Autonomous Truck Deployment – Impact of Road Construction

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Presented to: Aurora

Construction Impact Analysis

Summary

- Data: US road construction data (2016-2021)
- Critical insights for AV deployment strategy
- Identifying high-impact zones and routes
- Predict affect of Construction

22.6K

Total Cities Analyzed

5

Self-driving Routes

6.2M

Construction Projects

2.7B

Construction Hours

7.8M

Construction Length

6Yr

Continuous Data

Analysis Methodology

Data Processing Approach

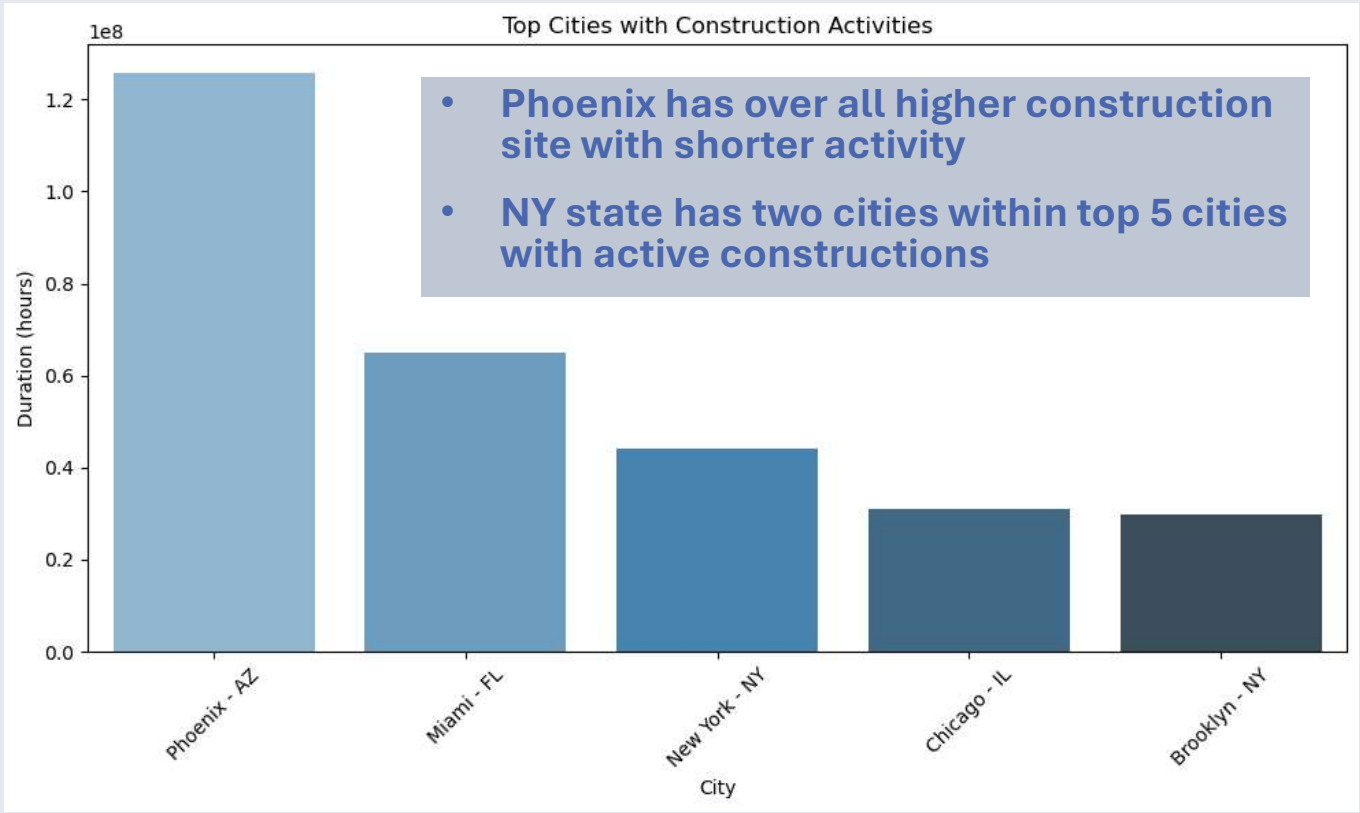
- Ingest Kaggle data using API
- Get the additional data
- Census population, employment
- National Road network for freights: to get the road density of cities - generating city size to normalize
- Extract features from additional files

