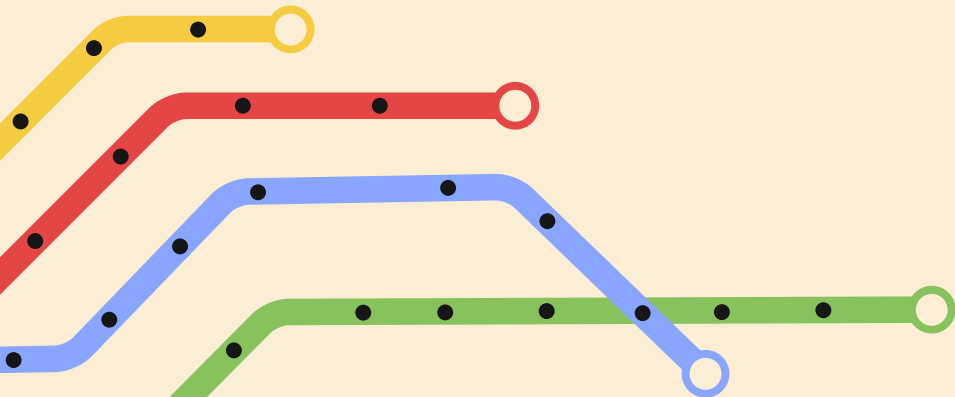# MTA X MACAULAY 2025 Datathon

Syeda Rahman, Salma Ghaeth, Alishya Loyd
Mind the Data Gap Team

Contents:

01
Business Question
You can describe the topic of the section here

02
Data & Methodology
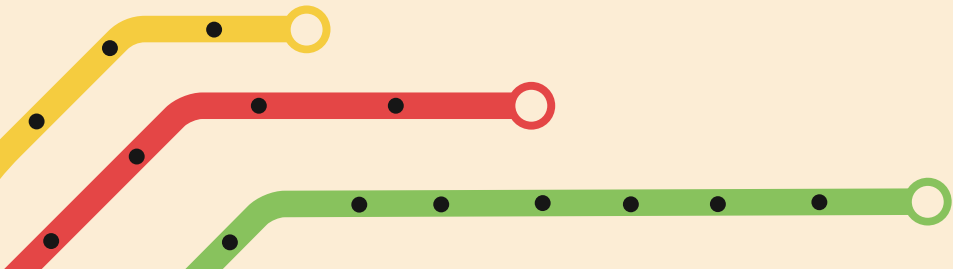You can describe the topic of the section here

03
Analysis
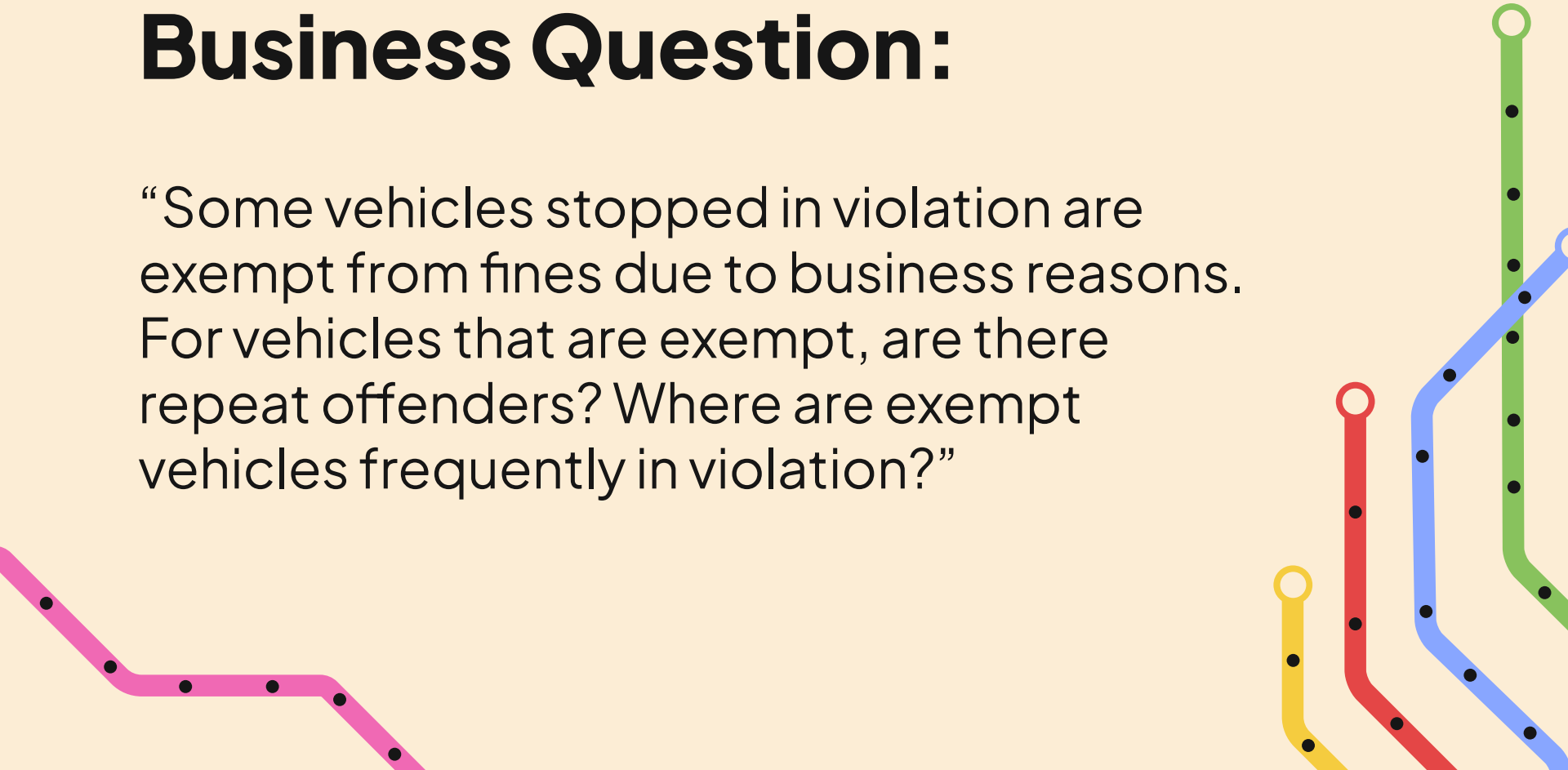You can describe the topic of the section here

04
Insights & Recommendations
You can describe the topic of the section here

Business Question:

"Some vehicles stopped in violation are exempt from fines due to business reasons. For vehicles that are exempt, are there repeat offenders? Where are exempt vehicles frequently in violation?"

