20-Minute Cities: Using Mobility Simulation to Strengthen Urban Resiliency

Cities are epicenters of business and culture, but in the ongoing COVID-19 pandemic, they have also become epicenters of infection. Urban dwellers' dependency on public transportation contributed to the rapid spread of the virus. Further, existing inequality affected underprivileged groups disproportionally. People with low incomes face much higher chances of infection as many lack access to private vehicles and continue to use public transportation. In New York City, the overall infection rate per 100,000 residents in the Bronx is twice that of residents in Brooklyn, a more affluent borough [1]. Transportation is only one of many problems cities face, amongst pollution, crowding, inequality and more. Such issues demonstrate the need to improve city planning and increase urban resiliency—the capacity of cities to "survive, adapt and grow in the face of stress and shocks, and even transform when conditions require it [2]."

This project explores urban resiliency through principles of the 20-minute city, where one's essential needs such as work, education, shopping and recreation, are all within 20 minutes of walking. Decentralizing city centers and increasing walkability reduces motorized-vehicle dependency and carbon emissions, promotes local economy, and encourages social inclusiveness. 20-minute cities are greener, safer, more resilient, and will minimize virus spreads while meeting essential needs [3].

This project aims to connect urban design, mobility simulation and community engagement. In summer 2021, this research will focus on the Bronx, an under-resourced borough with high COVID-19 infection rates. It will work with community organizations such as Third Avenue Business Improvement District, and the Women's Housing and Economic Development Corporation, as well as the New York City Department of Transportation (NYC DOT) to increase walkability and resiliency. The research will use urban simulation technologies to analyze existing conditions and evaluate possible short- and long-term improvements.

Specifically, the proposed project will focus on two questions:

1. Can characteristics of the 20-min city—such as walkability, availability of essential amenities, and safety—be quantified and evaluated?
2. Can the evaluations identify areas for permanent improvements, and for temporary changes during health crises, natural disasters, and unexpected events?

For the first question, the proposed project will work with Cornell's Environmental Systems Lab to further develop their mobility modeling and simulation software, Urbano [4], which combines Rhinoceros and Grasshopper (both architectural softwares) to assess existing streets and amenities. This project will establish metrics for numerically scoring walkability, amenity availability and safety within a 20-minute walking radius. The evaluations will then be computed with urban geospatial data sets from OpenStreet Maps and Safegraph, as well as from data collected through site visits and surveys. The project will also collaborate with Neil Gagliardi, Head of Urban Design at NYC DOT, to collect real-time mobility data in the Bronx.

For the second question, the project will collaborate with community organizations as well as local residents to interpret the evaluations and identify areas for change. Possible improvements include creating pedestrian-only spaces, adding amenities in demand, removing amenities in excess, and implementing temporary *open streets*.

In summer of 2022, this research will continue internationally in Hong Kong—one of the richest, densest, and most divided cities in the world. The high living expenses in Hong Kong has long disproportionately affected the poor, and their situations worsened as strict shutdowns during the COVID-19 pandemic

drastically decreased the demand for low-wage jobs. The pandemic has also accelerated gentrification. In neighborhoods such as Sham Shui Po, many trendy new shops replaced struggling traditional stores—making the area more appealing, increasing rent prices and driving out poor residents [5].

To combat inequality, the proposed research aims to evaluate current city layouts and increase urban resiliency, especially in Sham Shui Po. The 20-minute city metric will be adapted for high population density and used to help communities curb the spread of viruses and be better prepared in unexpected events. The project will also aim to increase walkability, reduce congestion and make the city safer and more livable for all. Collaborators will include local residents and organizations such as the Hong Kong Society for Community Organization and WalkableHK.

Limitations:

- Accuracy of simulations can vary depending on availability and precision of input data.
- A specific challenge is computing amenity demand during crises. The change in attractiveness of different amenities is reflected through foot traffic data and Point of Interest (POI) data. While detailed foot traffic and POI data within the United States can be found through Safegraph, there is not an easily accessible data collection for Hong Kong.

REFERENCES

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