Insight 1: **City With Highest Construction Activity**

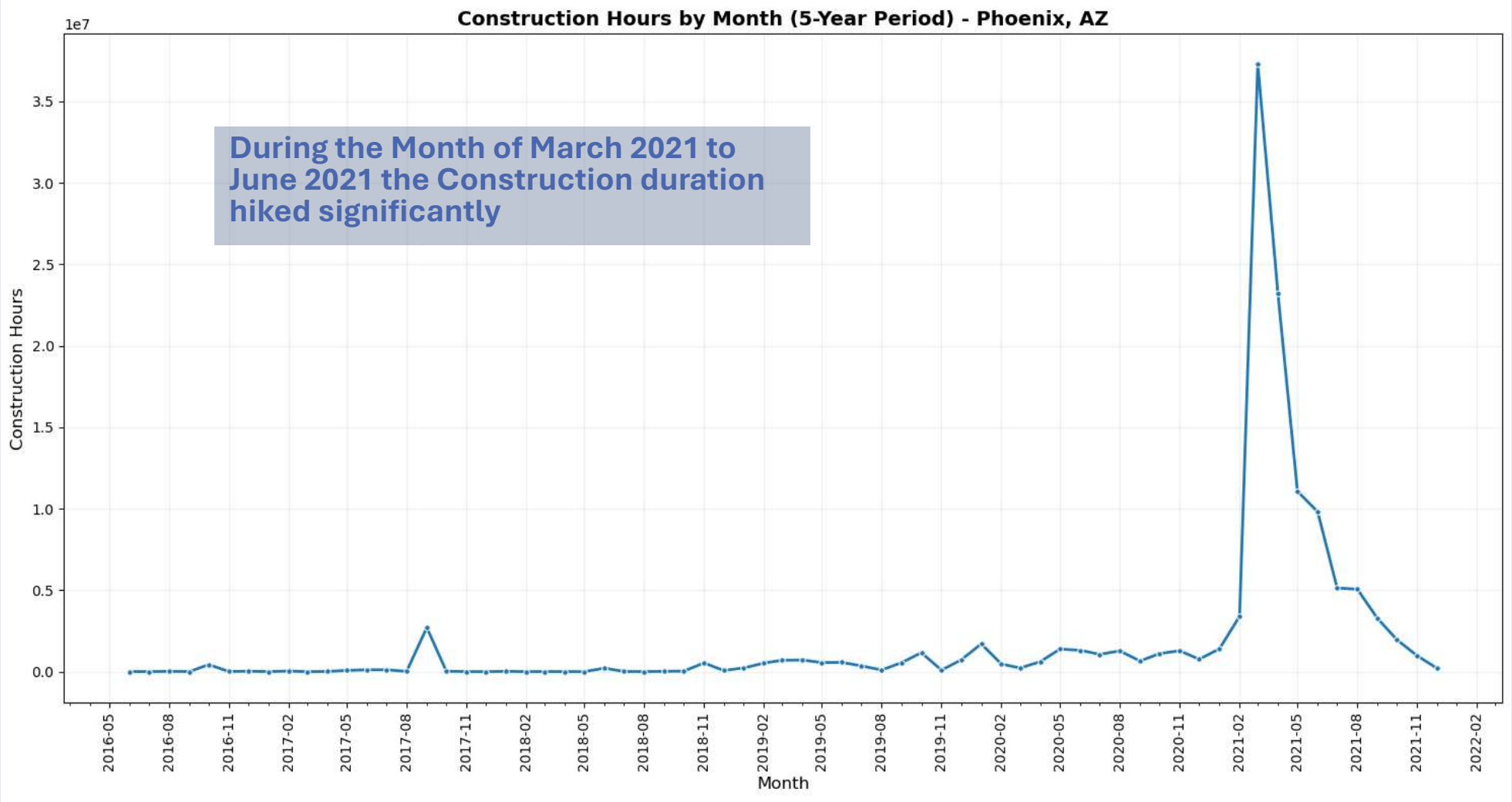
Top Cities Over 6 years

Year	City	Million Hours	Site	Avg. Distance (miles)
2016	Middletown, DE	10.4	299	0.9
2017	York, PA	10.3	841	1.8
2018	Winnfield, LA	9.8	461	1.9
