Modelling Pedestrian Demand in New York City

Carla A. Tejada Lopez
Ph.D. Candidate at CCNY
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Why a pedestrian demand model?

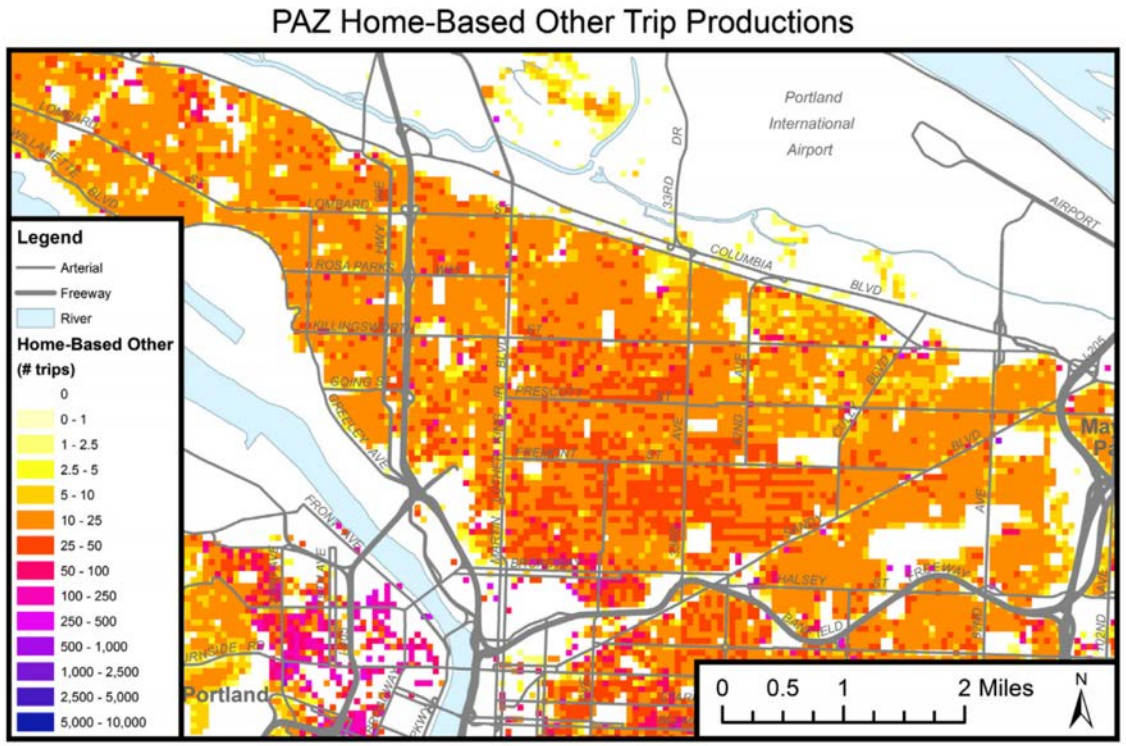
The peculiarity of pedestrian activity:

- In some cities it is one of the more convenient and equitable modes of transportation.
- It is considered as one of the “greenest” modes of transportation.
- It has long been left aside in modelling and planning.

Walking in NYC:

- According to the Citywide Mobility Survey of 2019, walking only represents 34% of the surveyed trips.
- Over 60% of trips include walking.

Methodology



K.J. Clifton et al. / Journal of Transport Geography 52 (2016) 111–122

To the best of our knowledge, **studies like this one have not been developed in New York City.**

Clifton,K., Singleton, P., Muhs, C., Schneider, R., Lagerwey, P. (2013). Improving the representation of the pedestrian environment in Travel Demand Models. OTREC.

