2025.8.11

ENHANCING NYC 311:

IDENTIFYING KEY DRIVERS OF DISSATISFACTION AND TREND

WHAT IS NYC311?

NYC311 is one of the most active civic engagement systems worldwide.

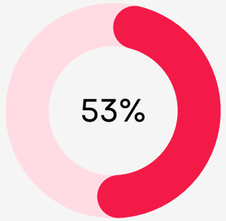
In New York City, the 311 system functions as the central non-emergency reporting platform, which enables residents to voice their concerns, including

- noise complaints
- illegal parking
- sanitation
- infrastructure problems

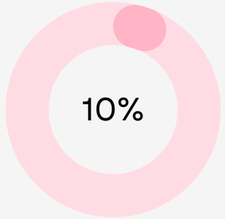
NYC 311

A growing mismatch between resident expectations and agency outcomes.

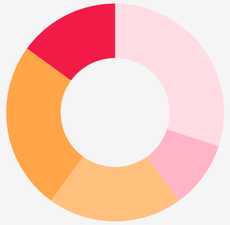
NYC311 received over 3.4 million calls in 2024



53% of respondents were strongly dissatisfied with service resolution



In cases like illegal parking, only 10% of reports led to enforcement

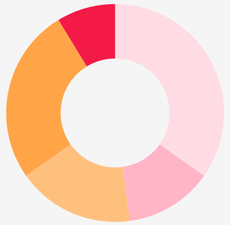


Complaints are geographically concentrated

Complaints cluster in areas like Downtown Brooklyn and the Bronx, revealing spatial disparities

Complaint types are highly skewed

Top 20 issues (e.g., noise, parking, heat) make up ~70% of all requests



Vague resolutions lead to low satisfaction

Agencies with vague resolution language received some of the lowest satisfaction scores

Current Trends in Complaints and Responsiveness

3,400,000 calls ↑

- There is a need for analysis methods that can detect both structural inequities and evolving patterns of concern.
- These insights emphasize the need to evaluate the linguistic framing of agency responses as a key determinant of public perception.

RESEARCH QUESTIONS

Our Research Questions

RQ 1.

What complaint types and borough-level characteristics are associated with low resolution satisfaction or unresolved cases in the 311 system?

RQ 2.

How are resolution description language patterns associated with citizen satisfaction, and do these patterns differ by complaint type or responding agency?

RQ 3.

How have complaint volumes for different issues changed over time, and what trends or seasonal patterns can be identified from the 311 request data?

Data & Suitability

311 Service Requests

Agency_Name, Complaint_Type, Descriptor, City, Status, Resolution_Description, Borough, Created_Date, Created_Time, Closed_Date, Closed_Time

311 Resolution Satisfaction Survey

Unique_ID, Agency_Acronym, Agency_Name, Complaint_Type, Descriptor, Borough, Resolution_Description, Survey_Year, Survey_Month, Satisfaction_Response, Dissatisfaction_Reason

KEY FIELDS **Complaint Type, Borough, Resolution Description, Satisfaction**

RQ 1
DISSATISFACTION DRIVERS

Complaint Distribution

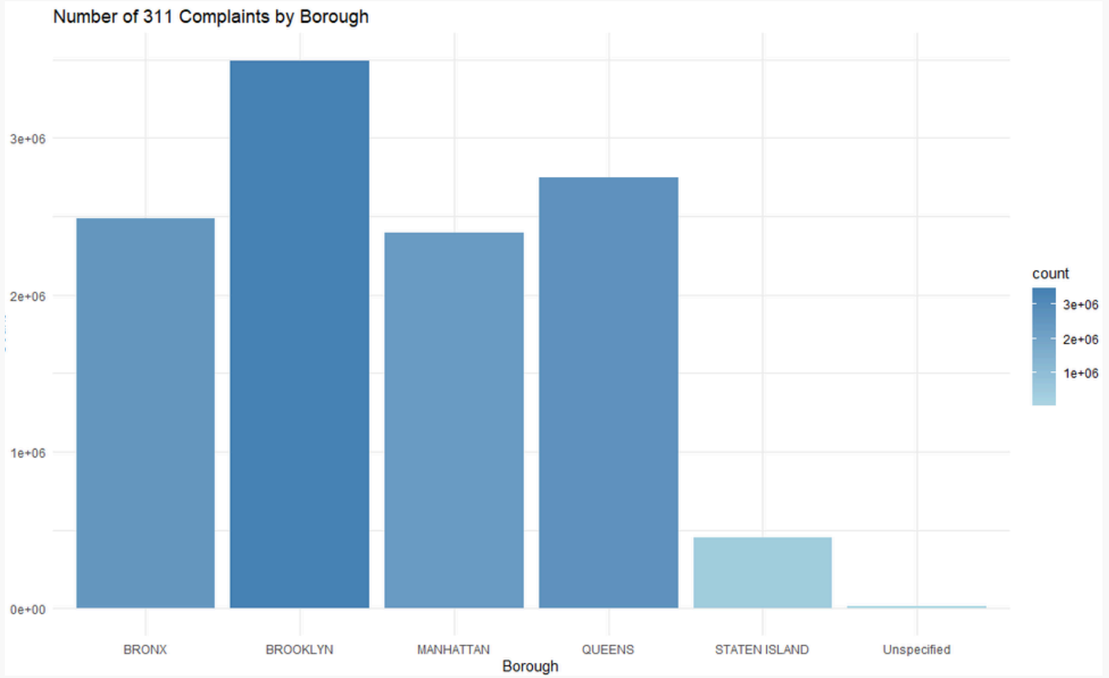


Exhibit 1. Number of 311 Complaints by Borough

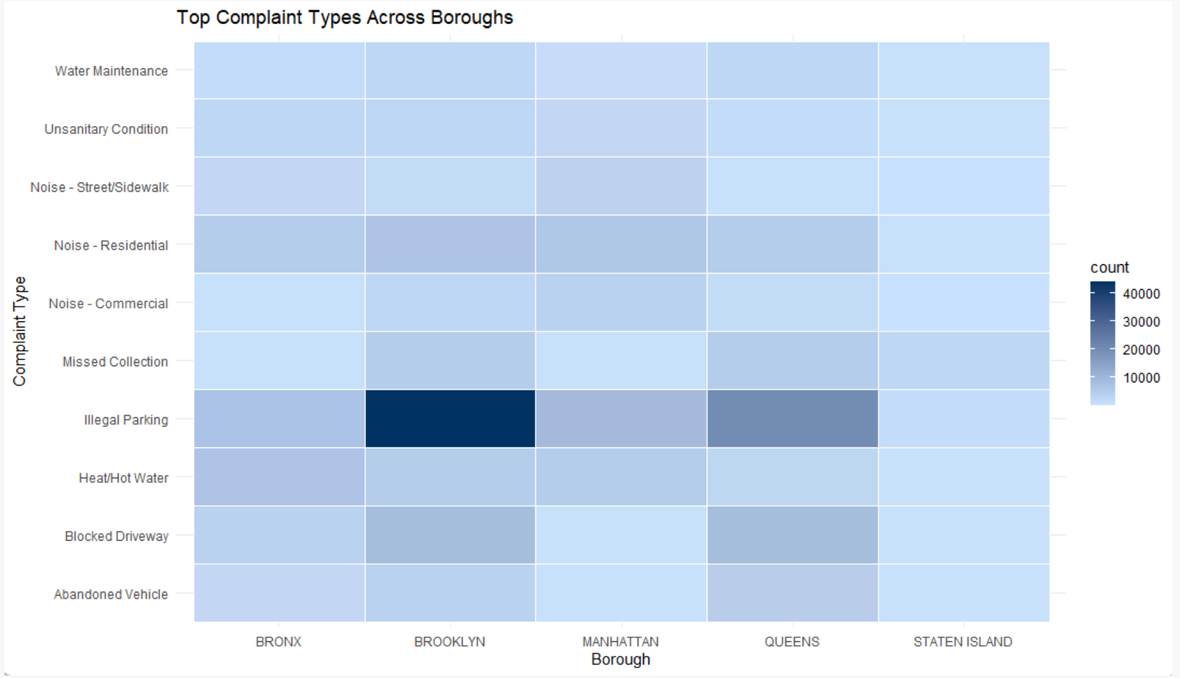


Exhibit 2. Top Complaint Types Across Borough

BROOKLYN RECORDS THE HIGHEST COMPLAINT VOLUME, WHILE STATEN ISLAND HAS THE FEWEST.