2019	Cle Elum, WA	**17.8**	1,393	**4.0**
2020	**Phoenix, AZ**	11.9	34,240	0.2
2021	**Phoenix, AZ**	10.3	**212,356**	0.2

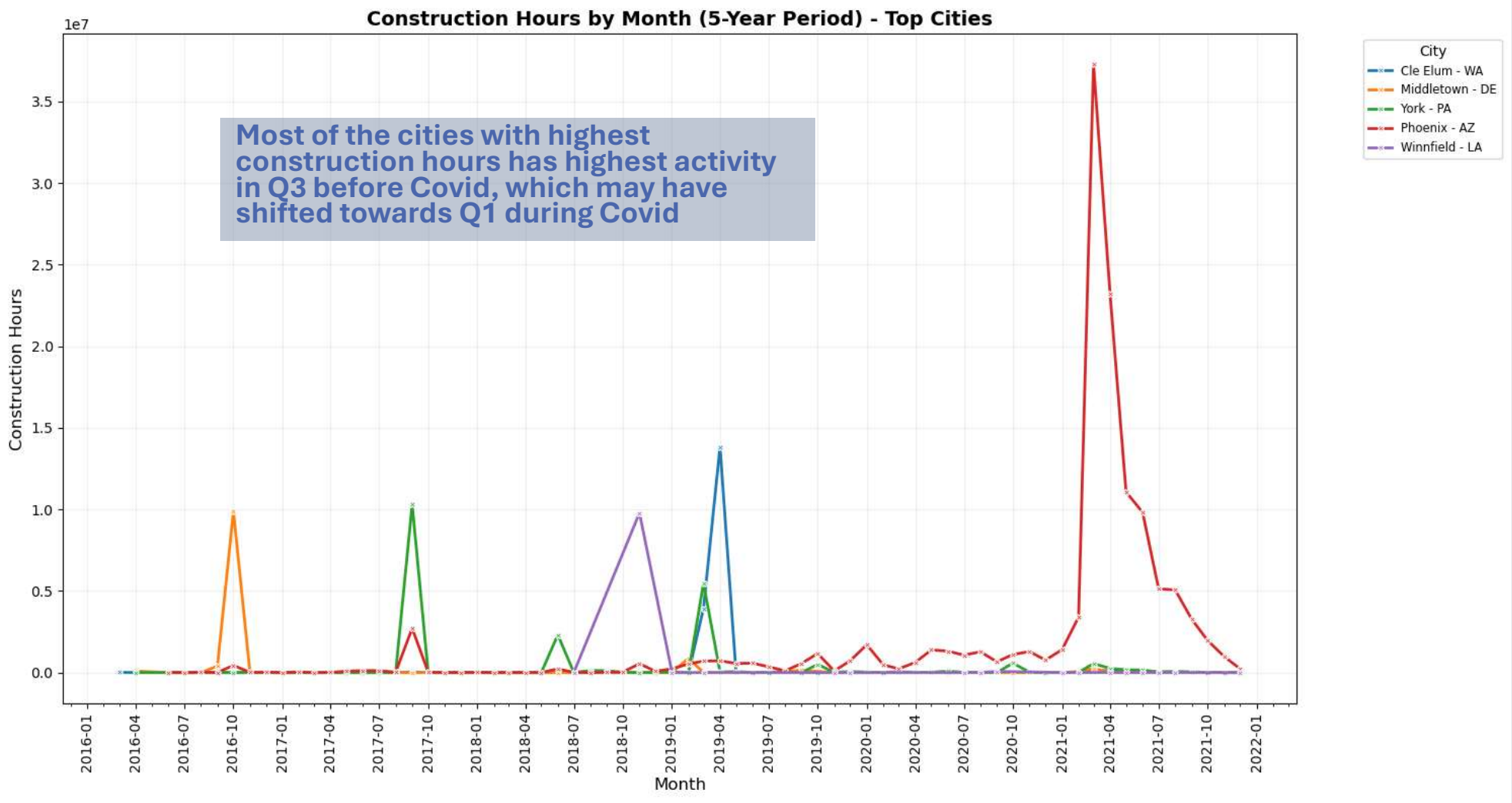
- Phoenix has higher construction site with shorter length
- Cle Elum has long stretched sites