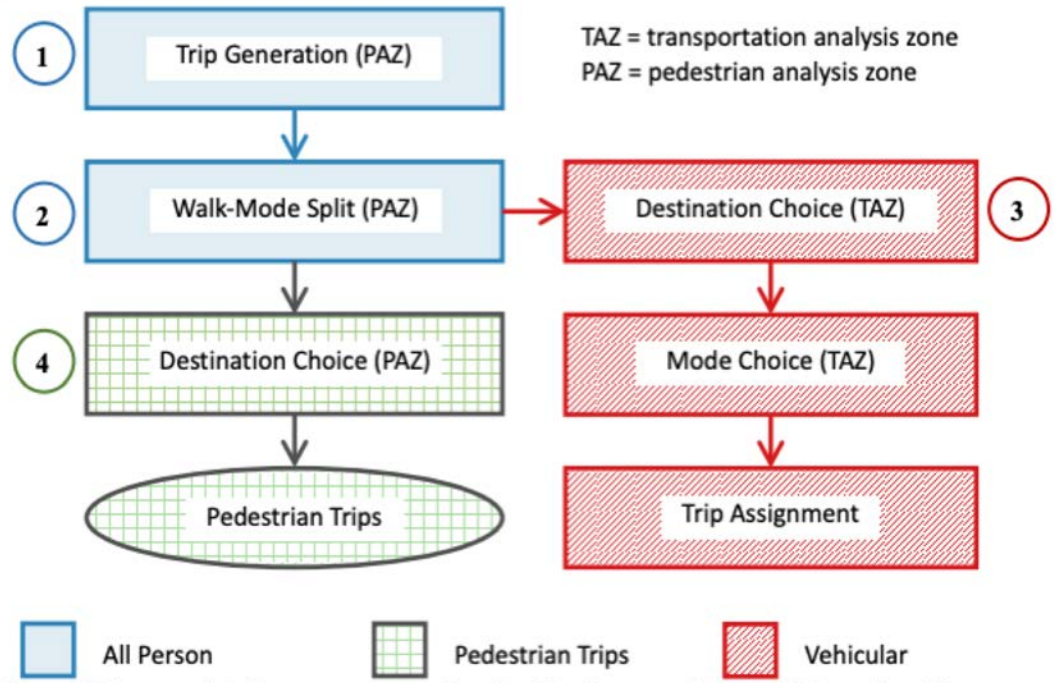