What we decided:
M101 Route

Why?

- A route often used by CUNY students
- One of Manhattan's busiest north-south bus routes, connecting Harlem, the Upper East Side, Midtown, and more
- This route is ACE-enforced
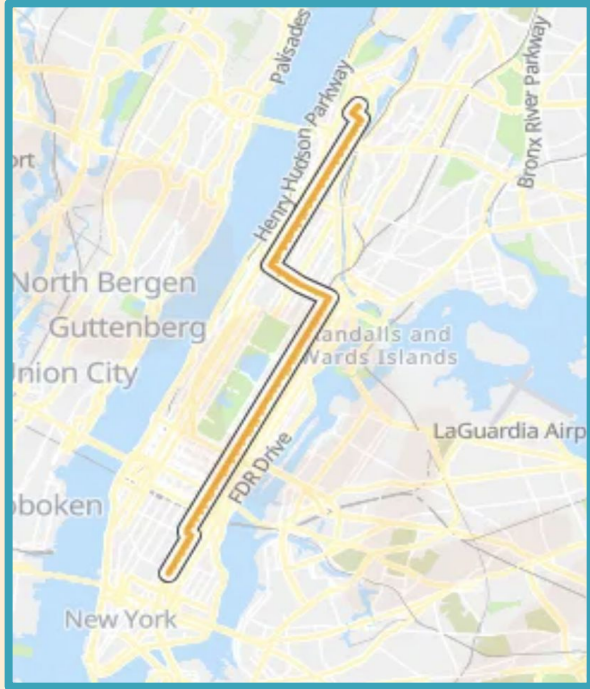
What we did:

- Imported the raw dataset for the M101 bus route; filtering specifically for exempt violations
- Grouped violations by Vehicle ID and location, revealing the top 10 repeat offenders and key violation hotspots

Index	Vehicle ID	violation_cou
2835	1feaad876c46cfe1cc4ee357e410ec2054c5c231d268169dfdd9527c1c084a80	1340
9586	6d7caef8bf15e2bf8d46aa1e6dd8c0da1ae2fbc5b31acec87ab5642558d4360b	903
9258	6979a2434b4611cf1ebf80624eaeb29622929b061958b956f0d93024261a4a3c	903
3756	2a8ac01b157a97b3c124cf33322e71c31062b815dd3b0a9c121ee3a6c22ff64a	864
20579	ebabc585284d95a10b6b45730c38fa55dfd57bcc5aea304b67693b84fb4d0eb0	787
17872	cbebd9b5a63416b9c246a35d3b5fc36214871dab0e5ccf88d54a4bf8a6a0f046	729
11305	80e7bae594e62aaaf4ed702b8230dfd12559743828922bcb043940ad4a087b75	628
3232	24908a1da372fdb0f5f03bcf7001ee589cf492894d57922ce65681ba2d23e774	605
8429	6059dcc4ef4516ca9f357ca2a789b9c4ca9c633258f2121f8ae29919356f7af0	537
1278	0e92016a483877f5c62115578a642425d710c43560e00cdd443e3aad2fed06fe	537

lat_bin	lon_bin	violation_count
40.843	−73.935	8851
40.842	−73.935	3270
40.774	−73.96	2453
40.737	−73.984	2431
40.815	−73.955	2036
40.767	−73.963	1759
40.833	−73.942	1648
40.791	−73.945	1560
40.738	−73.984	1398
40.834	−73.941	1394

What we created:

Violation Hotspots - M101
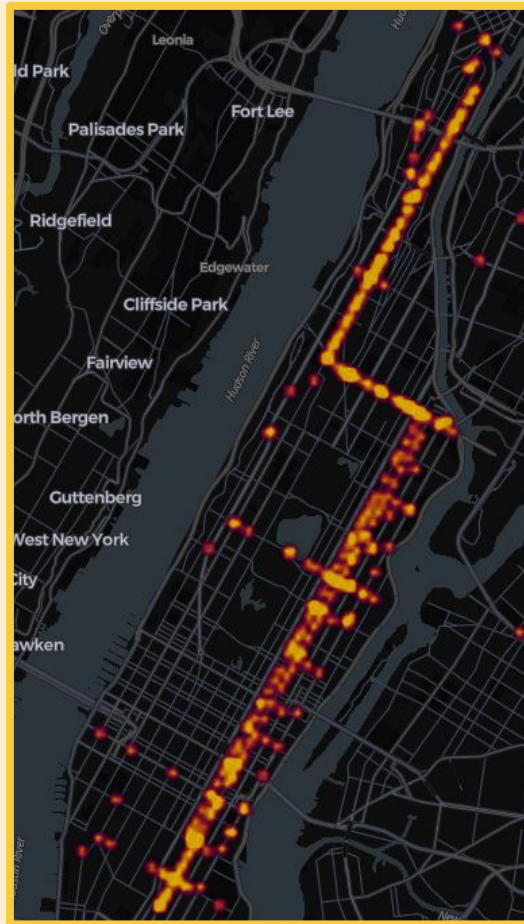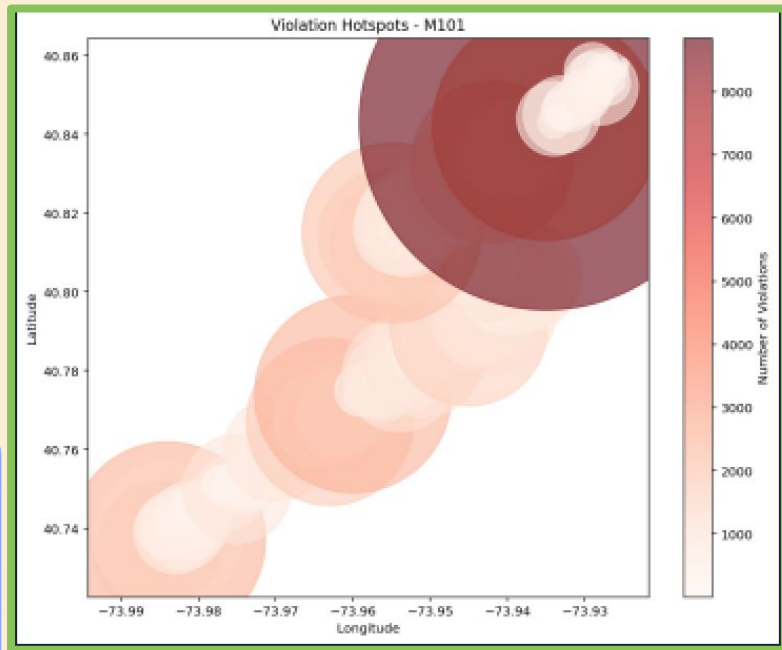
- Created a bubble heat map showing violation hotspots on the M101 route using matplotlib in Python. Created another heatmap on Kepler.Gl of exempt violations on M101.