ILLEGAL PARKING DOMINATES IN BROOKLYN AND QUEENS, WHILE NOISE AND INFRASTRUCTURE ISSUES ARE MORE EVENLY SPREAD.

Complaint Types Most Likely to Cause Dissatisfaction

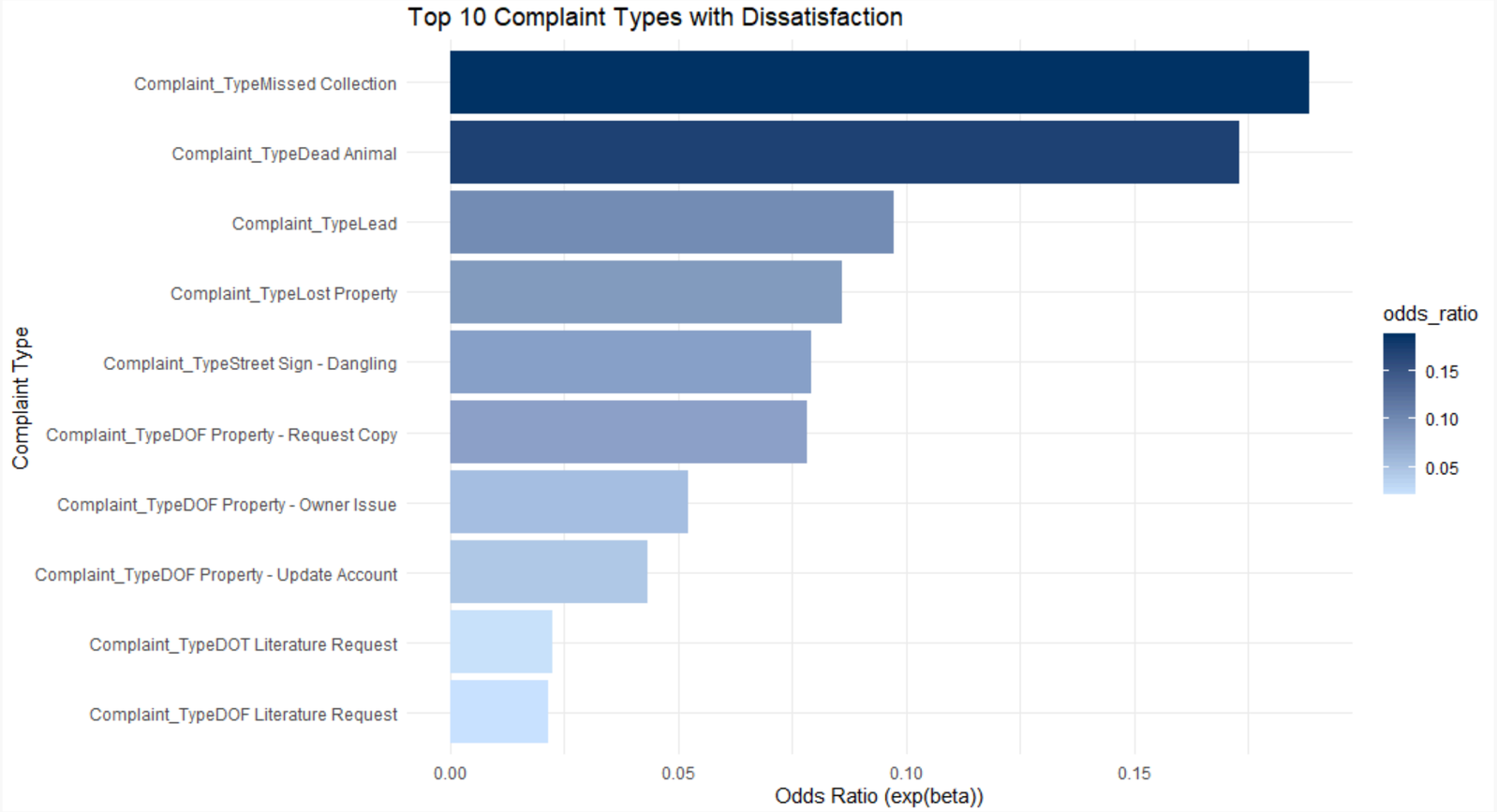


Exhibit 3. Top 10 Complaint Types with Dissatisfaction

Sanitation-related issues like missed collection are most likely to receive negative feedback.

Highest Dissatisfaction Rates by Complaint Type

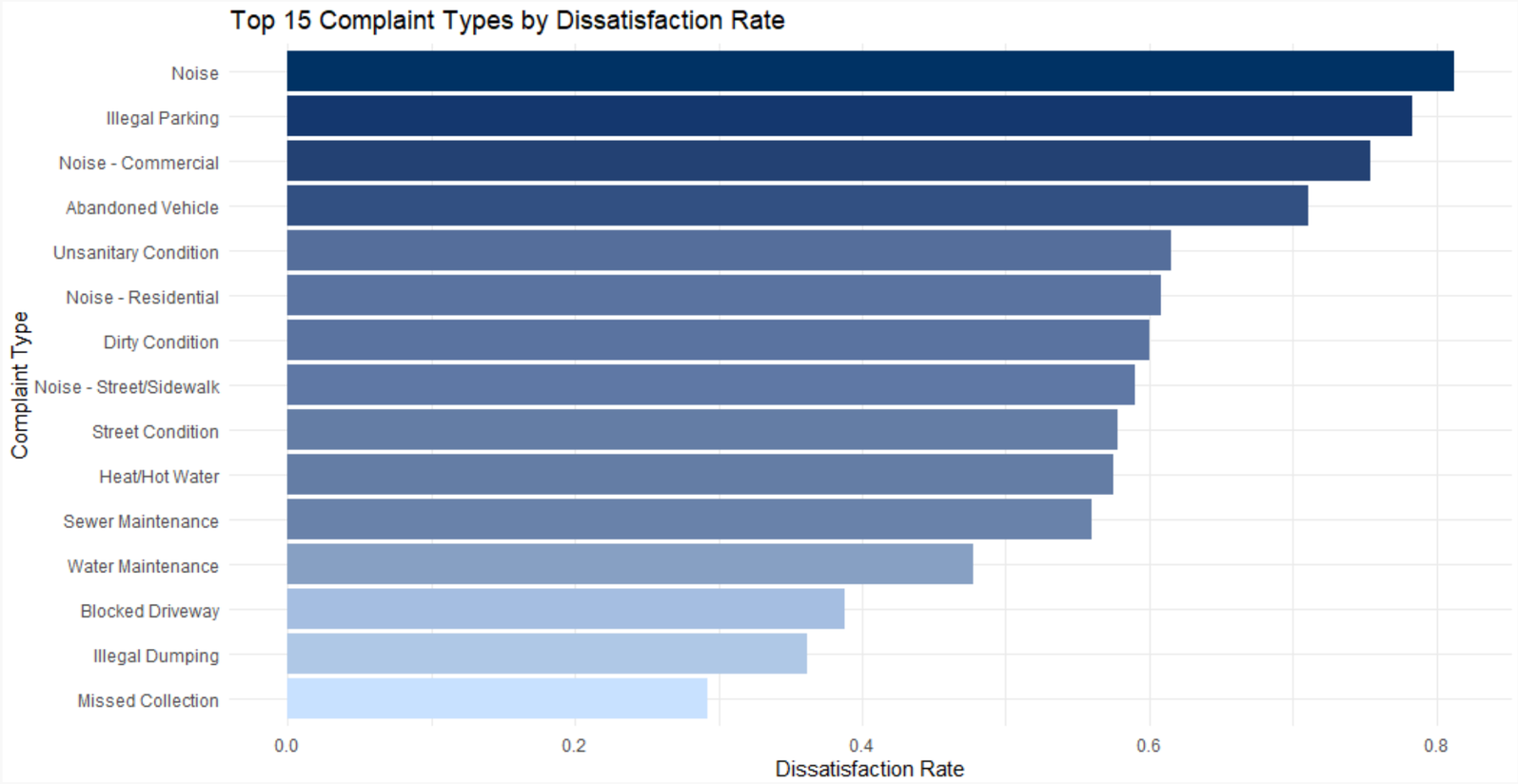


Exhibit 4. Top 15 Complaint Types by Dissatisfaction Rate

NOISE AND ILLEGAL PARKING COMPLAINTS SHOW THE HIGHEST DISSATISFACTION RATES, BOTH EXCEEDING 80%.

