Traffic Network Analysis at Times Square
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Introduction:
To examine the street network, we make use of open data sources that recorded a detailed street network and the latest traffic data in New York City. Such data sources provide excellent resolution of urban mobility and cover more than 90 percent of total traffic count which use taxi and for-

vessels daily. Therefore, taking taxi trip data as a proxy for urban movements and spatial interaction and Times Square, we aim to identify the essential elements of the street network in New York City.

Baseline Analysis:
We conducted a baseline analysis to identify the structure of the street network including integration, and network kernel density. This phase helped us understand the connectivity of the street network and examine the risk of Times Square in the network.

Gathering Routes:
In this phase, we set a specific scenario when the crowd was gathering at Times Square on a typical July evening. We extracted taxi data from TFL Trip Record Data to represent travel activities related to Times Square with a simplification of the travel activities as inter-destinations and Times Square. Based on the street network, the closest facility analysis layer solved the optimal routes through minimal time cost and shortest trip length criteria. All routes were aggregated together on the roadway network to see whether there is any difference between the most likely network and the aforementioned baseline network.

Research Questions:
Street network analysis does not merely relieve traffic congestion but serves for resilience and emergency evacuation purposes. We are seeking for the answer to the following questions: What is the risk of Times Square in the street network? How is the spatial distribution of routes connecting Times Square and other places? Which part of the street network is highly likely to be traveled? What is the impact on the street network at Times Square in New York City after infrastructure failure?

Methodology and Data:
Three phases includes Baseline Analysis, Gathering Routes, and Link Criticality. Each phases will be discussed in details.

Network Resiliency:
For hypothetical scenarios, we blocked the roads from Columbus Circle to 44th Street and 5th Avenue. We assumed that the lateral connections are inaccessible here, and the routes will leave only through the two

corners at 34th street and 58th street. The map shows results from Traffic Analysis by Grid-Od-Gid tool on the difference. Hotspots are located right next to the road blockage and the impact is concentrated only on the area just beside Times Square.

Conclusion:
The results indicate what one might anticipate about Manhattan. The grid offers many alternate routes and thus easily contains the impact of closure of any section. However, possibility due to the shape of the island, lateral street closure had a greater effect than closure parallel to avenues. Given the unique geometry of Manhattan, future studies might find even lesser or no change if the same analysis is repeated for outer boroughs. However, the research also has limitations. The analysis is a simplified version of a transportation model. Future studies could also account for other modes of transportation and explore travel time and distance disruption with agent-based modelling.