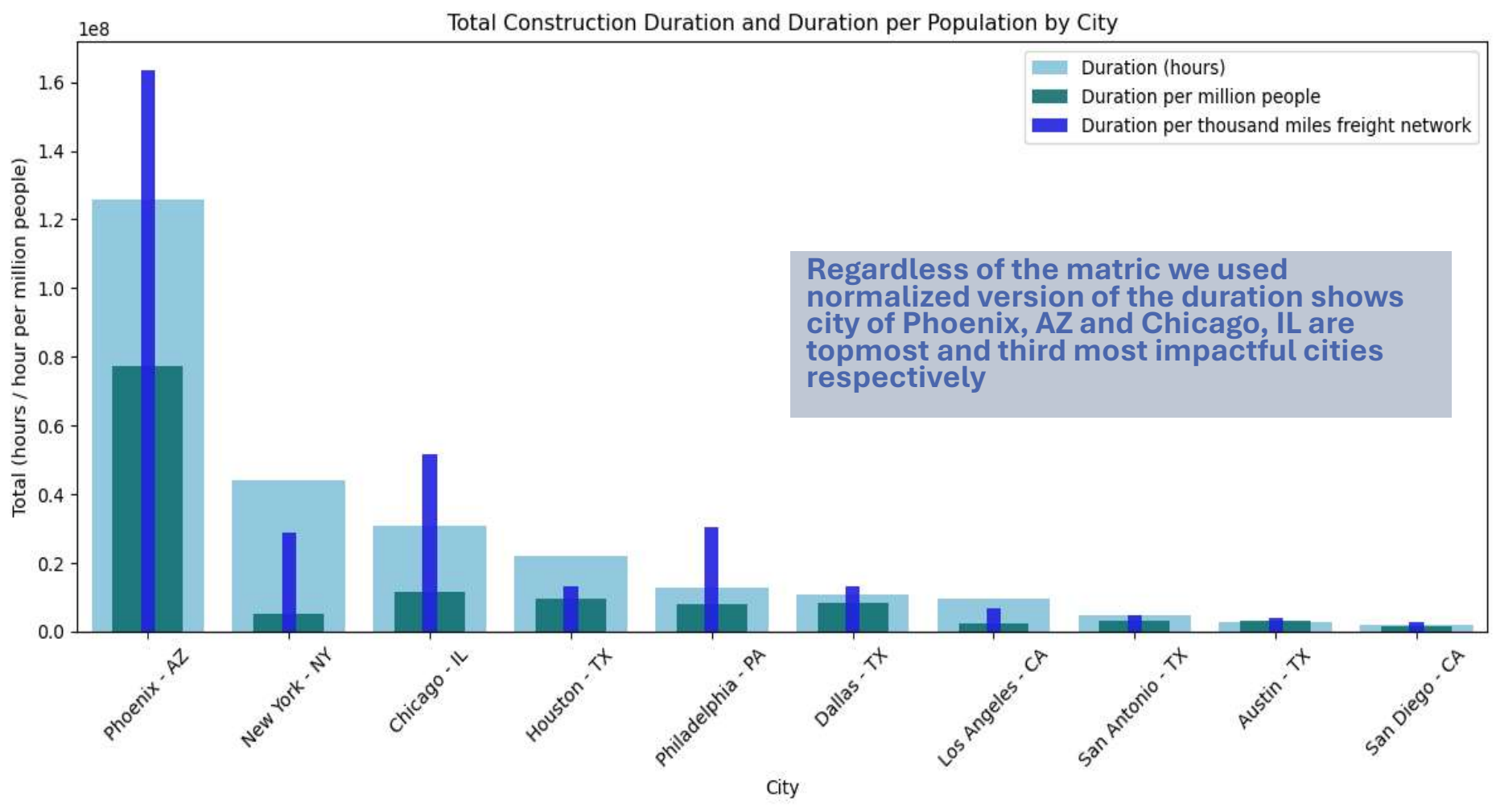
Insight 2: **Time Series Trends**



Insight 2: **Time Series Trends (Contd.)**



