Factors Influencing Bus Lane Violations in Athens

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Introduction

- Bus lanes are an important means for relieving traffic and enhancing the use of public transportation in Athens
- However, their effective operation is often hindered by violations and non-compliance by drivers
- Illegal parking, breaking traffic rules, and irresponsible behavior in these lanes threaten the safety and efficiency of the network
- To ensure the effective operation of bus lanes, cooperation between authorities and systematic enforcement of regulations are required

Objectives

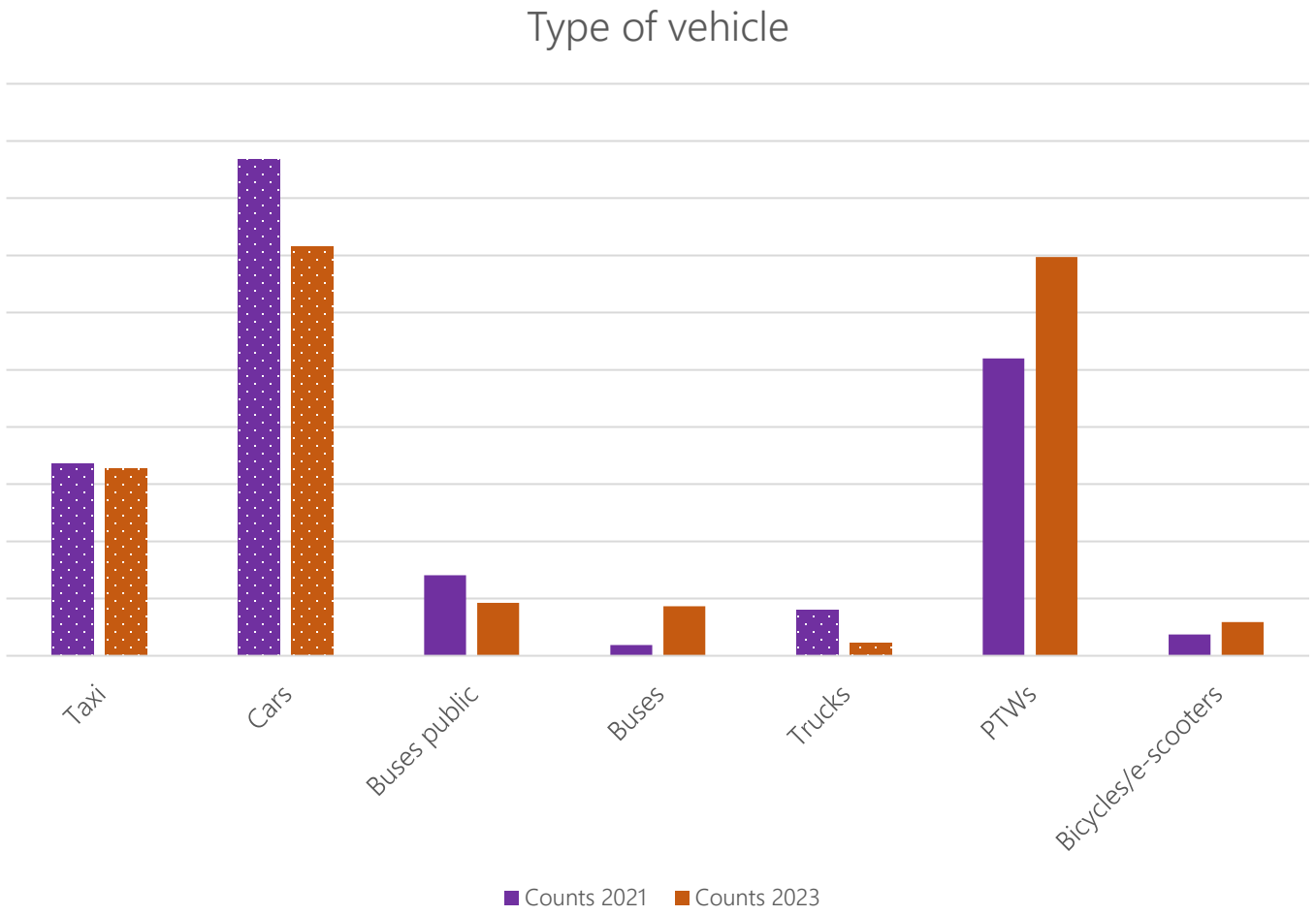
- Investigate the factors influencing violations in bus lanes in Athens using data from on-site measurements
- Specifically, identify the characteristics recorded from on-site measurements and road geometric characteristics determining the violations in Athens' bus lanes