Borough Analysis I

Unresolved request rates are highest in Manhattan, followed by Queens and Brooklyn.

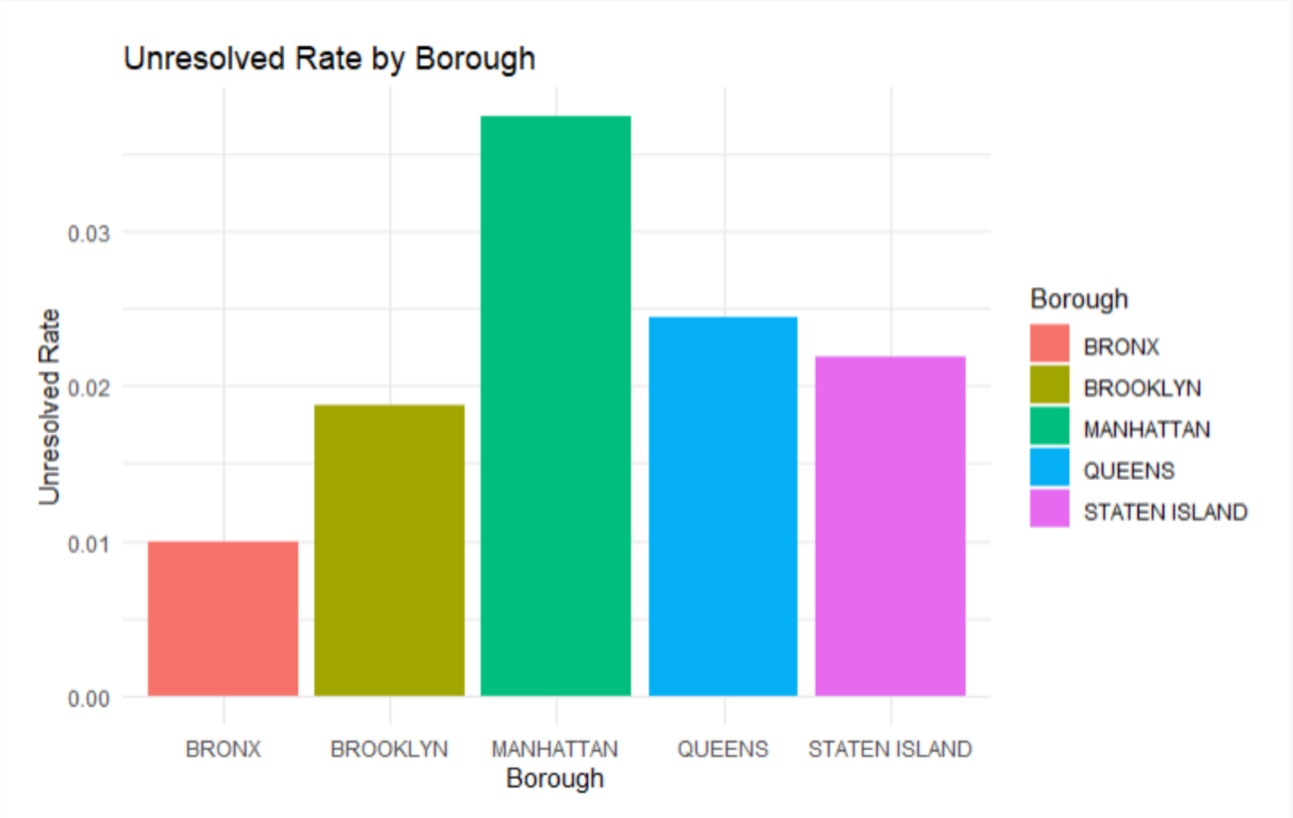


Exhibit 5. Unresolved Request Rates By Borough

Borough Analysis II

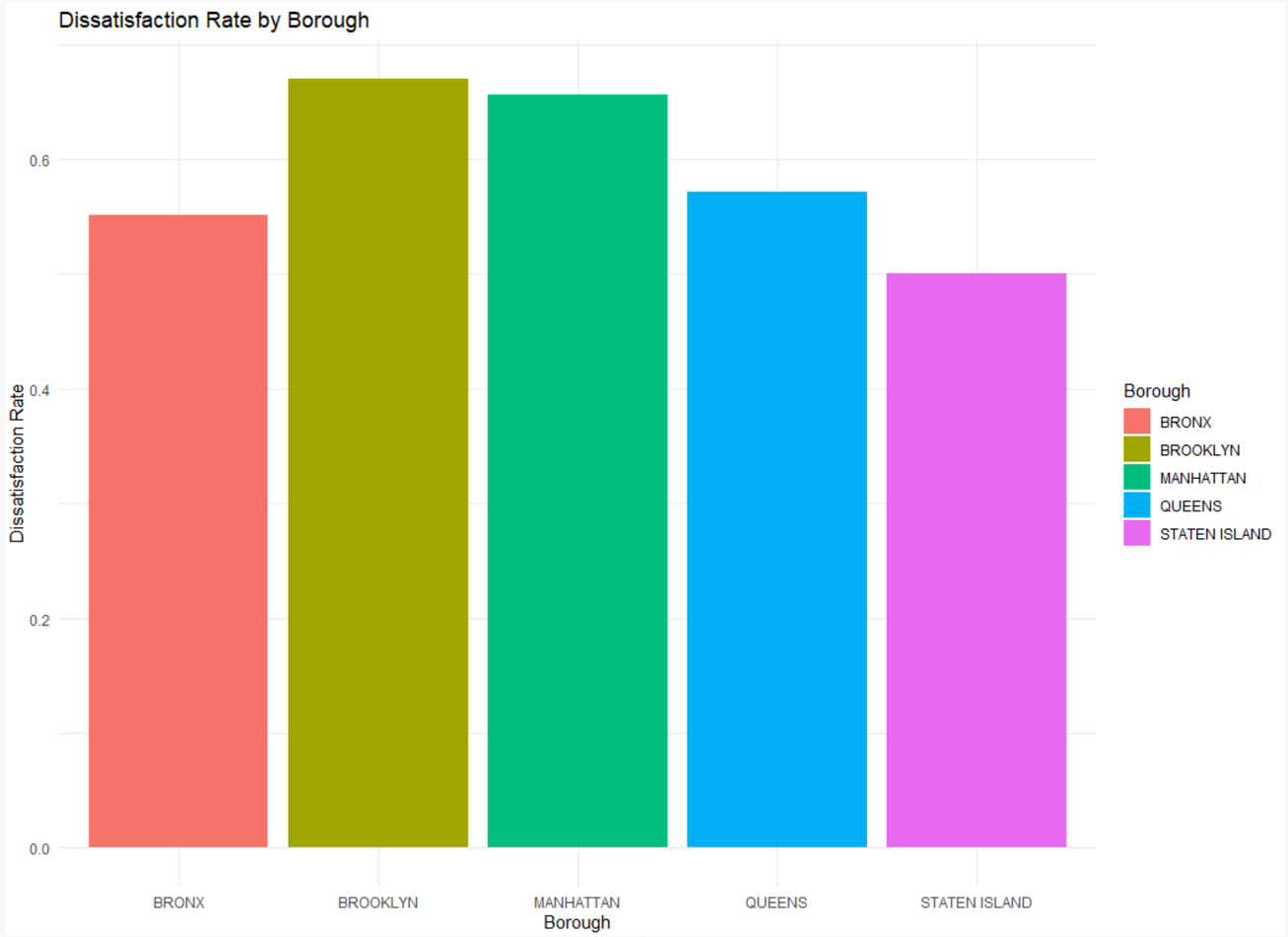


Exhibit 6. Dissatisfaction Rate by Borough

Brooklyn and Manhattan lead in dissatisfaction, both above 65%.