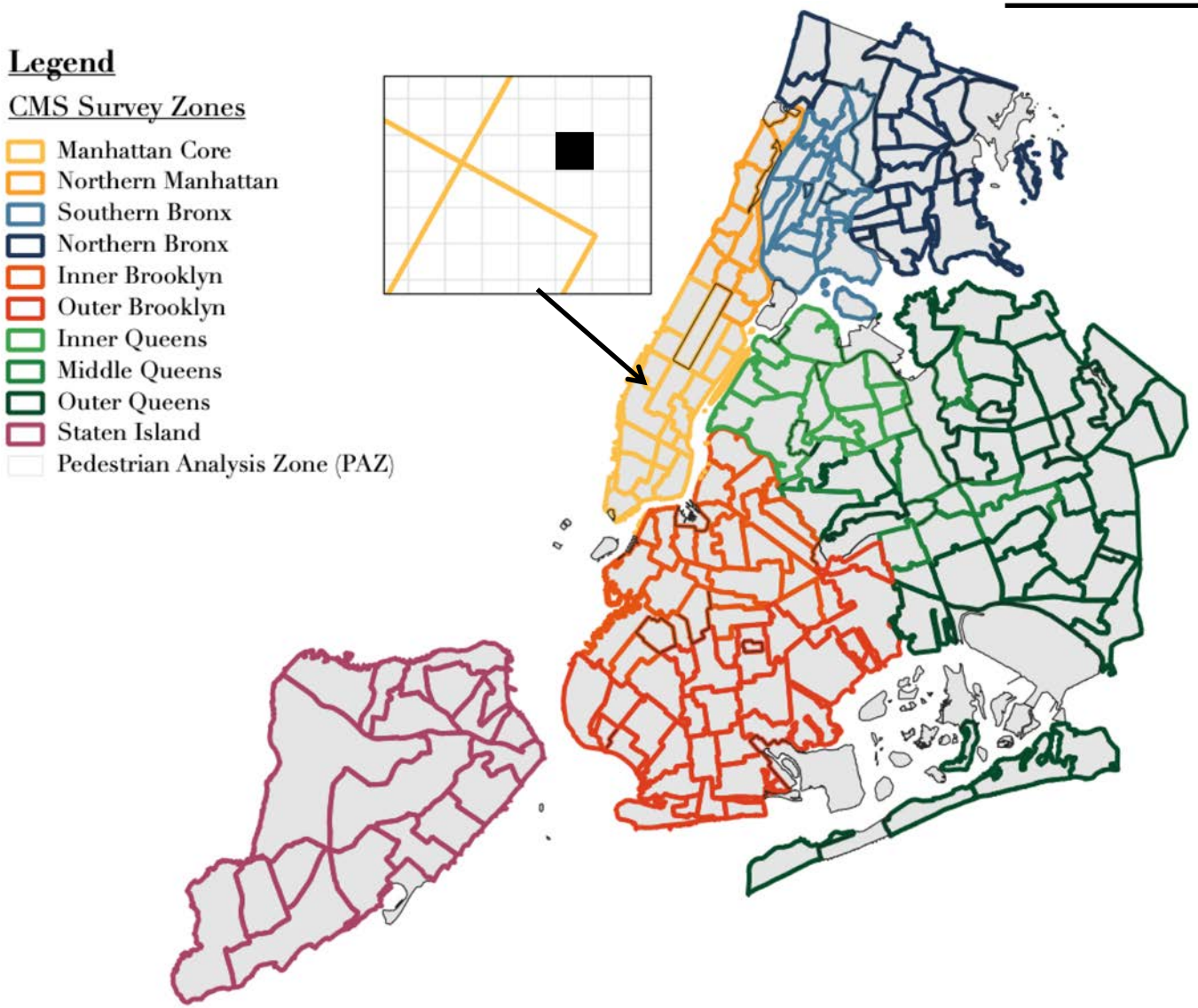