Insight 3: **Compare 10 largest US cities**



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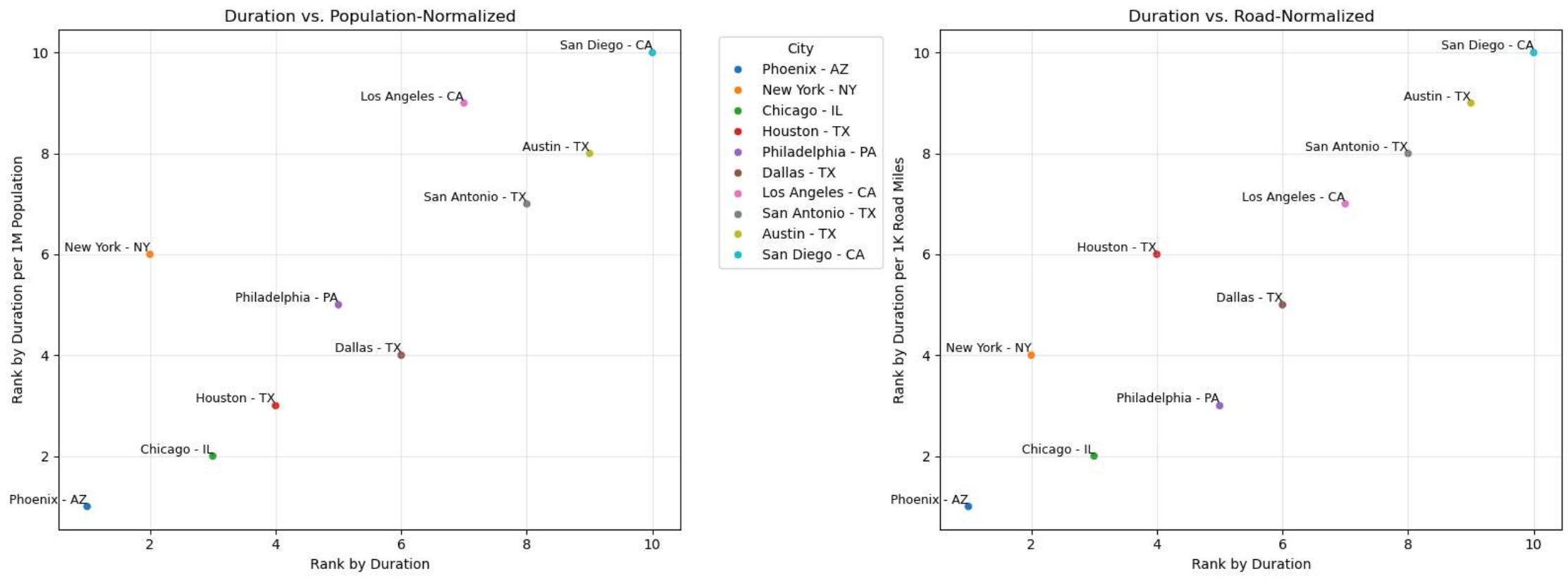
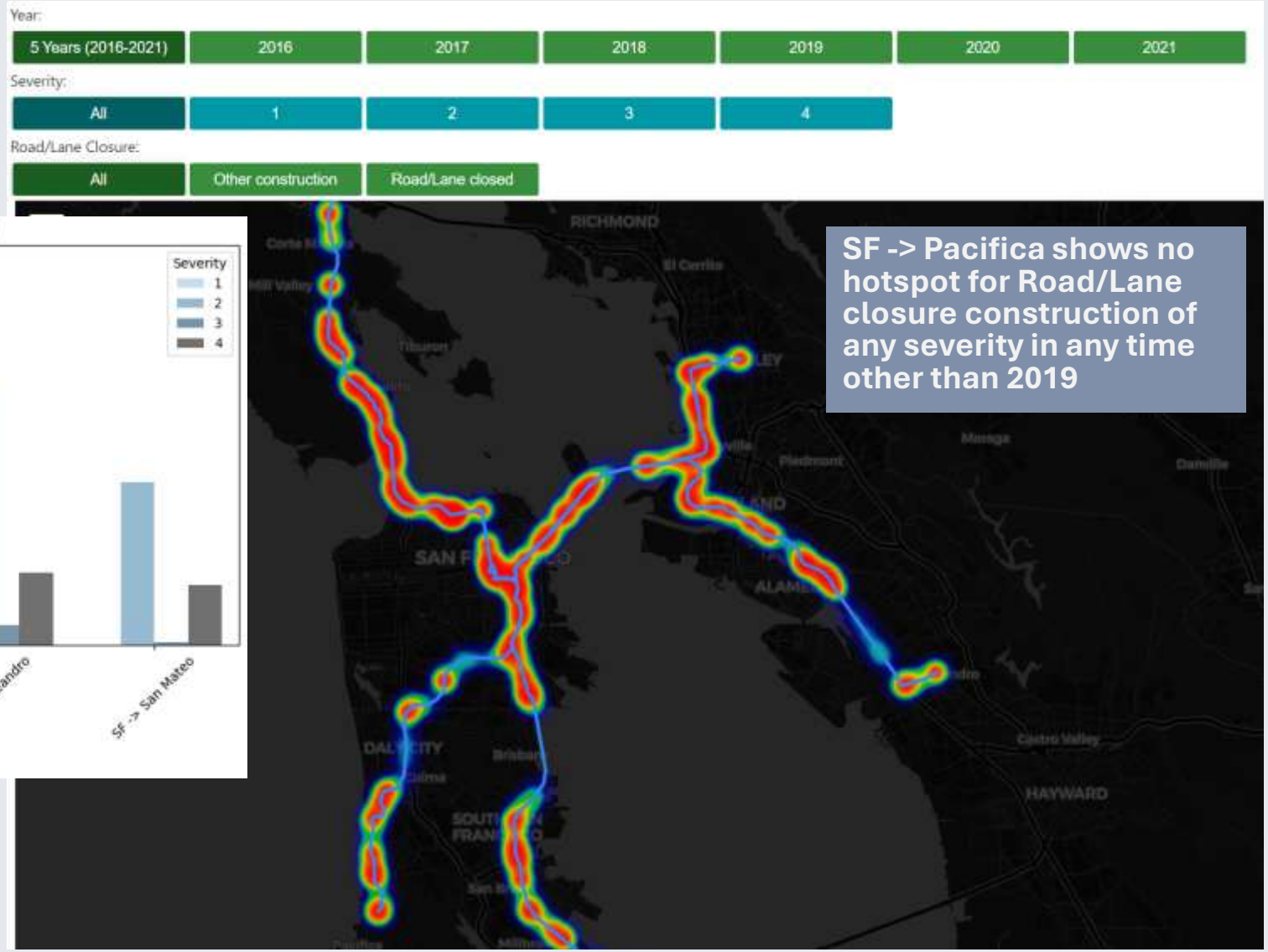
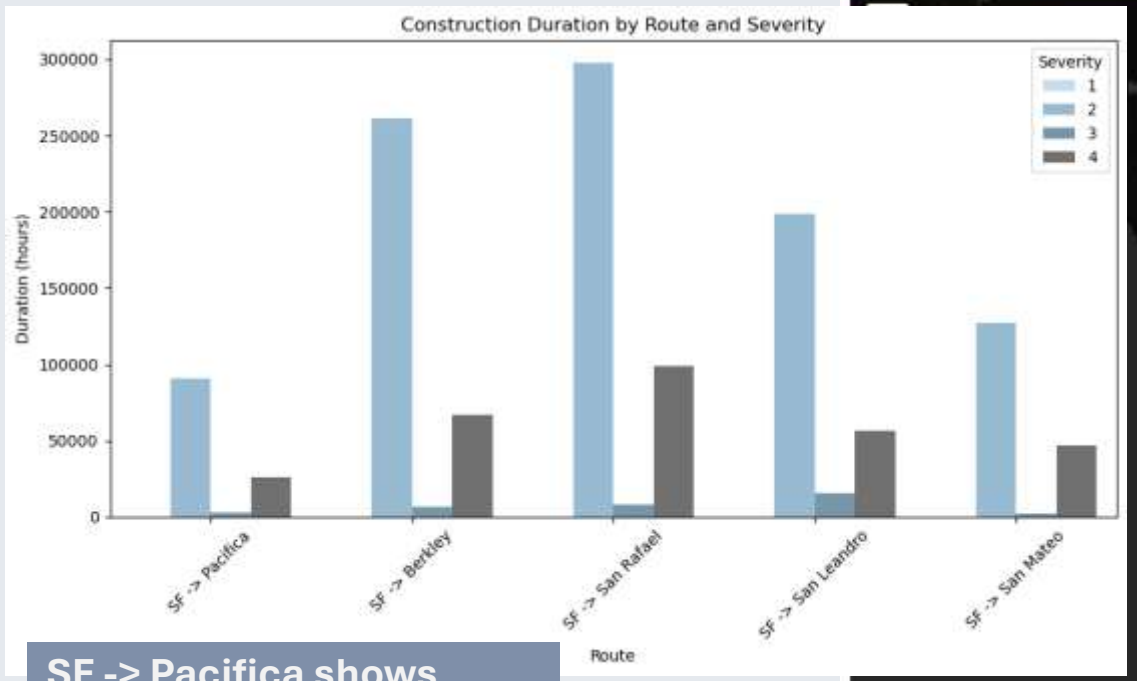


