## **WINYU TANDON**

# LAMP.3

The Fully-Loaded Methodology and Case Study Analytical Visualization Tool

**Final Presentation** 

05.04.2023

Capstone Groups 13 & 14 Under Prof. Graham Dove

## Meet the team(s)!

Team 13 - Product Team



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## Meet the team(s)!

Team 14 - Business Team



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# **Debriefing LAMP. 1 and QUIETed**

The Fall 2021 Tandon/MOT capstone project, Location Analyze Measure andPrioritize (LAMP), used DOT street-related data and 311 data to suggest subsurfaceinfrastructure vulnerabilities and related disruptions in a data visualization tool forManhattan-toidentifypotentialutilidorlocations.

The original problem was a lack of subsurface infrastructure locational data posited as an impediment to utilidors. The use of surface data in LAMP.1 was to suggest aging subsurface infrastructure vulnerability and related disruptions.

**The Fall 2022 Tandon/MOT capstone project**, Quantifying Urban Infrastructure Economic and Transit Disruptions (**QUIETed**). analyzed the traffic impacts with Streetlight data of four subsurface infrastructure failure case studies and linked those failures to authorized capital projects in the City Planning map and community district needs statements.



Figure. 1 NYC Map



# LAMP. 3

This project intended to put the work of LAMP and QUIETeD together as a full methodology with prior (updated) and new data to suggest the aging infrastructure vulnerability in absence of locational data resulting in disruptions and economic/social impact. The new data consists of Notice of Claims data, DOT street condition data from disruptions, and other 311 complaint type data for additional vulnerability.

All data would be combined into **one borough map, creating a Minimum Viable Product** with layers for each data source and an ability to combine them for analytical purposes.

This model shows **Replicability and Scalability** of the model.



Figure. 2 Queens Map



## **Datasets Used**

- 311 Service Requests data from 2020 to present (Complaint type, Descriptor, and Locations)
   311 Service Requests from 2010 to Present | NYC Open Data
- 2. Street Construction Permits (Location and Streets, Permit Issued Date) <u>Street Construction Permits (2013-2021) | NYC Open Data</u> <u>Street Construction Permits (2022-Present) | NYC Open Data</u>
- DOT Street Pavement Rating (Geometry Model, Street Information (on, from, to), Rating)
   Street Pavement Rating | NYC Open Data
- SCOUT Data (Extracted from 311 Service Requests, same metrics used) SCOUT Data | NYC Government
- Disadvantaged Communities Layer (NYS Disadvantaged Community Map)

Disadvantaged Communities Layer | NYSERDA

6. Comptroller's Notice of Claims database



#### References/Related work:

Mapping CDW Flow for Assessing Recovery and Reuse Potential in NYC LAMP Urban Infrastructure Disruption Analysis The QUIETED Methodology of Crumbling Infrastructure - An IT Approach Raw Data:

1. 311 Service Requests data from 2020 to present (Complaint type, Descriptor, and Locations)

311 Service Requests from 2010 to Present | NYC Open Data

2. Street Construction Permits (Location and Streets, Permit Issued Date) <u>Street Construction Permits (2013-2021), | NYC Open Data</u>

Street Construction Permits (2022-Present) | NYC Open Data

3. DOT Street Pavement Rating (Geometry Model, Street Information (on, from, to), Rating)

Street Pavement Rating NYC Open Data

4. SCOUT Data (Extracted from 311 Service Requests, same metrics used) <u>SCOUT Data | NYC Government</u>

5. Disadvantaged Communities Layer (NYS Disadvantaged Community Map)
Disadvantaged Communities Layer | NYSERDA

6. Comptroller's Notice of Claims database

#### Clean Data: Google Drive

Check the Dashboard: Tableau Map 1 & Map 2 & ArcGIS

Figure. 3 Repository

# Product Team

https://sites.google.com/nyu.edu/anqin ghu-lamp-quieted/repository

# **Project Scope and Commitments**

### Scope:

- Indicate subsurface infrastructure vulnerabilities, disruptions and impact of failures
- Analyze the reason and cause behind the disruption map
- Highlight areas of interest over a dynamic time period eg. areas with high incident rates

### **Commitments:**

- Reorganizing dataset chronologically to create stories, creating a **Disruption Occurrence Index**, a **SWOT Analysis**, and a **creating MVPs on Tableau (Flagship Deliverable) and ArcGIS (Beta Deliverable)**.
- Combining various data layers to suggest subsurface infrastructure vulnerabilities due to aging resulting in surface disturbances and analyzing the disruption occurrence index (DOI)