Figure 1.1 Framework to increase representation of walking in conventional travel demand models (Clifton et al., 2013)

Methodology

1.- Pedestrian Analysis Zones



2.- Definition of the **Pedestrian index of the environment**

$$PIE = \sum_{1}^{i} \frac{e^{(\beta)}}{\sum_{1}^{n} e^{(\beta)}} * 100$$

3.- Determination of the number of trips

Data inputs

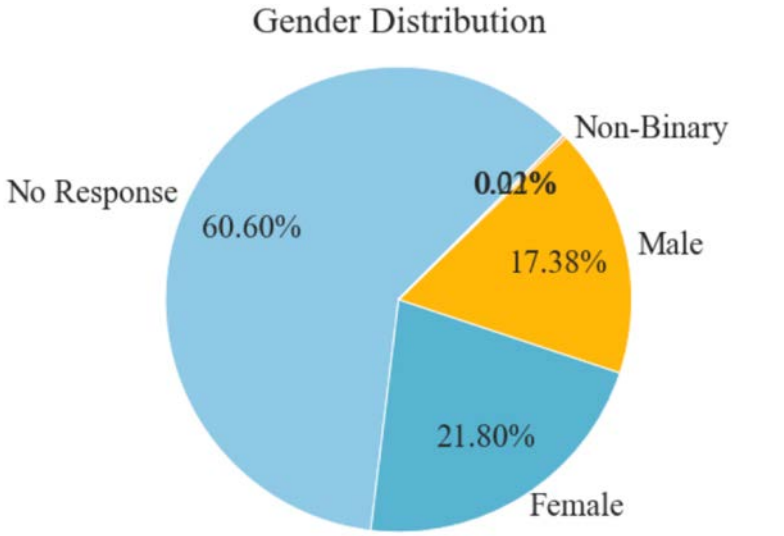