- **Normalization methodology significantly affects how construction impacts appear across different cities**
- **Freight road length KPI reveals higher impacts in major port cities like NYC, and LA due to their extensive freight infrastructure**

Insight 4: **Self-driving Routes' Risk Assessment**





SF -> Pacifica shows lowest number of construction with higher severity

SF -> Pacifica shows no hotspot for Road/Lane closure construction of any severity in any time other than 2019

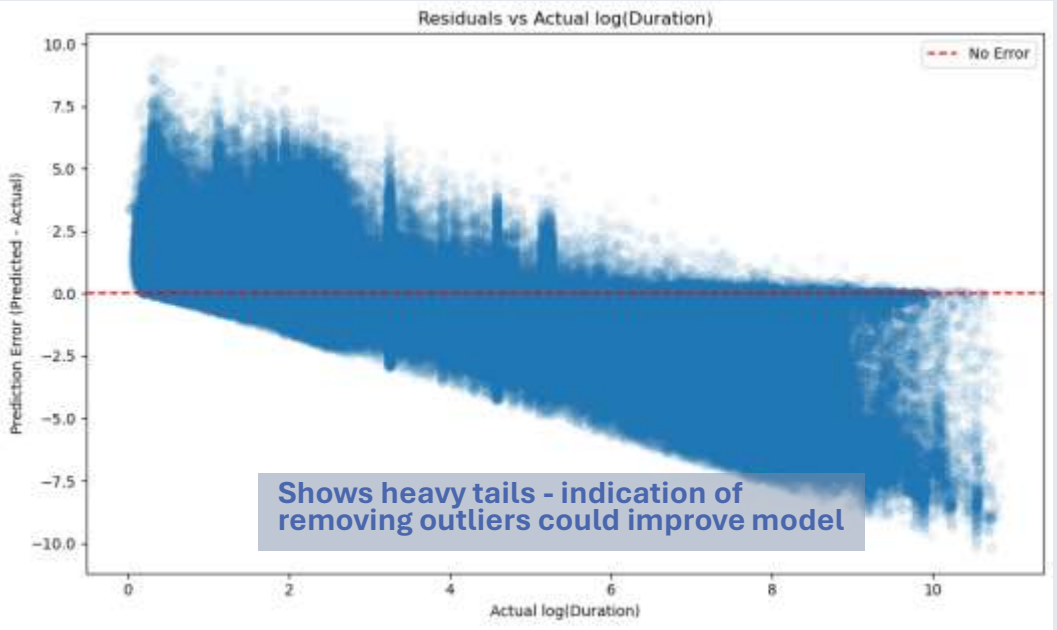
Insight 5: **Duration Prediction Model**

