOfDayEvening	-0.425*** (0.018)
TimeOfDayLate Night	-0.292*** (0.020)
TimeOfDayMorning	-0.206*** (0.019)
TimeOfDayNight	-0.293*** (0.021)
TimeOfDayNoon	-0.082*** (0.018)
Constant	-1.612*** (0.135)
Observations	1,920
Log Likelihood	-6,031.088
Akaike Inf. Crit.	12,100.180
Bayesian Inf. Crit.	12,205.820

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## Dotplot of random effects





# Key Insights

## Intercept

For a fixed police district, or across all districts, crimes taking place early morning during weekdays in January have odds = 0.2 of getting cleared.

## isWeekend

For a fixed police district, month and time of day, the likelihood of clearing crimes that took place on a weekend is 9% lesser than those that took place on a weekday.

## Time of Day

For a fixed police district, month and weekday, the likelihood of clearing crimes that took place in the evening is 35% lesser than crimes that took place early morning.



# Future Roadmap

**Include  
Crime  
Categories**

Clearance rates for different  
crime categories can vary

**Dynamic  
Data**

The dataset is updated daily, and  
some records may be modified

Status changes to resolution can be  
updated later with Supplemental  
Reports which are not provided in  
this dataset

**Resolution  
status change**

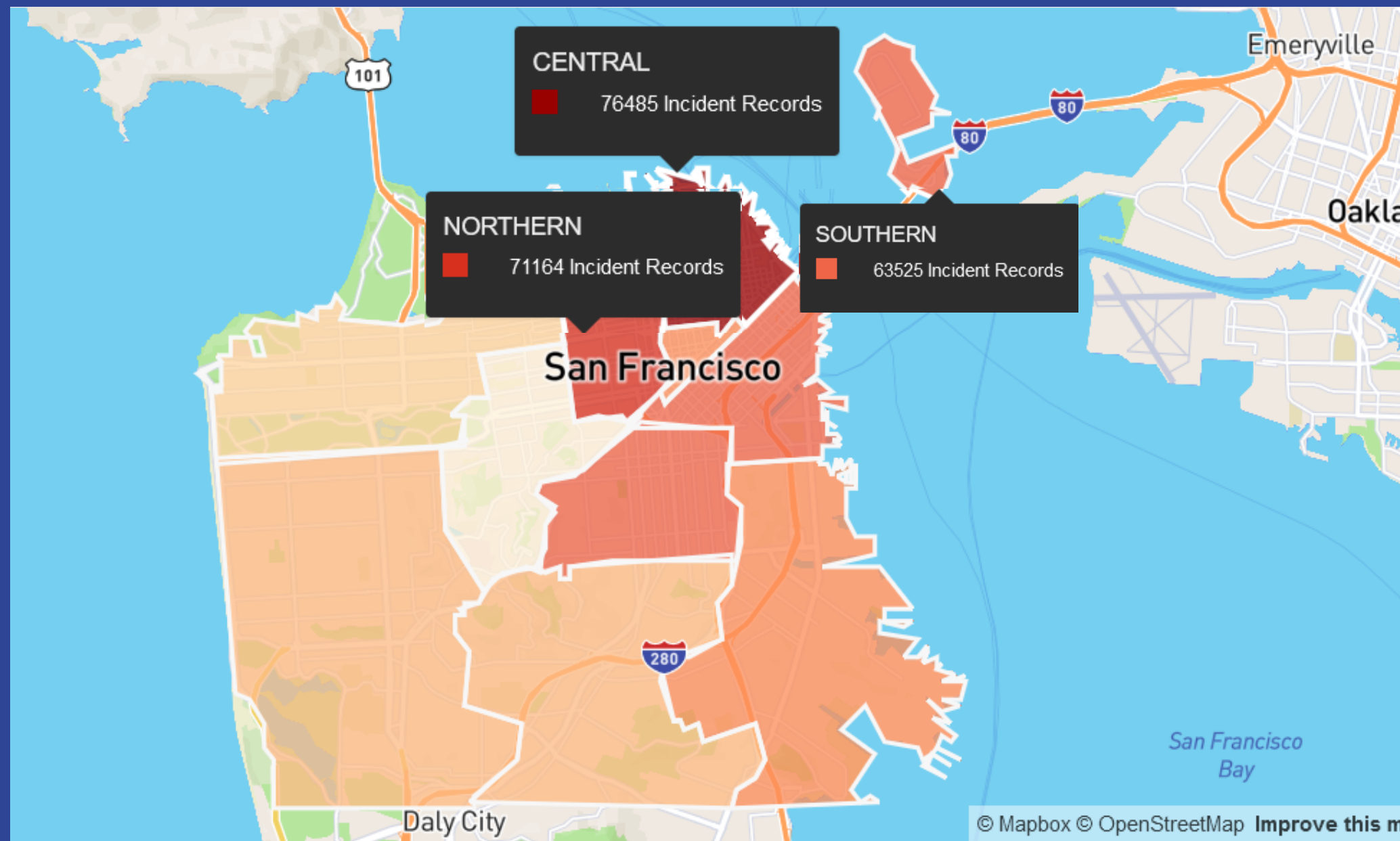
# Limitations

**MERCI!**



# Appendix

# Exploratory Analysis



Northern, Central, Southern are some of the notorious districts with crimes.