# What is the Problem?

Problem: NYC is being disrupted

Cause: Aging and Poor Infrastructure

**Effect:** Inconveniences in our daily lives by road excavation and closure



Figure. 4 Road Excavation by Con Edison : Clicked on April 14th, 2023 at 4:08 PM near 6 Metrotech Center, BK



Figure. 5 Road Excavation near 65 Worth St, New York, NY



# Who is Impacted?

### **Government Agencies**

- 1. Department of Transportation DOT
- 2. Department of Environmental Protection DEP (Public Utility)
- 3. NYC Office of Technology and Information (OTI)
- 4. Metropolitan Transportation Authority MTA
- 5. Town+Gown: NYC Smart Cities Utilidor Working Group

### **General Public**

- 1. Residents
- 2. Business Owners Retailers, Pharmacies etc.
- 3. Elected Officials/ Community Boards

### **Private Utilities**

- 1. Electricity and Steam Transmission
- 2. Telecommunication Transmission
- 3. Gas Transmission

### **Travelling Public**

- 1. Pedestrians
- 2. Cyclists
- 3. Drivers
- 4. Passengers in MTA Buses

### Not for Profit Policy Organisations

- 1. Regional Planning Association
- 2. Transportation Alternatives



# How can we address it?



#### Figure. 6 LAMP. 3 MVP



### By Utilizing the LAMP.3 MVP

Our tool highlights the majorly affected areas by subsurface infrastructure vulnerability and disruption in Queens

### Highest affected neighborhoods:

11385 - Glendale 11101 - Long Island City 11691 - Far Rockaway 11377 - Woodside 11358 - Flushing

Solution: These areas might benefit from Utilidors

# Utilidors

Utilidors—or multi-purpose utility tunnels—are subsurface infrastructures designed to accommodate all utility transmission infrastructure for water, gas and electric, steam, other telecommunications lines and possibly, sewage and stormwater, which would provide access to transmissions infrastructure for state of good repair activities via secured entrances instead of digging up the street. Then, the continual need for routine street excavations would end, and NYC, as a whole and with DEP, and the private utilities would realize direct cost savings and other benefits.

Our model highlights areas with subsurface infra vulnerability in Queens that experience frequent disruptions and identifies where utilidors could be implemented.





#### Figure. 7 Utilidors



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## **Tableau MVP**





## **Tableau Public**

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#### LAMP3 MVP



Tableau Public is a public visualization platform that to explore, create, and share visualizations data online

The left-hand side picture is the overview of LAMP 3 MVP on Tableau Public Service

In the middle is the MVP point map based on Queens, with 5 layers by using different datasets which from 2020 to now. Also, legends are on the two sides. Users can change disruption types and occurred time by using complaint type filter and time sliders.

Published LAMP3 MVP Dashboard Link





## **Tableau Public**



At the upper left corner, users have options to select different layers. The bottom two layers are the disadvantaged communities and the street conditions map.

When clicking on a specific street, users can get street information, street construction activities count number, and street condition rating.

Figure. 9 Layer Control Main Street



## **Tableau Public**



When selecting on 311+SCOUT, Crashes, and Notice of Claims, users can see numerous different points.

To help users check locations easier, the map has options to change complaint type, and if users click on a point, they can see the location information with street name, address, latitude and longitude.

Additionally, users can see what type of disruption is on the information card. Each layer can be changed by using time sliders.

Figure. 10 Heavy Flow

Product Team

# **Tableau - DOI Map**

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Another important dashboard is DOI Analysis. DOI, as known as Disruption Occurrence Index, which counts how many disruptions occurred in specific Queens. areas in

Here we can see the deeper the color, the more disruptions occurred in the area. The bar chart which under the map also helps users to have a straight look of the disruption situation. occurrence

When changing the time sliders, the map and the bar chart will be changed.

Published DOI Dashboard Link

Figure. 11 Tableau DOI



## **Tableau - DOI**



As one may observe - the following Zip Codes have the **highest DOI** -

1. 11385 - Glendale

2. 11101 - Long Island City

Some important neighborhoods following closely are -

1. 11691 - Far Rockaway

2. 11377 - Woodside

3. 11358 - Flushing

Figure. 12 Tableau DOI ZIP



## **Tableau Visualization**



Product Team

\*This video has no voice. Please refer to the speaker for information

## **ArcGIS Visualization**





# Why ArcGIS



Figure. 14 ArcGIS Tool

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ArcGIS is a software widely used by city agencies, and we wanted to keep an agnostic approach to show the replicability and scalability of the Tableau-based MVP.

ArcGIS has certain geospatial benefits, like the optimized toolkit to create geospatial files and map layers by using software based credits.

We used ArcGIS and Tableau in conjunction to create a virtuous cycle, which benefited both the MVPs.