DOT's Citywide Mobility Survey 2019

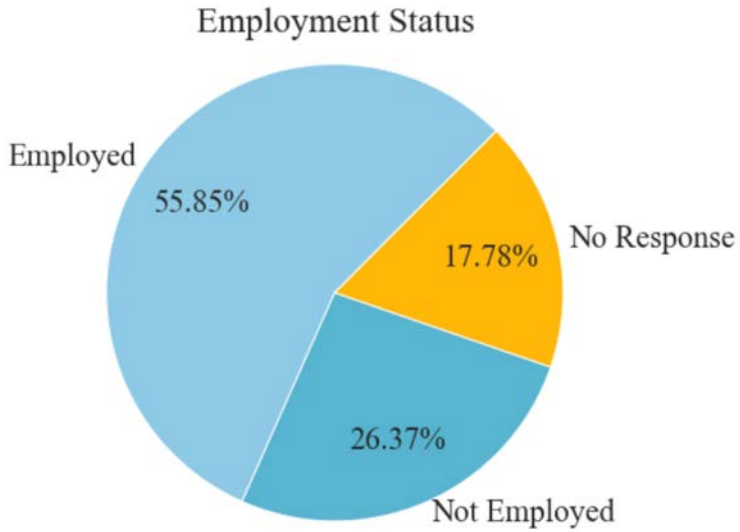
Person Table	Household Table	Trips Table	Day Table	Vehicle Table	Location records
8286 x 165	3346 x 52	85459 x 75	18322 x 35	2346 x 12	1182837 x 9

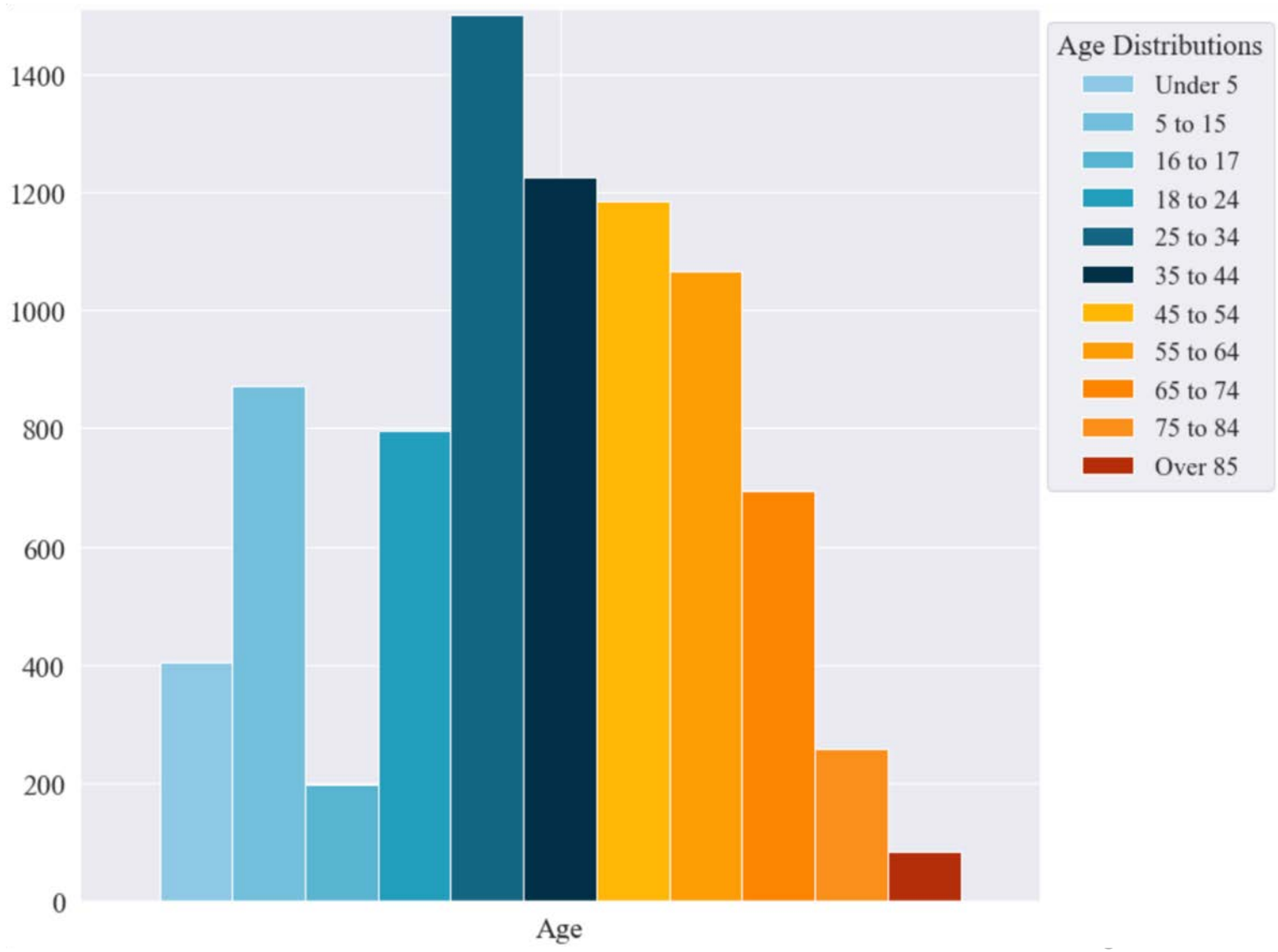
This survey is **representative** for each neighborhood.
We applied weights to confirm that it is representative citywide.