Complaint Types with Highest Unresolved Rates

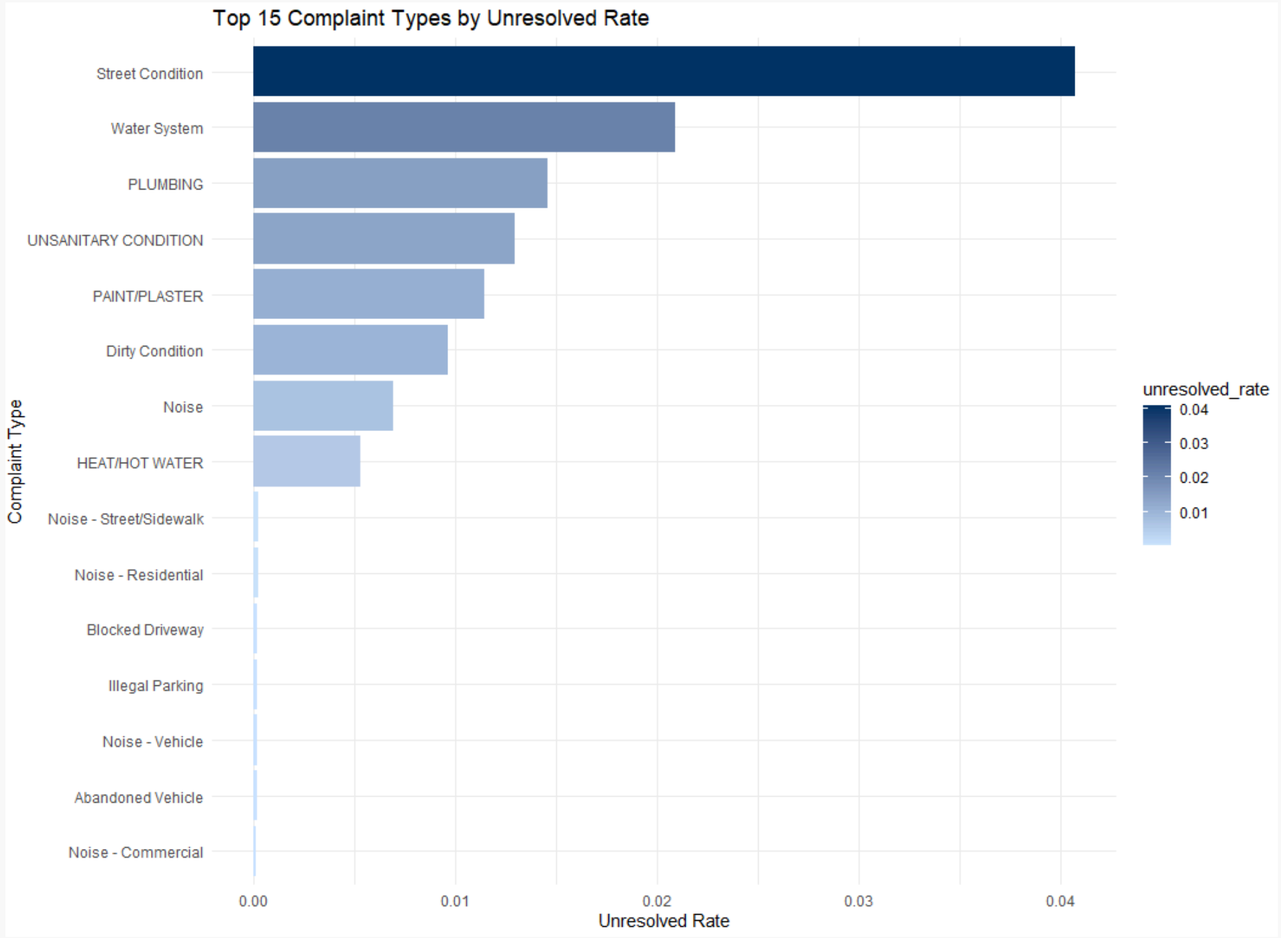


Exhibit 7. Top 15 Complaint Types By Unresolved Rate

Street condition and water system complaints are the most likely to remain unresolved.

100% Unresolved Complaint Types

Complaint_Type	Borough	total	unresolved	unresolved_rate
Construction Lead Dust	BRONX	844	844	1
Construction Lead Dust	BROOKLYN	1217	1217	1
Construction Lead Dust	MANHATTAN	1187	1187	1
Construction Lead Dust	QUEENS	480	480	1
Construction Lead Dust	STATEN ISLAND	36	36	1
For Hire Vehicle Report	Unspecified	75	75	1
Green Taxi Report	BROOKLYN	30	30	1
Green Taxi Report	MANHATTAN	22	22	1
Green Taxi Report	QUEENS	65	65	1
Harboring Bees/Wasps	BRONX	248	248	1

At the extreme, a small group of complaint types—"Construction Lead Dust," "Green Taxi Report," and "Harboring Bees/Wasps"—have a 100% unresolved rate .

KEY TAKEAWAYS

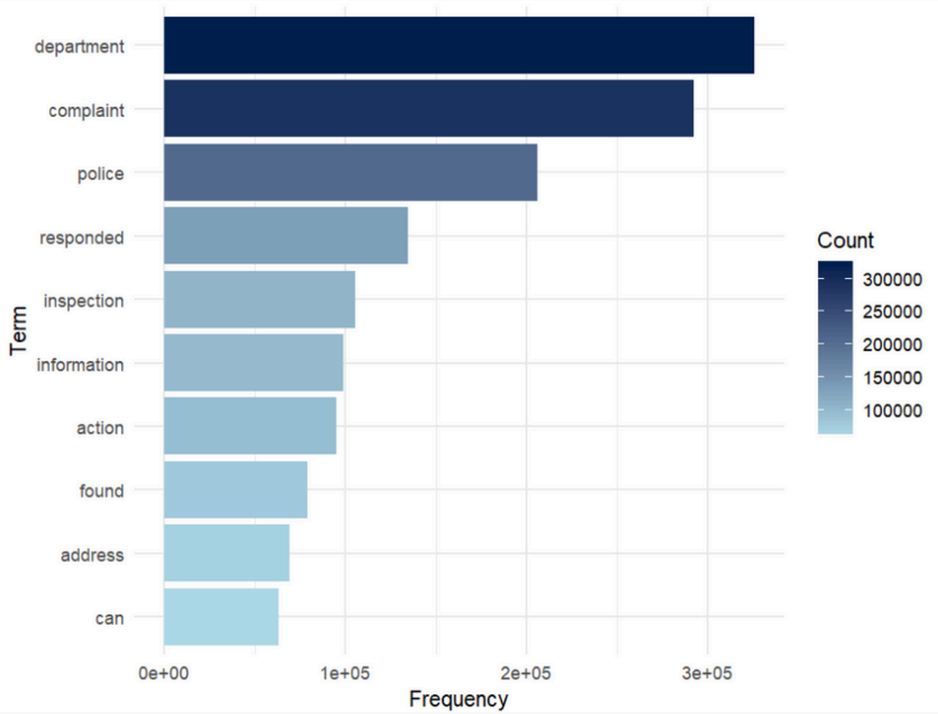
- Chronic quality-of-life issues such as noise and illegal parking are the leading drivers of dissatisfaction.
- Borough differences are clear – Brooklyn and Manhattan have the highest dissatisfaction rates, while Manhattan also has the highest unresolved rate.
- Most unresolved: Street Condition & Water System
- Findings support targeted improvements by issue type and location

RQ 2
TEXT MINING ANALYSIS OF RESOLUTION LANGUAGE

Vague Phrases Detection

We started by detecting instances of known boilerplate phrases using a regular expression search and standard language preprocessing.

Frequent boilerplate phrases like “No violation observed” and “Unable to locate” appear in thousands of resolution descriptions. These vague statements lack concrete actions and are associated with lower satisfaction.



We also conducted a frequency analysis to identify the most used terms across all 311 service cases.

Frequently occurring terms such as “department,” “complaint,” and “police” in the resolution narratives suggest resolution language often relies on standardized, procedural responses from agencies.