- The hotspots are concentrated along the Washington Heights/ Harlem areas of Upper Manhattan!

What we found:

Violation Status Counts
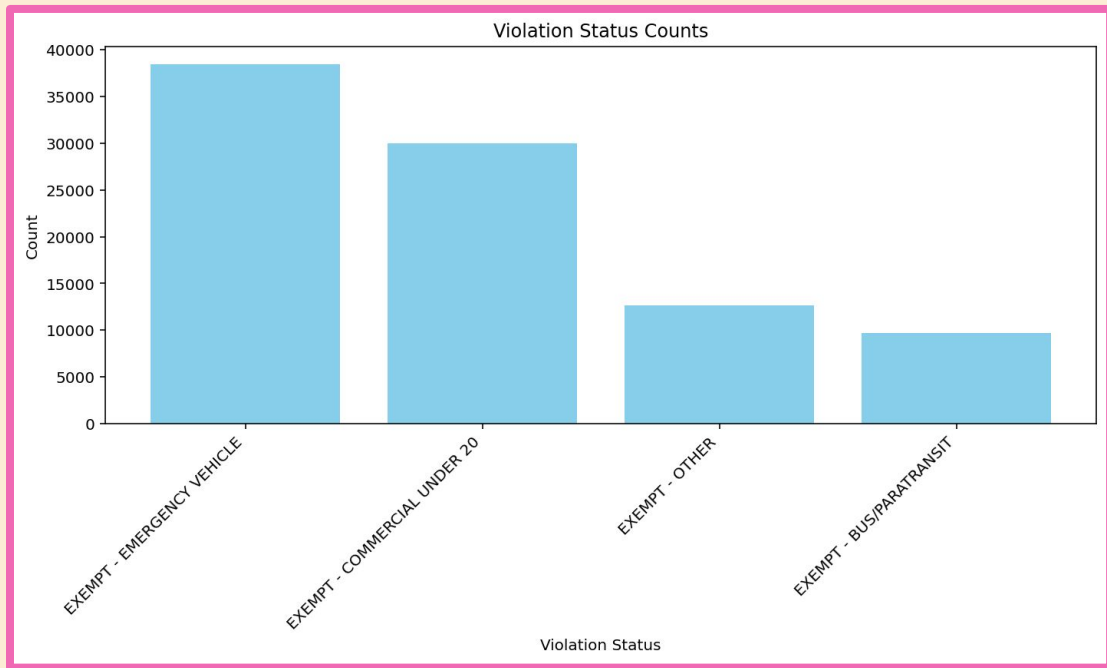
Our Analysis:

- Vast majority of exemptions are violations made by emergency vehicles (42.31%) and commercial vehicles (33.06%) .

- Manhattan is a busy area where many businesses and residents use commercial services.

- The M101 route passes by several hospitals, precincts, etc. Manhattan being a highly population dense area would lead to more use of emergency services.

What we found:
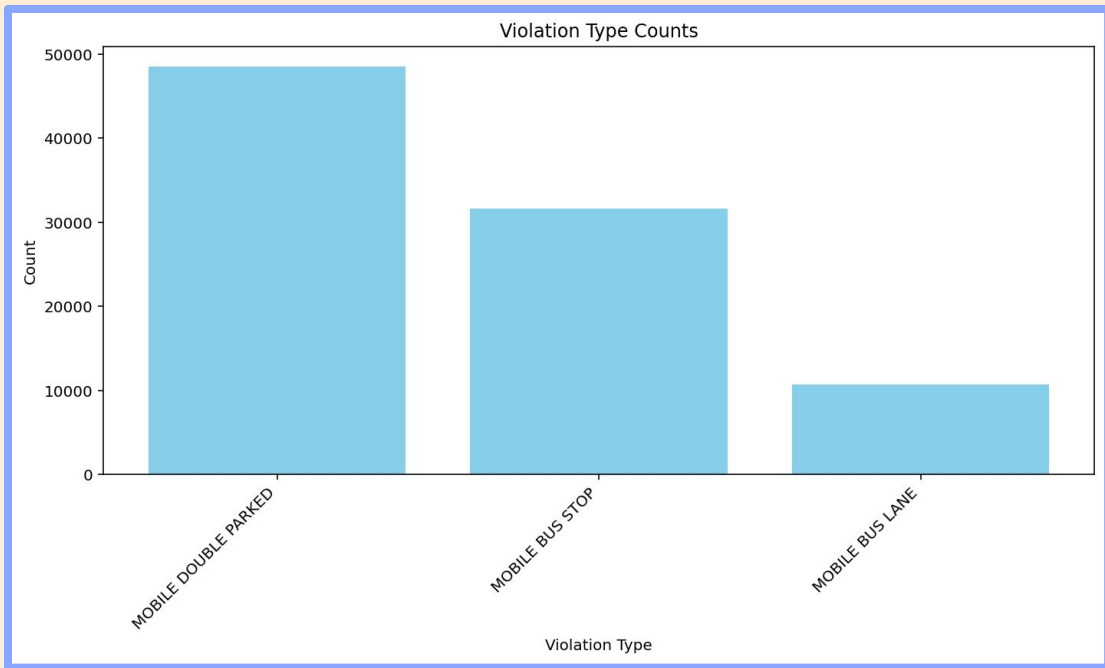
Our Analysis:

- We found that 53.42% of the violation types are due to vehicles being double parked

- The M101 Bus route was predominantly created on narrow one way streets. Many of these streets are also heavily congested, tourist zones.