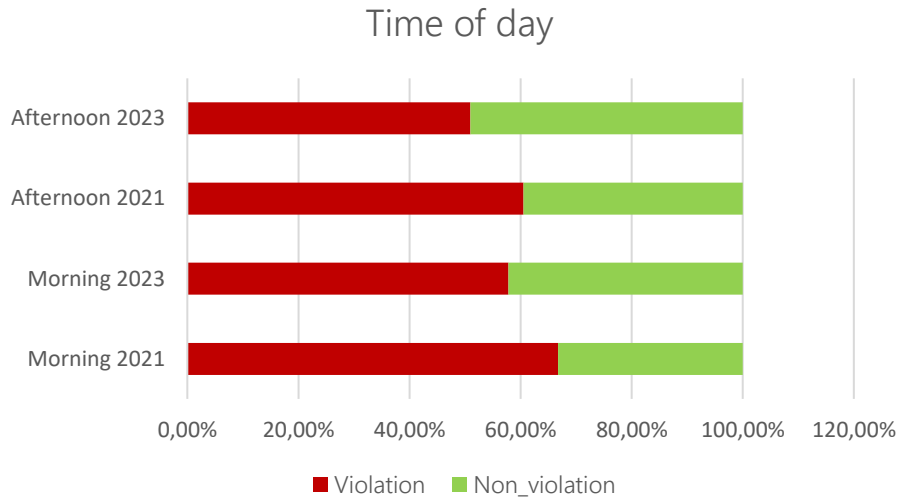
Methodological Approach

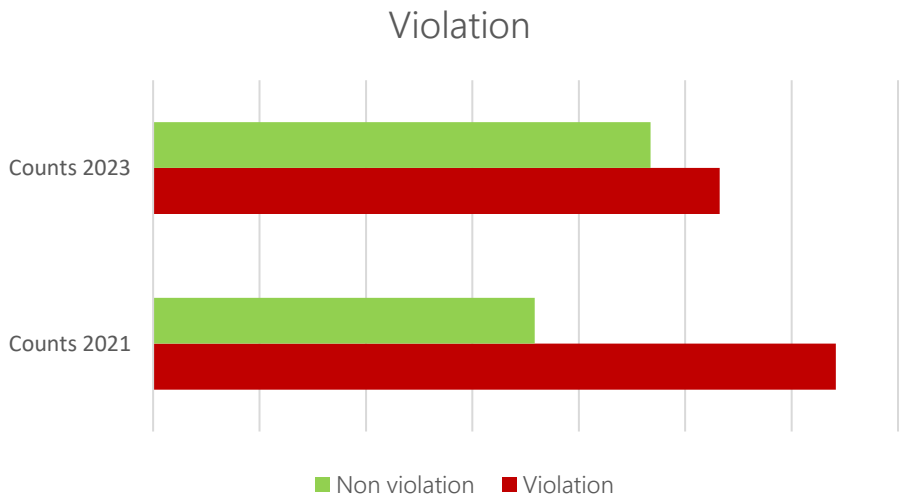
- Measurements were carried out on most major roads in Athens that contain bus lanes
- Specifically, measurements were conducted in two periods: May and June 2021 and November 2023
- The collected data were entered into an Excel spreadsheet that included all elements during the hours of measurement and the type of violation