Exhibit 5. Most Frequent Terms in 311 Resolution Descriptions

Topic Modeling (LDA Results)

LDA topic modeling reveals 5 dominant resolution response themes. Topics 1 (Vague Inspection Outcome) and Topic 4 (Unsuccessful Outreach) capture non-actionable or ambiguous resolutions, while Topic 5 reflects clear actions and is more positively received.

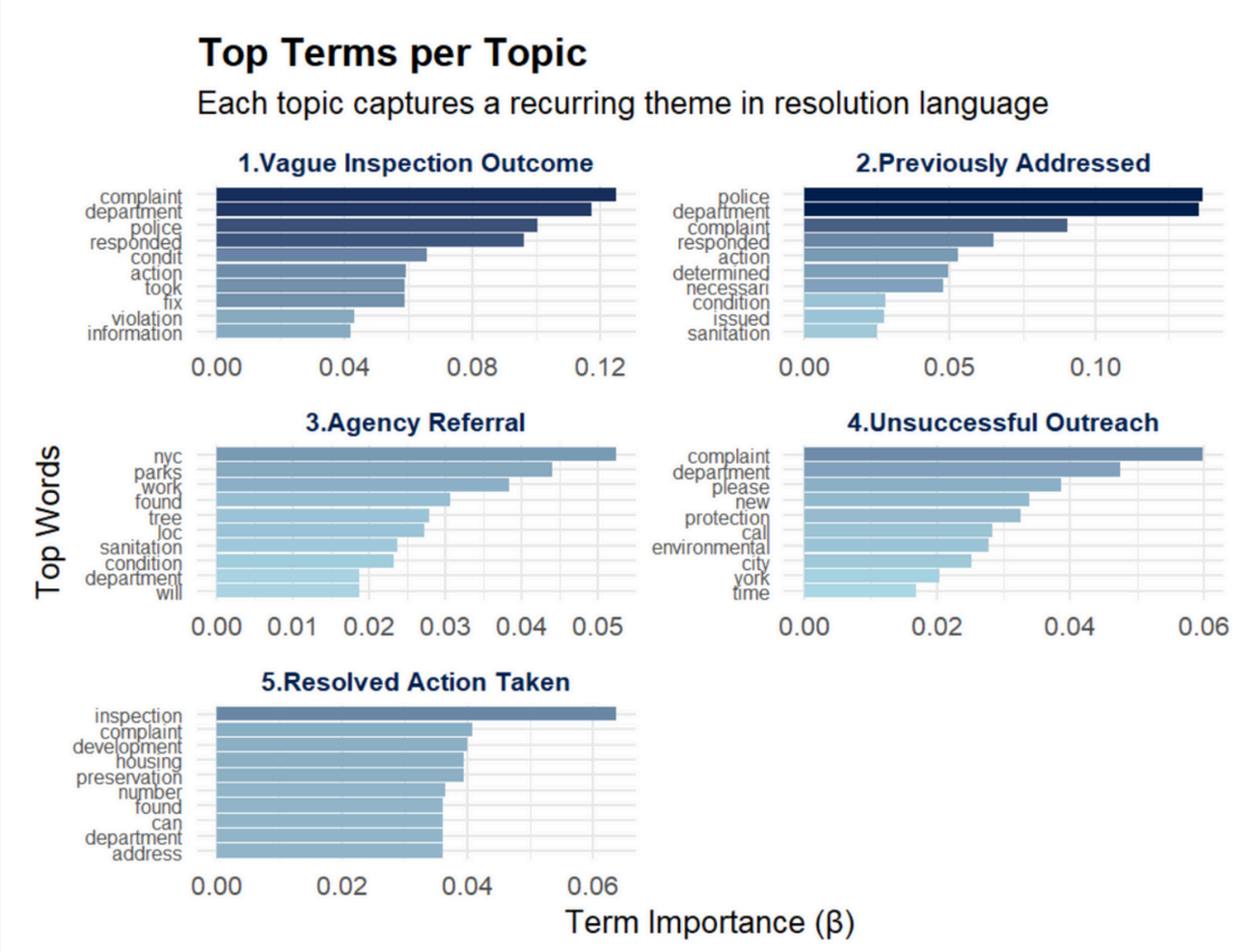


Exhibit 6. Resolution Descriptions Associated with Each of the 5 LDA Topics

Topic Modeling (Thematic Label)

Topic	Top Terms	Thematic Label	Interpretation
1	unable, access, locate, verify, prior	Vague Inspection Outcome	Describes situations where inspectors could not verify or access the reported issue.
2	duplicate, already, resolved, found	Previously Addressed	Indicates complaints already addressed or duplicated cases.
3	department, forwarded, agency, unit	Agency Referral	Refers to cases redirected to another department or internal unit.
4	attempted, contact, no response, door	Unsuccessful Outreach	Highlights failed efforts to reach the complainant or responsible party.
5	corrected, repair, completed, fixed	Resolved Action Taken	Indicates tangible corrective actions, typically satisfying for residents.

Exhibit 7. LDA topic modeling and thematic interpretation

Logistic Regression Results

- Logistic regression result indicates that the usage of vague, non-committal language is linked to dissatisfaction.
- Cases containing boilerplate phrases are 58% less likely to be rated as satisfactory;
- Resolutions categorized under vague topics are 42% less likely to earn a positive rating.

Predictor	Coefficient (β)	Odds Ratio (exp(β))	p-value	Interpretation
has_vague_phrase	-0.88	0.42	< 0.001	Cases with vague phrases are 58% less likely to receive a satisfied response.
topic_vague	-0.53	0.59	< 0.001	Resolution text under vague topics reduces odds of satisfaction by 41%.

Exhibit 8. Logistic Regression Model Results

Resolution Patterns by Complaint Type

- **Noise complaints** → Mostly vague (Topic 1); hard to verify, low enforcement
- **Tangible issues** → Clear actions taken (Topic 5)
- **Vehicle-related** → Frequent outreach failures (Topic 4)
- **Water & Parking issues** → Often referred to other agencies (Topic 3); some duplicates (Topic 2)

Noise-related complaints are more likely to end with vague or inconclusive language, while tangible service issues tend to result in clearer and more action-oriented descriptions.