- This likely causes higher rates of double parking with many offenders parking in bus lanes.

What we found:

Top 20 Stop Name Counts
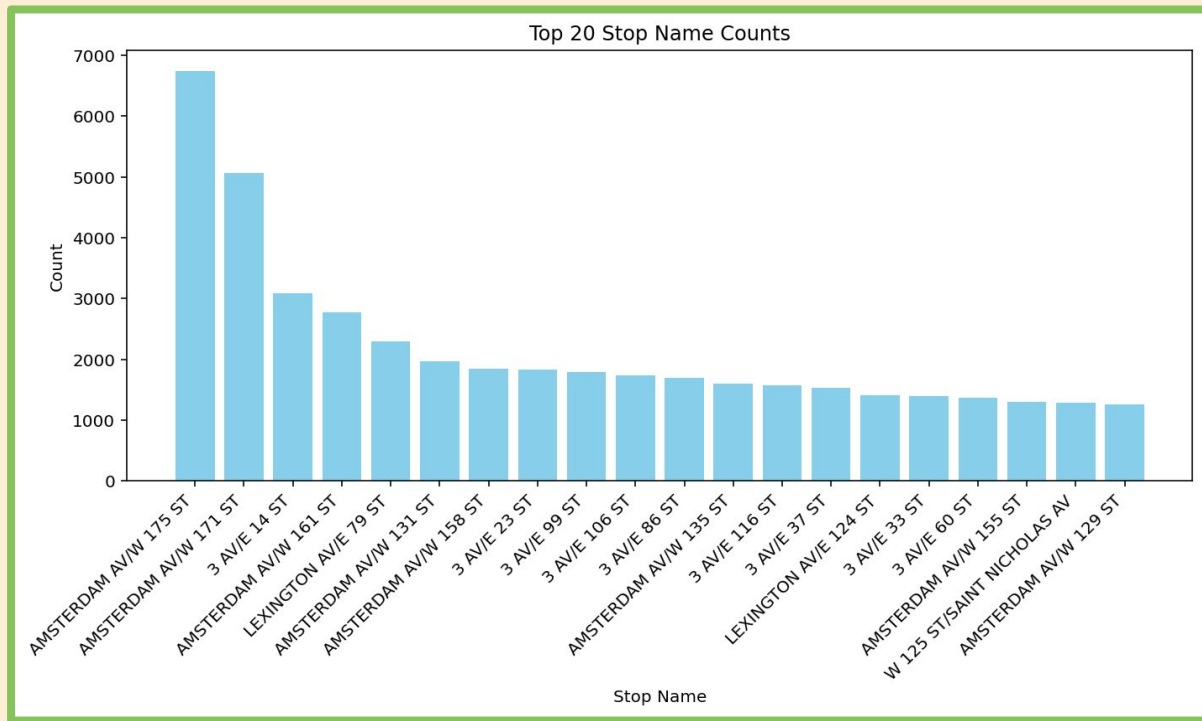
Our Analysis:

- We found that 45% of the violations occur along 3 Ave

- 40% of the stop name's are along Amsterdam Ave

Violation Hotspots: A Closer Look

Amsterdam Ave/ W 175 st & Amsterdam Ave/ W 171

- Over 11,000 Exempt Violations combined
- Nearby: FDNY EMS Battalion 13
- Major EMS Service Location. Many Ambulances are parked on Amsterdam ave in surrounding blocks which blocks bus lane.
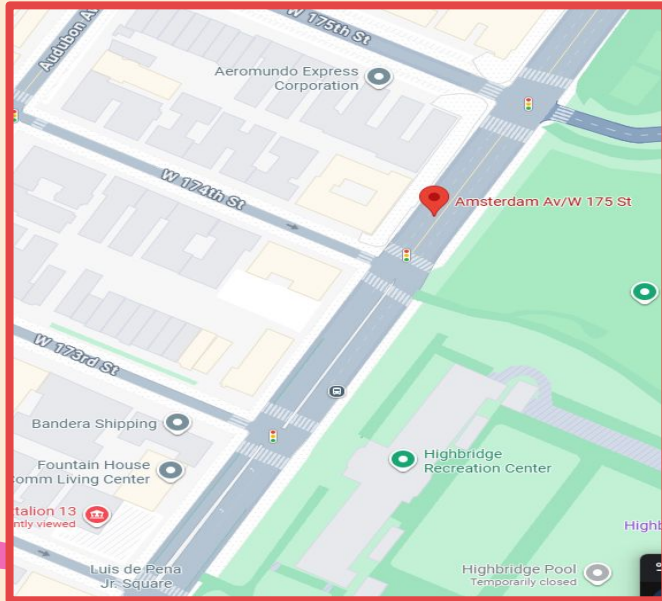
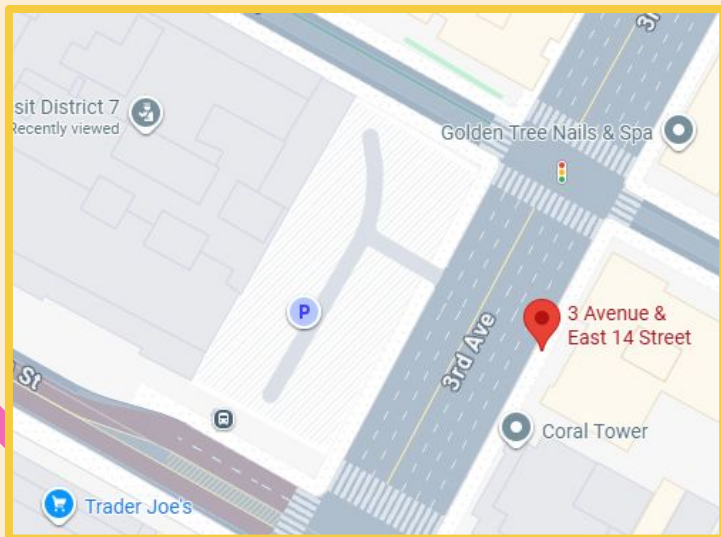**Frequent Violators in this area (Amsterdam /W 175 st):**