For example, the disadvantaged community layer on the left was exported to Tableau for the final version of our MVP.

# **ArcGIS Web-App**



The ArcGIS Web-App is the accessible 'Dashboard' visualization tool to show the replicability of the product using a software used by various departments in the city.

Here, you can see the default view of the web-app, which showcases key points of interest in the borough of Queens with a legend on the right side of the application.

Users have the option to adjust a time slider in order to view the instances based upon user preferences, and the layers change dynamically.





# **ArcGIS KPIs**



Upon clicking on any highlighted point, users will be able to see the complaint type, created date as well as a brief description.

The user can adjust the time slider to cover any time between 1 - 48 months and 'move' the slider window to highlight different incidents around the city.

The map updates the key points of interest accordingly, and mimics a 'heatmap' - settings of the same visualization can easily be altered by changing the base map legend.



## **ArcGIS Visualization**





\*This video has no voice. Please refer to the speaker for information

# **Story for Public**

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AMP+OUIETeD

#### LAMP + QUIETeD: The Fully-Loaded Methodology and Case Study

Anging Hu Draft

#### **ArcGIS Web Application**

The ArcGIS Web App is the accessible 'Dashboard' visualization tool to show the replicability of the product using software used by various departments in the city.

The default view of the web app showcases key points of interest in the borough of Queens with a legend on the right side of the application. Adjust the time slider in order

#### 311 Data



Street Construction Permits(2020 - 2023)



#### Figure. 17 ArcGIS Story

### https://storymaps.arcgis.com/stories/90169cc061 ca43d7a203725607d69248/preview



Fully-Loaded Methodology and Case Study

Discover the impact of aging infrastructure

Our mission is to use the LAMP and QUIETeD datasets to fill out the aging infrastructure vulnerability, economic, and social impact issues.

The aging underground infrastructure in New York City poses a significant risk, but traditional hazard analysis doesn't consider the economic and social costs of failure. Direct burial of infrastructure leads to environmental degradation and accidental damage

LAMP+QUIETeD Tool

#### Figure. 18 Website

### https://sites.google.com/nyu.edu/anqinghu-lam p-quieted/home

# User Journey Map - LAMP.3 MVP



#### **The Dashboard**

#### **DOI Map Slider**

Once the stakeholder/user knows which area, month and complaint type they want to view, they can head over to the MVP Dashboard.

Here the stakeholder/user can use the slider to go to a particular month that he/she wants to look up in the DOI Map.

#### **Bar Chart Slider**

Here the User can select the month which he/she wants to better understand through the bar chart.

#### **Incident Zip**

They then click on the Incident Zip to understand more features about the place.

#### **Additional Info.**

If the user wishes to see more details, such as additional information or Unique Attributes, they can click on the "bulb" icon.



# **SWOT Analysis**

## Strengths

- Indicates subsurface infra vulnerability in absence of locational data and permits analysis (through DOI) for infrastructure planning
- Allows initial understanding and analysis of impacts of failures in communities
- Use of historical (vs real time) data helps us understand the baseline conditions and operations

## **Opportunities**



- After scaling across all NYC boroughs, the pilot use of MVP for infrastructure planning and impacts on communities can provide basis for model adjustment for improved functionality
- Low cost of model
- Pilot use can also support "smart" city initiatives
- Replicable and scalable across other U.S. cities

## Weaknesses

- Historical data is not real time data; unclear at MVP stage, the degree to which the data in the MVP has any predictive power
- Lack of standardization to analyse disruptions across the city can cause challenges in identifying critical areas



- Changes in government capital funding levels and policies may impact demand for using/scaling out the MVP
- The use of publicly available data for the MVP may initially limit its attractiveness as a commercial product



# **Threefold Conclusions**

#### Stakeholders

This MVP Dashboard will benefit five key groups of stakeholders that we identified earlier who are affected by road excavation project failures



### Scalability

Moving forward, if we receive positive feedback on the dashboard, we can explore potential opportunities to replicate and scale across other U.S. cities

### Utilidors

Implementing utilidors in areas of continuous road disruption and areas showing infrastructure vulnerability, will be beneficial for the identified stakeholders



# **Story for Public**

For whom outside of NYU, please check the video from the link: <u>https://nyu.zoom.us/rec/share/ISMpN--BsoaXT1g</u> <u>L2z4UpGs2mIGu7Mh-Ep-8XZXTQI9ccZG6NZt</u> <u>GEhbrSRNvcl68.E\_GNZMctLMOtwpBZ?startTi</u> <u>me=1683082436000</u>

Same as the TinyURL: <u>https://tinyurl.com/2p94mrxr</u>