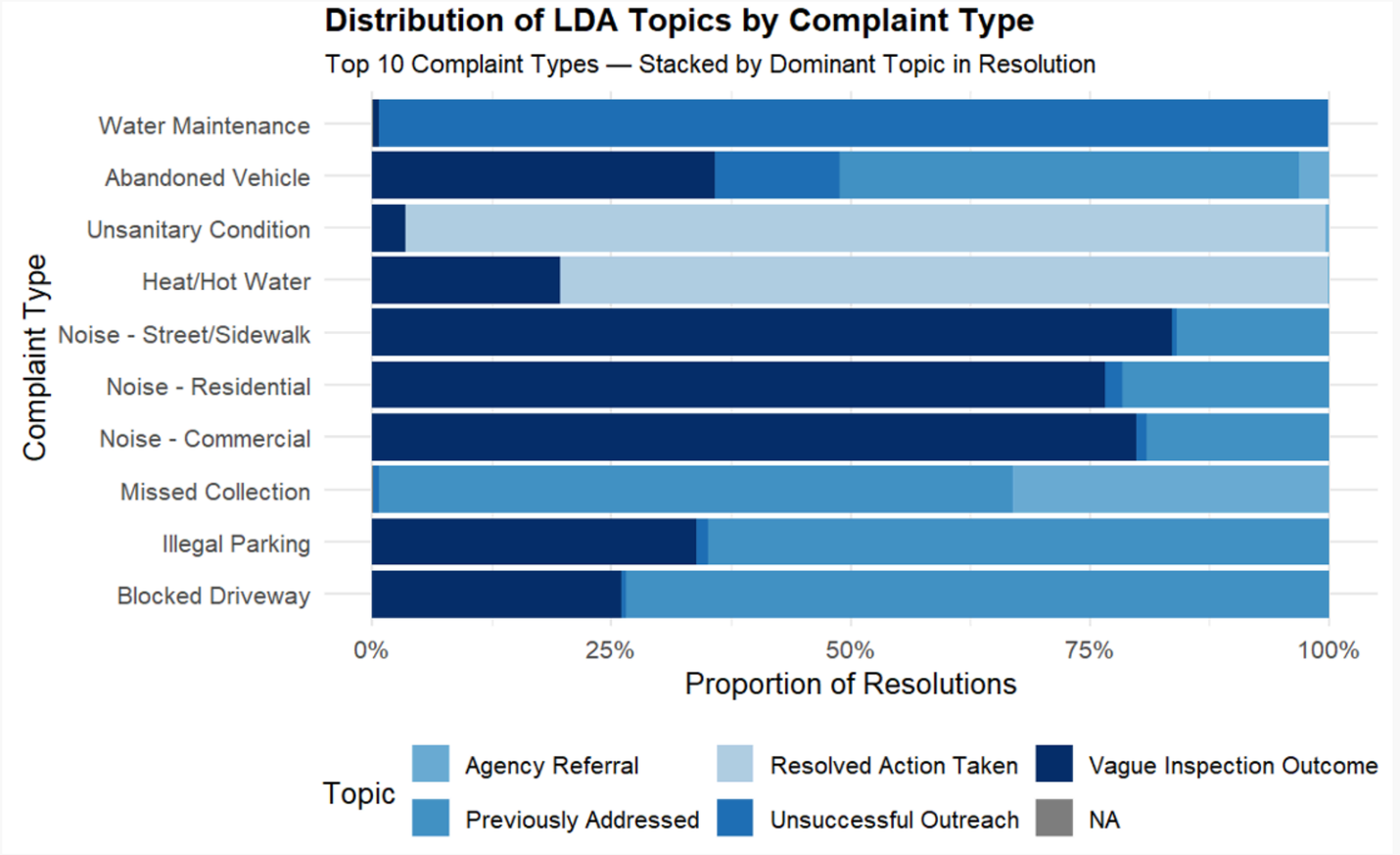


Exhibit 9. Distribution of LDA Topics by Complaint Type

Resolution Patterns by Agency

- **HPD & NYPD** → High use of vague outcomes (Topic 1)
- **DCWP & DSNY** → Frequent unsuccessful outreach or repeat cases (Topics 4 & 2)
- **DOB & DOT** → More clear, resolved actions (Topic 5)

Some agencies (e.g., HPD, NYPD) rely on vague or generic language, while others (e.g., DOB, DOT) use clearer, action-based resolutions—likely reflecting differences in procedures, mandates, or communication norms.

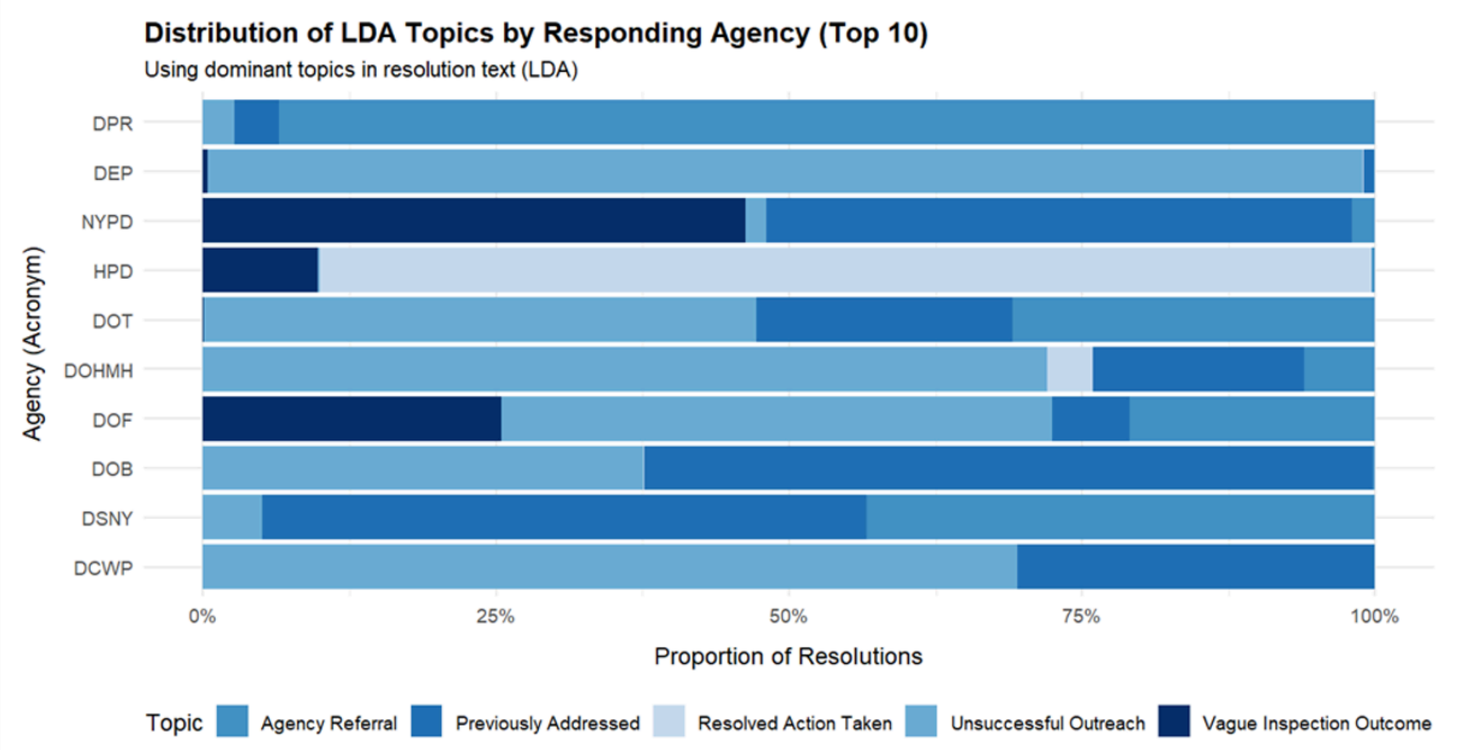


Exhibit 10. Distribution of LDA Topics by Responding Agency

OUR RECOMMENDATIONS

- Reduce vague responses: Re-train staff to avoid over-reliance on templated phrases (e.g., “no violation observed”), especially for complaints like noise and sanitation.
- Improve follow-up: Use re-inspections or better outreach for recurring or unresolved cases.
- Use clearer language: Agencies like HPD and NYPD should adopt more transparent, personalized messaging to boost trust and satisfaction.