Vehicle ID vehicle_id	count_vehicle_id count_vehicle_id	Violation Status violation_status
6d7caef8bf15e2bf8d46aa1e6dd8c0d...	522	EXEMPT - EMERGENCY VEHICLE
2a8ac01b157a97b3c124cf33322e71c...	487	EXEMPT - EMERGENCY VEHICLE
ebabc585284d95a10b6b45730c38fa...	481	EXEMPT - EMERGENCY VEHICLE
cbebd9b5a63416b9c246a35d3b5fc3...	390	EXEMPT - EMERGENCY VEHICLE
80e7bae594e62aaaf4ed702b8230dfd...	370	EXEMPT - EMERGENCY VEHICLE
0e92016a483877f5c62115578a6424...	359	EXEMPT - EMERGENCY VEHICLE

- Many of the exempt offenders in this area are repeat offenders.
- Most of the high recidivists, were exempt as emergency vehicles and their violation type is Mobile Double parked.
- From this we can infer that they are stationed ambulances in the bus lane that are constantly being flagged by the ACE System.

Violation Hotspots Continued:

3rd Ave/ E 14st

- Over 3,000 Violations
- Nearby: NYPD Transit Police Precinct 7, Urgent Cares (City MD, Mount Sinai). Area is also home to many commercial businesses + a heavy tourist area.
- Ambulances, police cars,and Commercial Vehicles frequently use the Bus lane

Frequent Violators in Area:

Tt Vehicle ID vehicle_id	# count_vehicle_id count_vehicle_id	Tt Violation Type violation_type	Tt Violation Status violation_status
176827791f47edf76d0ec3b9a1fb39c...	154	MOBILE BUS STOP	EXEMPT - EMERGENCY VEHICLE
c65f9ae5bcb3a5ebd8c0cabfb775d01...	62	MOBILE DOUBLE PARKED	EXEMPT - COMMERCIAL UNDER 20
28d5db97c873ef7c0baf48e363edeee...	36	MOBILE BUS STOP	EXEMPT - OTHER
2a38d5cc05cfeb0a4412c093c658dea...	30	MOBILE BUS STOP	EXEMPT - EMERGENCY VEHICLE
3ef404eb6ff5bca9d2d0a02fe65bccc5...	27	MOBILE DOUBLE PARKED	EXEMPT - COMMERCIAL UNDER 20

- Similar to the previous hotspot, many frequent exempt violators have racked up a large amount of violations.
- This hotspot shows more diversity in both violation type and status. Which reflects back to the diverse mix of commercial and emergency service locations in the area.

Hotspot Takeaways:

- The hotspots we took a closer look give us insights about why violation exemptions tend to occur on the M101 route. There are dozens of hospitals, FDNY Ladders, and Police Precincts along the route from north to south. This has led to a a high count of exempt emergency vehicles.

- M101 Route also passes by heavily congested and heavy commercial areas which has caused a high count of exempt – Commercial under 20 vehicles.

- Many exempt offenders are repeat offenders. These repeat offenders use the bus lanes as a part of their operational activities (ambulances, police cars, etc), since their violations are waived they are not deterred from stopping.

- While these geographical, operational, and urban features can't necessarily be changed – We can change the way we gather, collect, and analyze the M101 Ace program Data.

Top Violators: A Closer Look

```
Top Exempt Offender Vehicle ID: 1feaad876c46cfe1cc4ee357e410ec2054c5c231d268169dfdd9527c1c084a80
Total Violations: 1340
```

1:

```
Violation Types Breakdown
Violation Type
MOBILE BUS STOP     1338
MOBILE BUS LANE        2
Name: count, dtype: int64

Top 5 Stop Names for This Vehicle
Stop Name
3 AV/E 60 ST              535
3 AV/E 65 ST              438
3 AV/E 37 ST               91
E 125 ST/PARK AV           36
AMSTERDAM AV/W 165 ST      32
```

2:

```
Violation Types Breakdown
Violation Type
MOBILE DOUBLE PARKED    890
MOBILE BUS STOP          10
MOBILE BUS LANE           3
Name: count, dtype: int64

Top 5 Stop Names for This Vehicle
Stop Name
AMSTERDAM AV/W 175 ST           524
AMSTERDAM AV/W 171 ST           336
AMSTERDAM AV/W 161 ST             4
AMSTERDAM AV/W 158 ST             3
W 125 ST/ADAM C POWELL BLVD       3
```

3:

```
Violation Types Breakdown
Violation Type
MOBILE BUS STOP          898
MOBILE BUS LANE            3
MOBILE DOUBLE PARKED      2
Name: count, dtype: int64

Top 5 Stop Names for This Vehicle
Stop Name
AMSTERDAM AV/W 131 ST          626
AMSTERDAM AV/W 129 ST          267
W 125 ST/AMSTERDAM AV            3
W 125 ST/MORNINGSIDE AV          2
W 125 ST/5 AV                    1
```
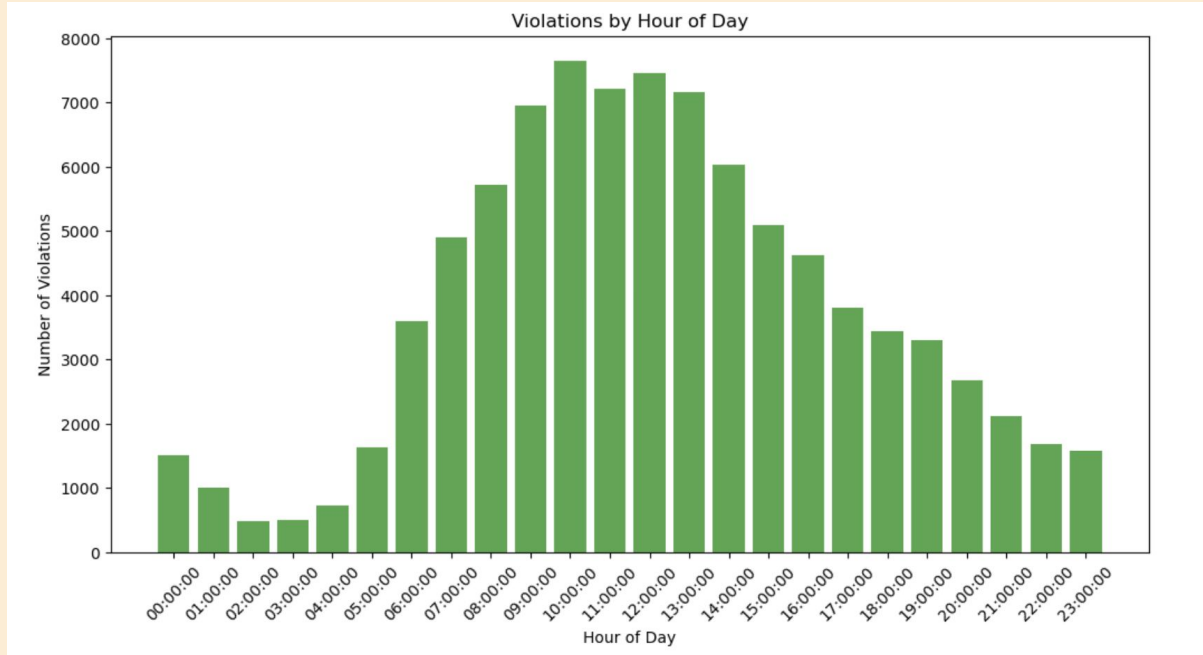
Prime Times for Violations:

Violations by Hour of Day

- You can see the hours when buses or vehicles are most likely to commit violations. In this case, the 8–12 AM morning peak likely corresponds to rush-hour traffic.

- Transit authorities or enforcement agencies could use this information to deploy inspectors or cameras more efficiently during peak violation hours.

- Operational insights – if certain bus routes or stops have more violations in the morning, it might indicate scheduling conflicts, traffic congestion, or enforcement gaps.
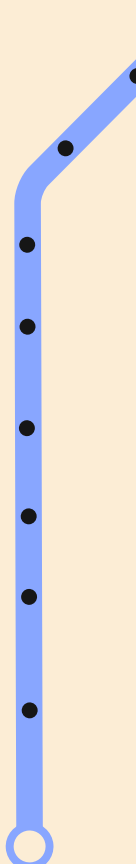
Comparing Exempt vs Issued Violations

Top 10 Exempt Repeat Offenders

Top 10 Non-Exempt Repeat Offenders
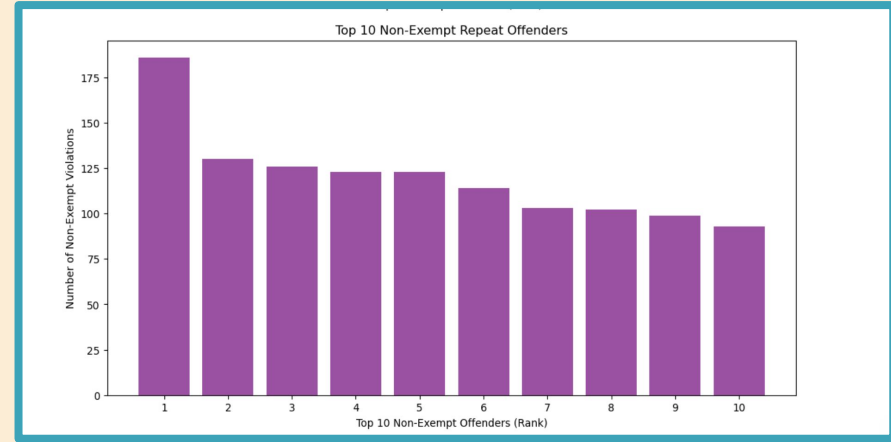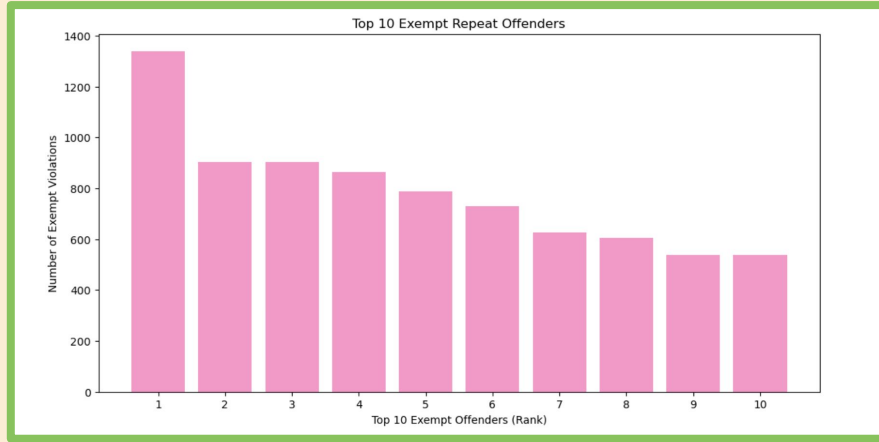
- Based off the graphs, exempt repeat offenders have much higher recidivism counts than non-exempt repeat offenders.
- This highlights that the ACE program has been successful at lower recidivism rates for vehicles who actually had violations issue.
- On the other hand, exempt repeat offenders are skewing the data set by constantly being flagged. Many of these exempt repeat offenders are simply engaging in their daily operational activities and stopping these critical activities would be unrealistic. Thus, this points to the important of properly filtering the ACE Program data so that the actual impacts of the program on regular violators are clearer.

Key Issues

- **Emergency vehicles dominate:** 29% of 312k captures; mostly ambulances, fire trucks, NYPD.

- **Hotspots:** Amsterdam Ave & 3rd Ave—near firehouses, depots, police stations, hospitals.

- **Redundant records:** 3,600+ duplicates from cameras logging same vehicles.

- **Commercial exemptions:** Less frequent; clustered near depots & service corridors.

- **Result:** Emergency stops → mostly exemptions; residential/commercial → more violations.