Variable	Description
Date	Exact date of observation
Year	Year of observation
Street	Street name
Segment	Road segment identifier
Direction	Direction of traffic flow
Time	Specific timestamp
Time_slot	Aggregated time interval (e.g., 15-min, hourly)
Vehicle_type	Category of vehicle (car, bus, truck, etc.)
Inside_Athens	Indicator whether the location is inside Athens limits
Count	Number of vehicles observed
Violation	Type of traffic violation (if any)
Length	Segment length
Lanes	Number of lanes
Count_violation	Number of violations recorded
Time_of_day	Categorized time (morning, afternoon, evening, night)

Descriptive Statistics







Modelling Approach

Selection of multiple linear regression models

- **General model form:** explores the relationship between a continuous dependent variable and multiple independent variables
- **Model specification:** $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \varepsilon$
- **Interpretation of coefficients:** each β_i represents the expected change in the dependent variable for a one-unit increase in X_i ,holding all other variables constant
- **Model evaluation:** typically assessed using R^2 , Adjusted R^2 ,F-statistic, residual analysis, and significance of coefficients

Results – Linear Regression Models

Count of Violations in Bus Lanes in Athens								
	Model 2021				Model 2023			
Variables	βi	Pr(>|t|)	Elasticity ei	Relative Elasticity ei*	βi	Pr(>|t|)	Elasticity ei	Relative Elasticity ei*
(Intercept)	-1.743	1.49E-15	-	-	-6.990	0.00023	-	-
Lanes	0.219	0.000105	1.244	1.244	1.109	0.01346	3.031	3.031
Length	0.606	1.82E-14	1.834	1.834	1.616	4.65E-08	5.033	5.033
Vehicle_typeBuses	3.31E-15	-	1.000	1.000	-1.02E-14	-	1.000	1.000
Vehicle_typeBuses public	3.64E-14	-	1.000	1.000	8.59E-15	-	1.000	1.000
Vehicle_typeCars	6.476	< 2e-16	649.368	649.368	8.405	< 2e-16	4469.358	4469.358
Vehicle_typePTWs	1.77E-15	-	1.000	1.000	2.80E-14	-	1.000	1.000
Vehicle_typeTaxi	3.837	< 2e-16	46.386	46.386	3.843	< 2e-16	46.665	46.665
Vehicle_typeTrucks	0.460	0.024452	1.584	1.584	0.262	-	1.299	1.299
Time_of_dayMorning	1.208	< 2e-16	3.347	3.347	-	-	-	-
Directiontowards downtown	-	-	-	-	1.183	< 2e-16	3.264	3.264
R^2	0.5153				0.6598			

Conclusions (1/2)

- Bus lane violations in Athens decreased between 2021 and 2023, reflecting the positive impact of enforcement and awareness campaigns
- Vehicle type plays a significant role: taxis and private cars are more likely to commit violations compared to vans
- Road geometry matters: longer routes and roads with more lanes are associated with higher violation rates
- Spatial patterns show that central and high-demand corridors face the greatest violation pressures

Conclusions (2/2)

- Violations are time-dependent, with peaks in the morning rush hours
- Despite improvements, infringements remain a persistent issue requiring continuous attention
- Data-driven analysis provides valuable insight into traffic behavior and enforcement effectiveness in Athens' bus lanes
- The study demonstrates the value of combining sensor data with policy evaluation for evidence-based decision making

Policy & Planning Implications

- Strengthen targeted enforcement, particularly focusing on taxis
- Enhance real-time monitoring systems (e.g., cameras, sensors) to increase compliance
- Integrate public awareness campaigns with stricter penalties to sustain behavioral change
- Use insights from traffic modeling to prioritize infrastructure upgrades in high-violation corridors

Future Challenges

- Ensuring long-term sustainability of enforcement and monitoring systems
- Addressing driver culture and behavior, beyond just policing
- Adapting bus lane management to growing urban pressures (ridesharing, delivery vehicles, etc.)
- Balancing strict enforcement with equitable mobility goals for all road users

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