RQ 3
TIME SERIES ANALYSIS

Data Preparation & Focus: How We Built Our Time Series

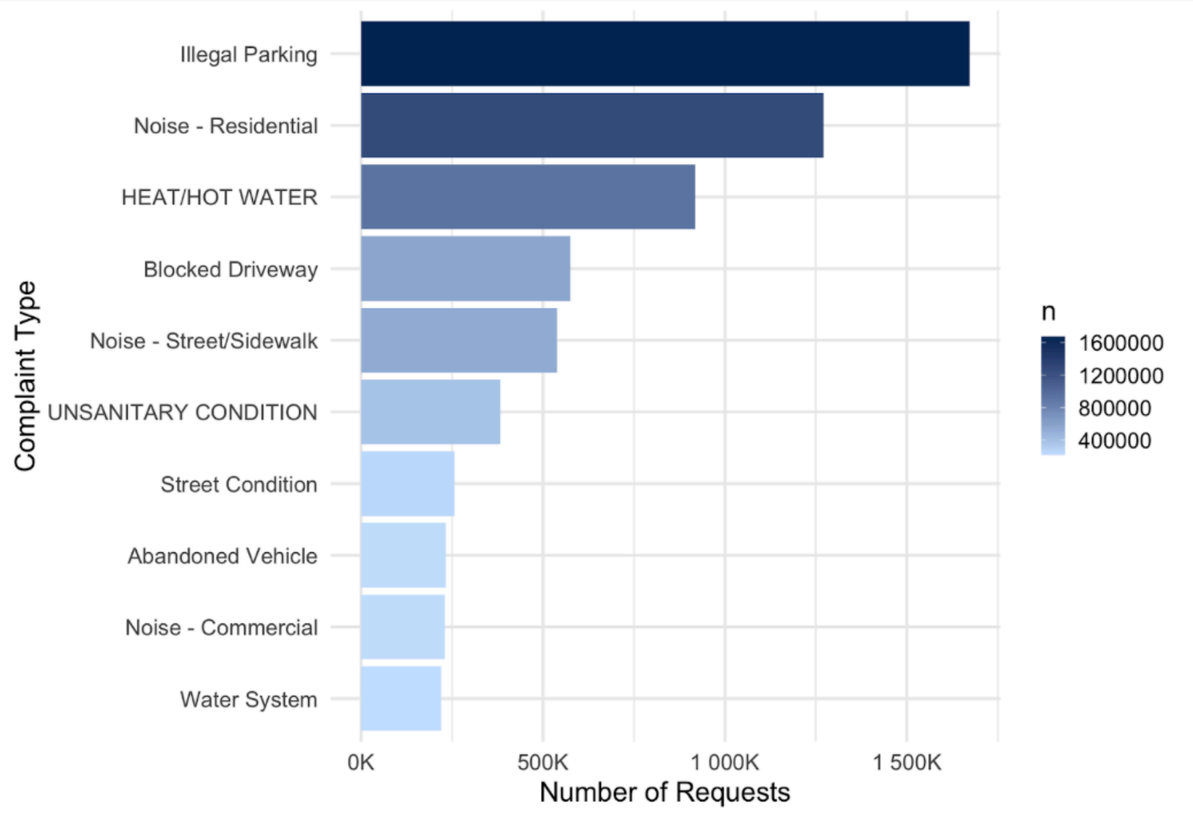


Exhibit 11. Top 10 Complaint Types in NYC311

- Filtered entries with valid **Created_Date and Complaint_Type**
- Focused on Top 10 complaint types (covering over **54%** of total requests)
- Monthly aggregation from 2022–2025
- Constructed a complete monthly time series object. **ts()**
- Methods used: **Autoplot, ggseasonplot, STL decomposition** to uncover meaningful, complaint-specific temporal patterns

Key Trend Observations & STL Decomposition

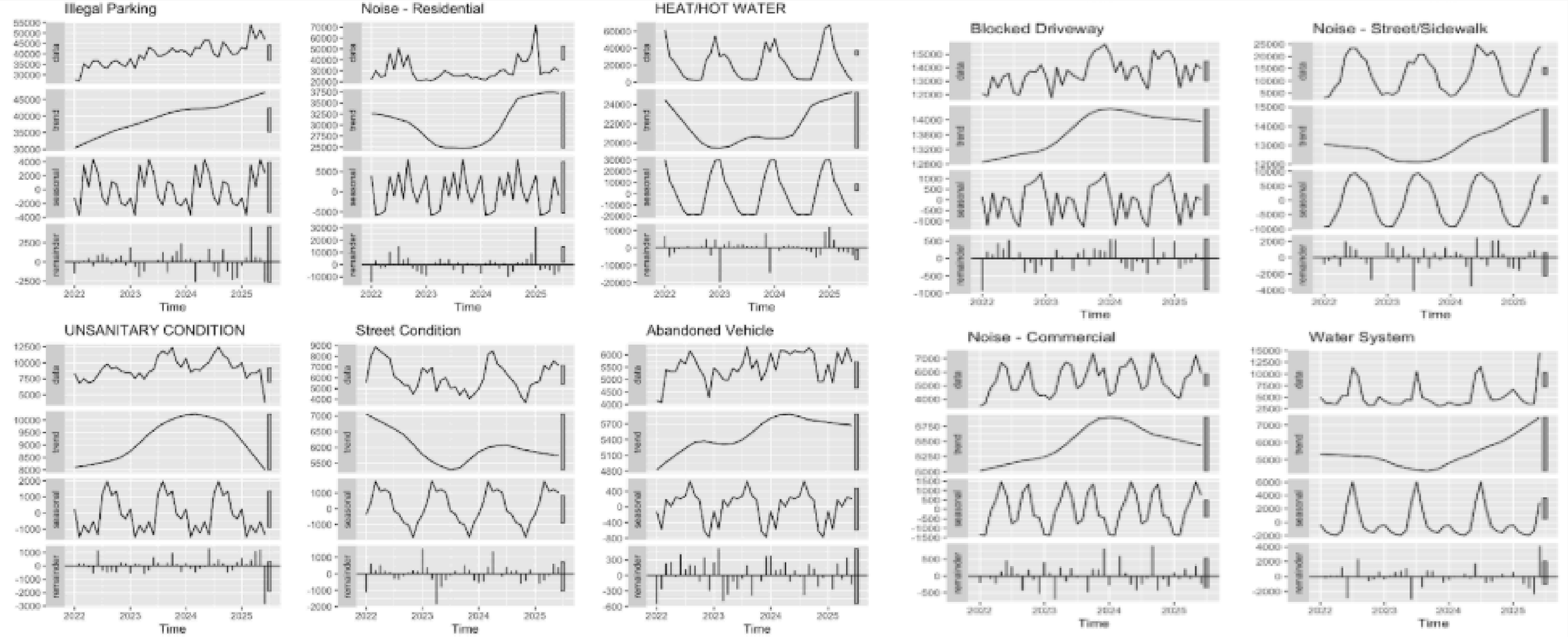


Exhibit 12. STL Decomposition Visualization

KEY TAKEAWAYS

- 🚙 **Illegal Parking**: Consistent upward trend
- 🔊 **Noise – Residential**: Gradual rise; recovered in 2024, mild summer peaks
- ❄️ **Heat/Hot Water**: Sharp spikes during winter months (Dec–Feb)
- 🚪 **Blocked Driveway**: Gradual upward trend, minimal seasonality
- 🎶 **Noise – Commercial/Street**: Clear summer peaks, linked to outdoor activity
- 🧼 **Unsanitary Condition**: Moderate summer seasonality, gradual decline
- 🛣️ **Street Condition**: Mild spring increase (Mar–Jun), overall downward trend
- 🚙 **Abandoned Vehicle**: Peaked in late 2023–early 2024, stable since
- 💧 **Water System**: Steady rise, recurring summer seasonality