Solutions

Emergency Vehicles Dominate Exemptions

Reasoning: Firehouses, police stations, hospitals, EMS depots along Amsterdam Ave & 3rd Ave → Frequent bus lane usage

Solution: Classify emergency exemptions separately in data, geo-fencing around emergency facilities → Flag "Emergency Exempt"

Hotspot Areas

Reasoning: High density of FDNY, MTA depots, NYPD precincts, hospitals → Cameras constantly triggered

Solution: Optimize camera placement to reduce unavoidable exempt captures Split reports into emergency hotspots vs. commercial hotspots

Redundant Vehicle Logging & Deduplication

Reasoning: Current frame-based system logs every plate detection

Solution:
1. <u>Event based logging</u>: Group captures of same vehicle within a short window
2. <u>Deduplication rules</u>: Combine repeated captures at same spot within x minutes
3. <u>Integrate transportation vehicle identification data</u> : Flagged vehicles go into Exempt Emergency Vehicles category, reducing repetitions

A pictures always reinforces the concept

Images reveal large amounts of data, so remember: use an image instead of a long text. Your audience will appreciate it

12 million

Big numbers catch your audience's attention

9h 55m 23s

Jupiter's rotation period

333,000

The Sun's mass compared to Earth's

386,000 km

Distance between Earth and the Moon

Let's use some percentages

25%

Mercury

Despite being red, Mars is actually a cold place. It's full of iron oxide dust

100%

Total percentage

Mercury is the closest planet to the Sun and the smallest one in the entire Solar System. This planet's name has nothing to do with the liquid metal, since Mercury was named after the Roman messenger god
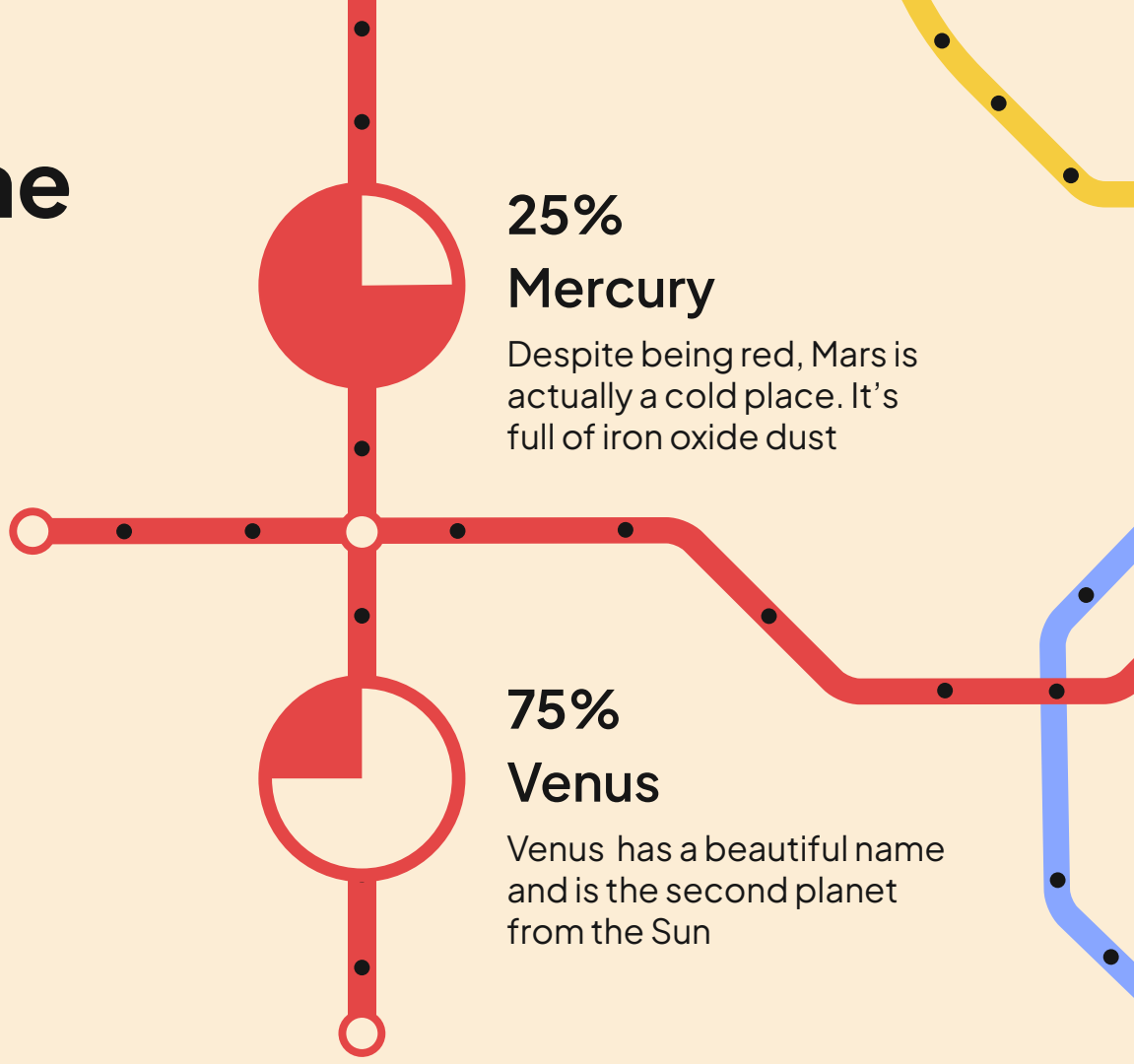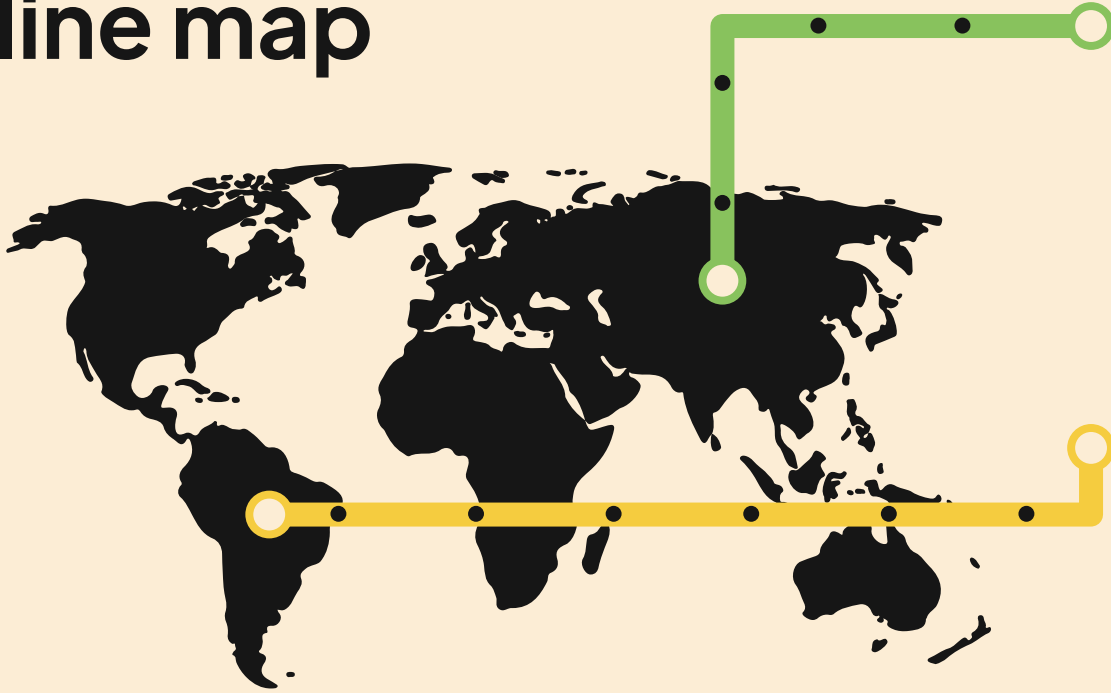
75%