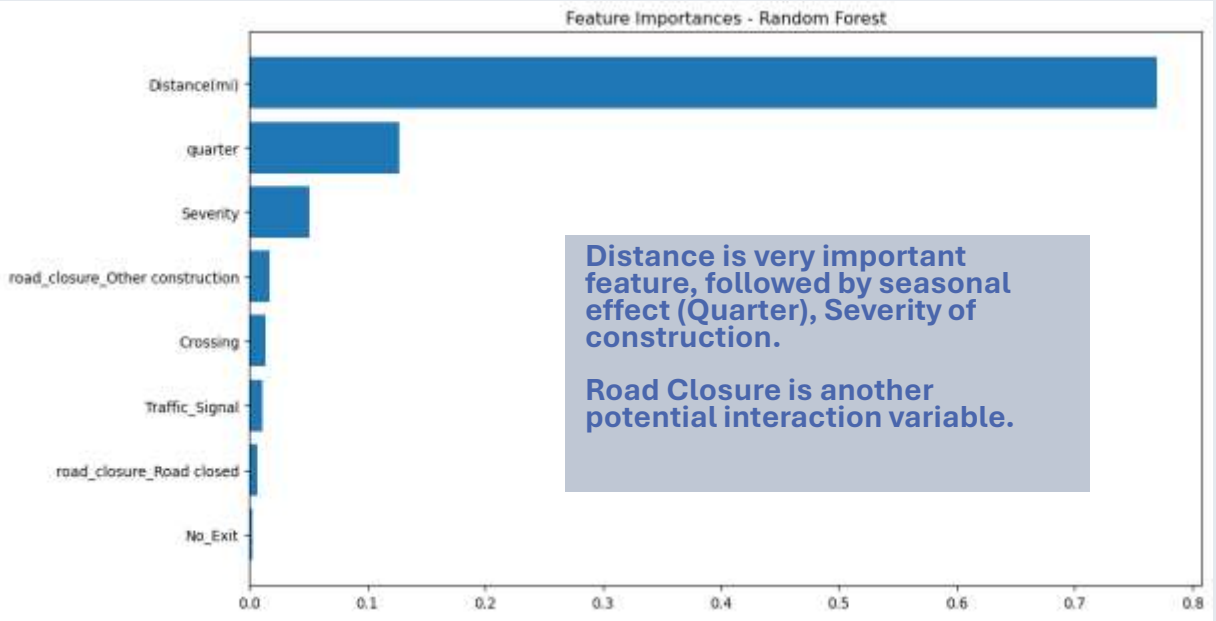
Log Linear Regression Model

- Training, Test data split 80% - 20%
- Performs poorly
  - MAE: 1.645
  - RMSE: 2.132
  - R^2: 0.076

Random Forest Regressor

- Training, Test data split 80% - 20%
- Performs Decently Good
  - MAE: 1.2344
  - RMSE: 1.851
  - R^2: 0.303





Overall Summary

Key Findings

- **Phoenix, AZ** emerges as highest risk city with 212K+ construction sites but shorter duration projects
- **COVID-19 shifted construction patterns from Q3 to Q1**, requiring adaptive route planning
- **SF → Pacifica** route shows **minimal construction risk**, ideal for initial deployment
- **Random Forest model** achieves over **30% accuracy** with **distance** as primary predictor

Strategic Recommendations

- **Prioritize low-risk routes** like SF-Pacifica for initial autonomous deployment
- Implement **dynamic routing algorithms** for high-impact cities like **Phoenix** and **Chicago**
- Develop **seasonal deployment strategies** accounting for **Q1 construction peaks**
- Enhance **model accuracy** by incorporating **road closure interaction variables, or using geospatial modeling** approach