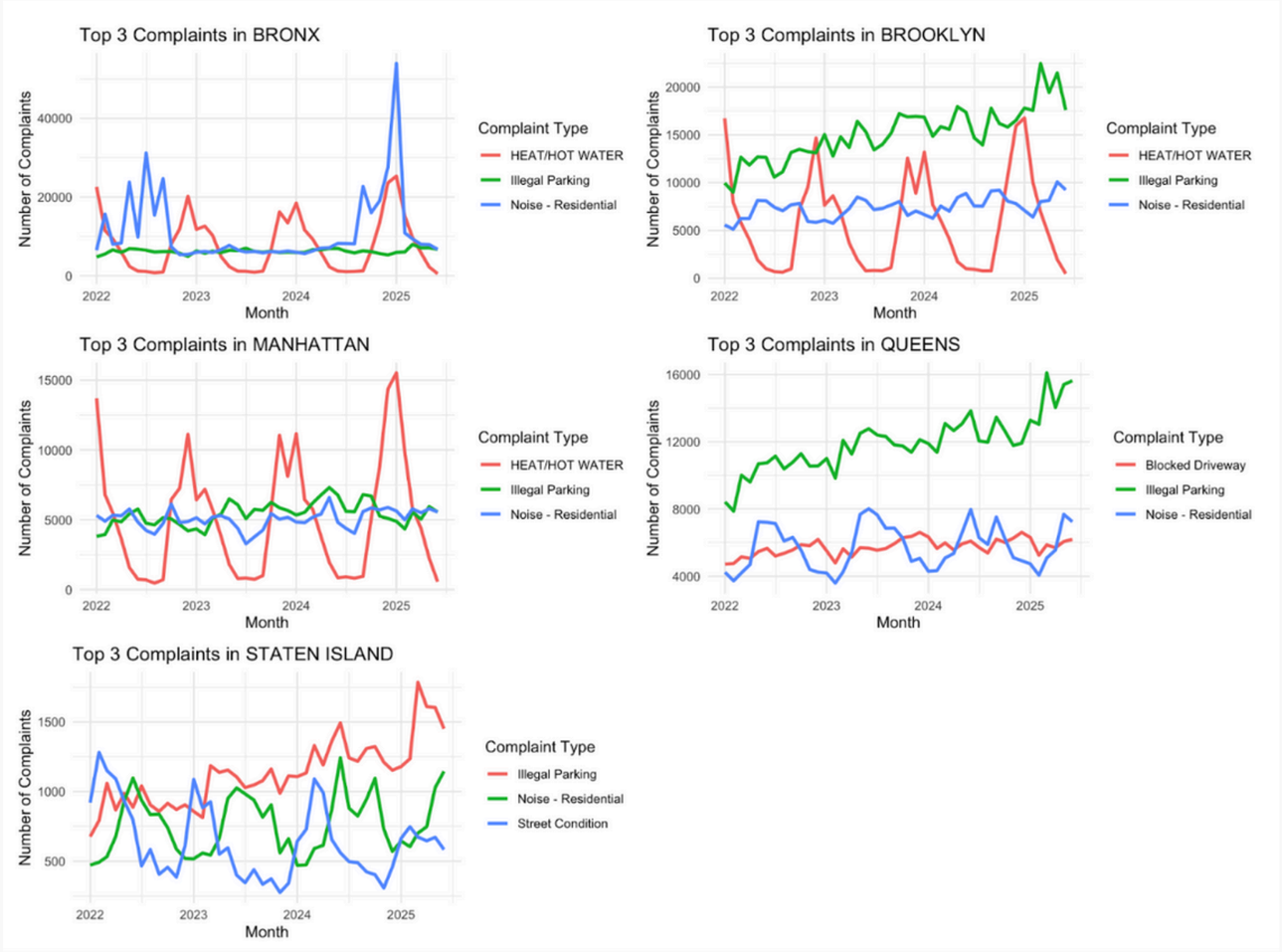


Exhibit 13. Borough-specific Time Series Plots with Top 3 Complaint type

Borough-Level Comparative Analysis

- **Bronx**: Noise and heating dominate
- **Brooklyn**: Surge in Illegal Parking
- **Manhattan**: Heat complaints lead
- **Queens**: Sharp rise in Illegal Parking, stable Blocked Driveway
- **Staten Island**: Illegal Parking is top issue, Spring spike in Street Conditions

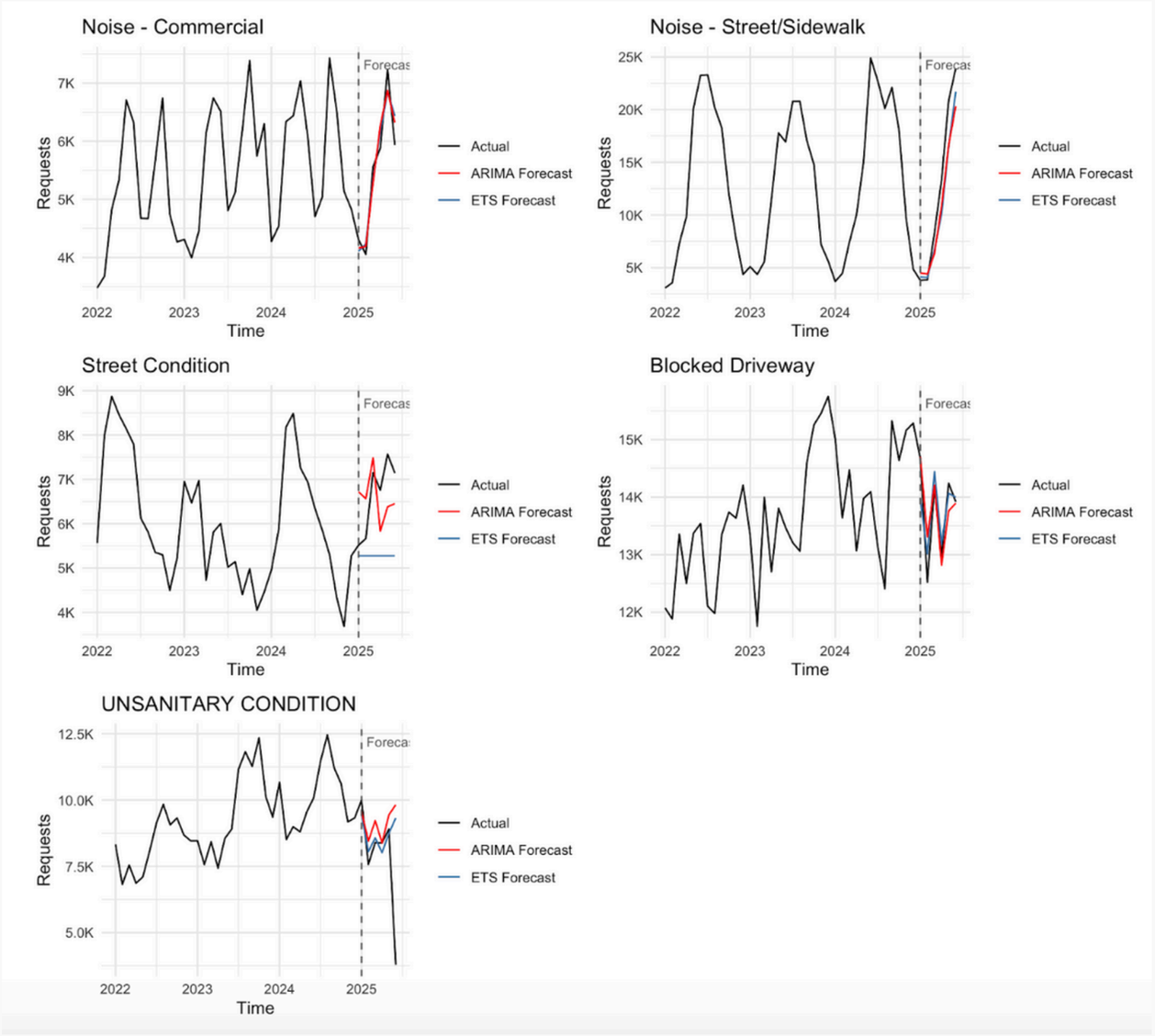


Exhibit 14. Visualization of Forecast Results

Time Series Forecasting of Key Complaints

- Focused on **5 complaint types** with strong patterns
- Split data into training/testing (**last 6 months = holdout**)
- Compared **ETS vs. ARIMA** models
- **Visualized** the forecasts
- Assess performance with **RMSE, MAE, MAPE, MASE**

Time Series Forecasting of Key Complaints

ETS vs. ARIMA: Who Wins?

- ARIMA outperformed ETS for most complaint types
- ETS did slightly better for **Noise – Street/Sidewalk**
- Both models aligned well visually with actual complaint volume
- **ARIMA offers greater flexibilit**y and **predictive accuracy**, especially when dealing with complaint types exhibiting evolving trends and moderate noise.

	Complaint_Type	Model	ME	RMSE	MAE	MAPE	MASE
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	Noise - Commercial	ETS	-25.9	321.	300.	5.36	0.474
2	Noise - Commercial	ARIMA	-20.9	302.	283.	4.99	0.447
3	Noise - Street/Sidewalk	ETS	1813.	2483.	1989.	14.6	0.892
4	Noise - Street/Sidewalk	ARIMA	1841.	2639.	2257.	18.4	1.01
5	Street Condition	ETS	1357.	1563.	1357.	19.3	1.03
6	Street Condition	ARIMA	61.6	925.	875.	13.6	0.663
7	Blocked Driveway	ETS	-27.4	387.	322.	2.34	0.405
8	Blocked Driveway	ARIMA	-31.3	383.	253.	1.92	0.318
9	UNSANITARY CONDITION	ETS	-857.	2286.	1208.	27.7	1.07
10	UNSANITARY CONDITION	ARIMA	-1309.	2528.	1449.	31.9	1.28

Exhibit 15. Forecast Results

WHAT CAN NYC311 DO WITH THESE INSIGHTS?

- Seasonal Resource Allocation: **Staff up** during predictable spikes
- Forecasting Tools: **Use ARIMA or dashboards** for short-term complaint surge prediction
- Borough-Specific Strategy: **Tailor operations** to borough-level trends
- Proactive Communication: **Alert public ahead** of forecasted spikes to guide behavior & reduce complaints

THANK YOU

REFERENCES

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