Venus

Venus has a beautiful name and is the second planet from the Sun

Subway line map

Mars

Despite being red, Mars is actually a cold place

Jupiter

Jupiter is the fourth-brightest object in the night sky

Awards

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Name of the award (Organization), 2020

Meet the subway team

Kali Harris

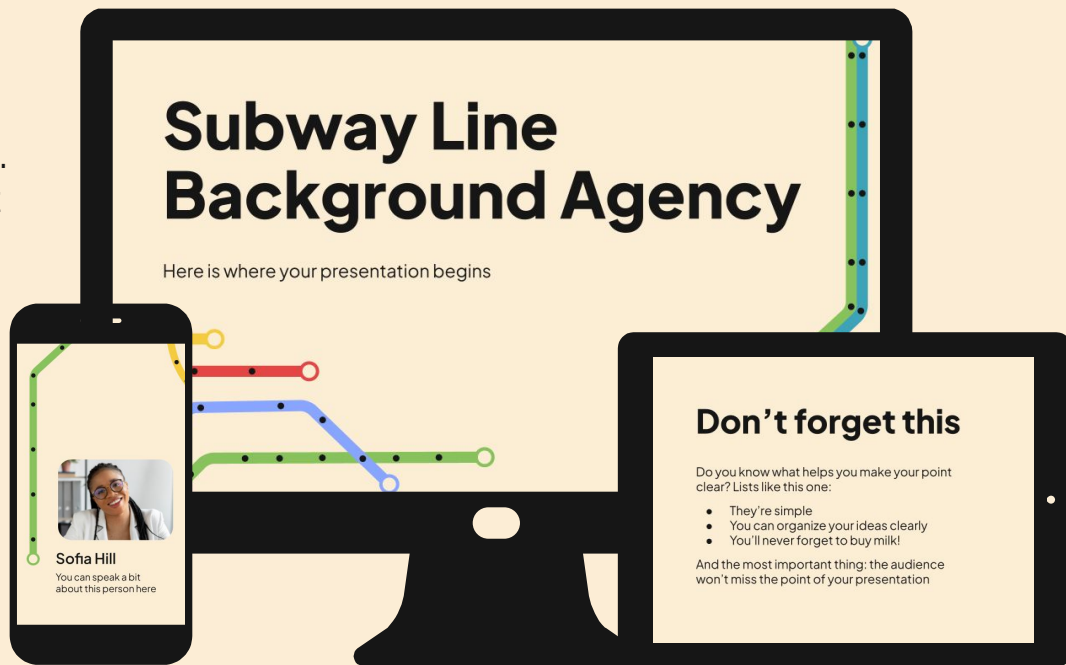You can speak a bit about this person here

Sofia Hill

You can speak a bit about this person here

Try these mockups

You can replace the image on the screen with your own work. Just right-click on it and select "Replace image"
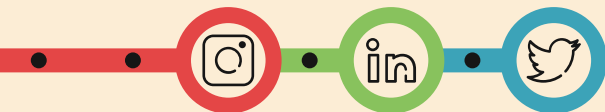
Subway Line Background Agency

Here is where your presentation begins

Sofia Hill
You can speak a bit about this person here

Don't forget this

Do you know what helps you make your point clear? Lists like this one:

- They're simple
- You can organize your ideas clearly
- You'll never forget to buy milk!

And the most important thing: the audience won't miss the point of your presentation

Thanks!

Do you have any questions?

youremail@freepik.com
+34 654 321 432
yourwebsite.com

Alternative resources

Here's an assortment of alternative resources whose style fits that of this template:

Vectors:

- Public transport with underground map

Resources

- https://data.ny.gov/Transportation/MTA-Bus-Automated-Camera-Enforcement-Violations-Be/kh8p-hcbm/explore/query/SELECT%0A%20%20%60violation_id%60%2C%0A%20%20%60vehicle_id%60%2C%0A%20%20%60first_occurrence%60%2C%0A%20%20%60last_occurrence%60%2C%0A%20%20%60violation_status%60%2C%0A%20%20%60violation_type%60%2C%0A%20%20%60bus_route_id%60%2C%0A%20%20%60violation_latitude%60%2C%0A%20%20%60violation_longitude%60%2C%0A%20%20%60stop_id%60%2C%0A%20%20%60stop_name%60%2C%0A%20%20%60bus_stop_latitude%60%2C%0A%20%20%60bus_stop_longitude%60%2C%0A%20%20%60violation_georeference%60%2C%0A%20%20%60bus_stop_georeference%60%0AWHERE%0A%20%20caseless_eq%28%60violation_status%60%2C%20%22VIOLATION%20ISSUED%22%29%0A%20%20AND%20caseless_one_of%28%60bus_route_id%60%2C%20%22M101%22%29%0AORDER%20BY%20%60violation_id%60%20DESC%20NULL%20FIRST/page/filter