Data inputs _ CMS Person table

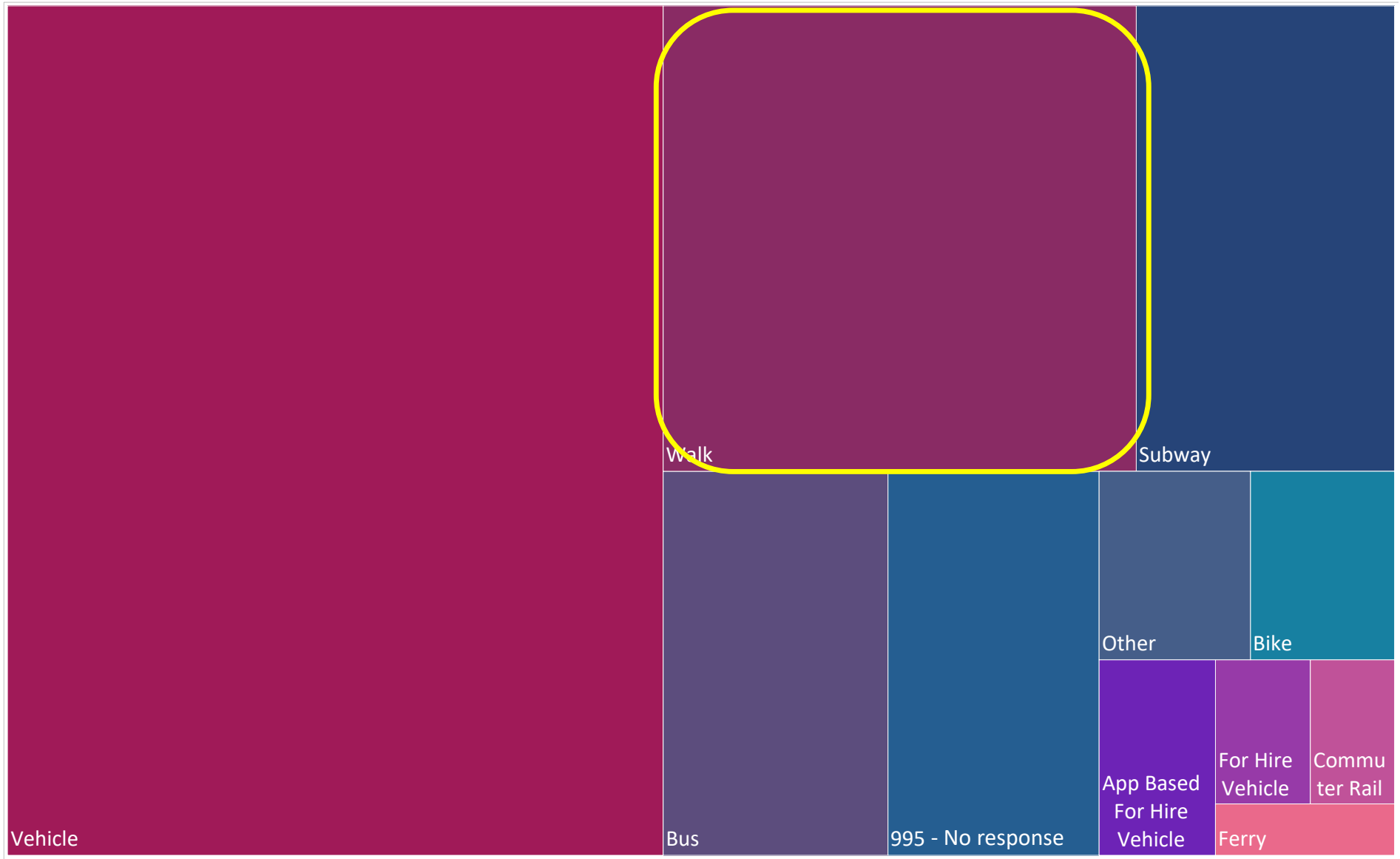
Socio-demographic variables







Data inputs _ CMS Trip table



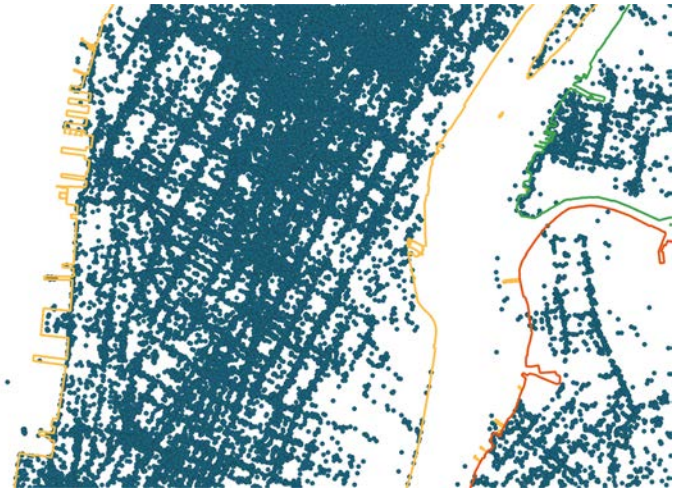
From the answers of the 2019 CMS location & trip data, we know that:

- **21.93%** of trips were reported as **"Walking"**

Data inputs _ CMS Location records

Location records

Manhattan Core



Inner Queens

Data inputs

Other data input: The city's environment

- Bike racks/shelters
- Citi Bike stations
- Bike routes

NYC OpenData

- Subway
- Bus
- Path
- Ferry

- Entrance
- Location

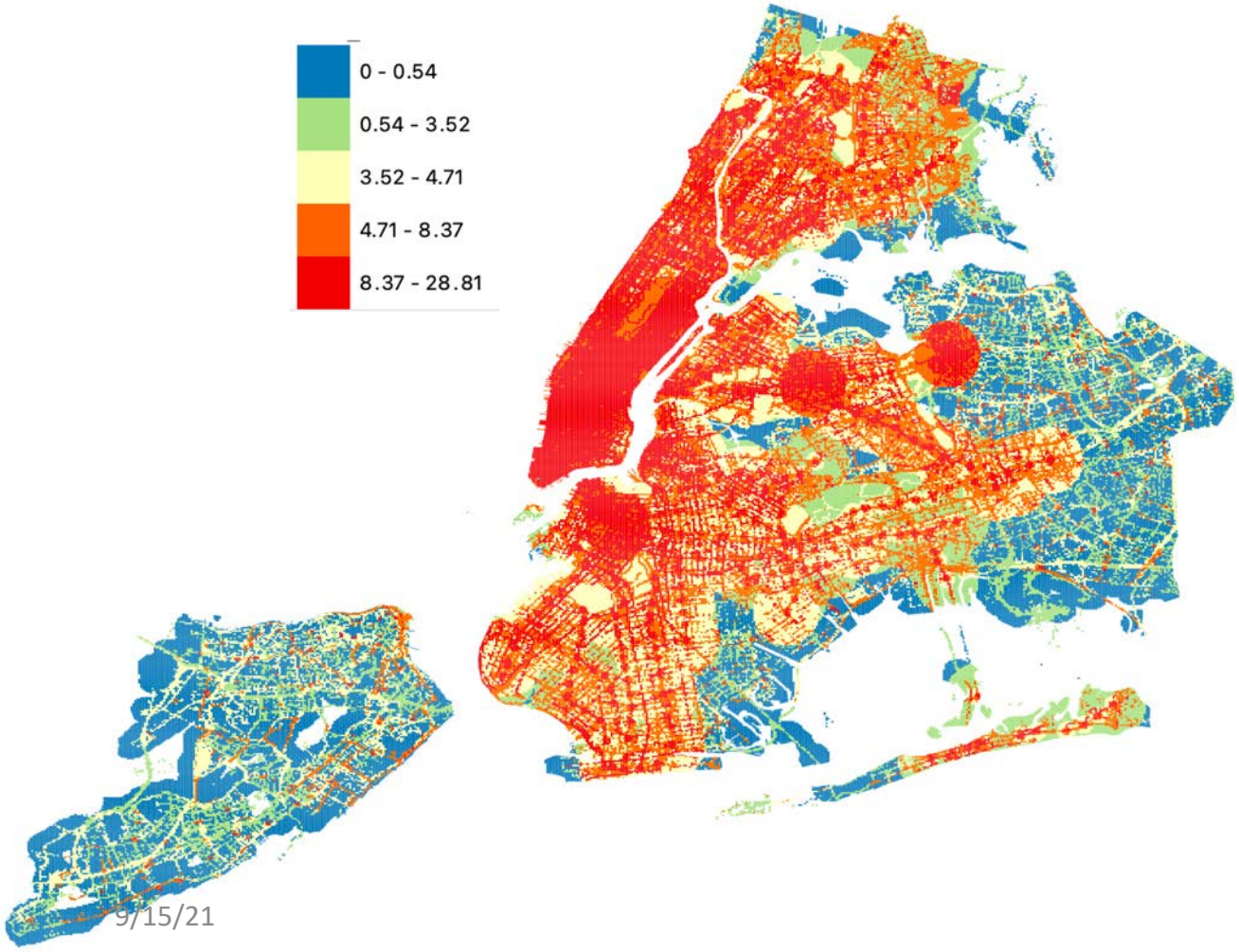
United States Census Bureau

- Population
- Jobs

- Grocery stores
- Food venues
- Schools
- Commercial areas

Pedestrian index of the Environment (PIE)

The Pedestrian Index of the Environment (PIE) is a **measure of the weight that each one of the environment variables has on the decision of walking**.



This index shows that the areas more attractive for walking are:

- Manhattan (Core and Northern)
- Southern Bronx
- Inner Queens
- Inner Brooklyn

There are three walking "hotspots" in Queens and in Brooklyn, located in:

- Flushing
- Jackson Heights
- Downtown Brooklyn

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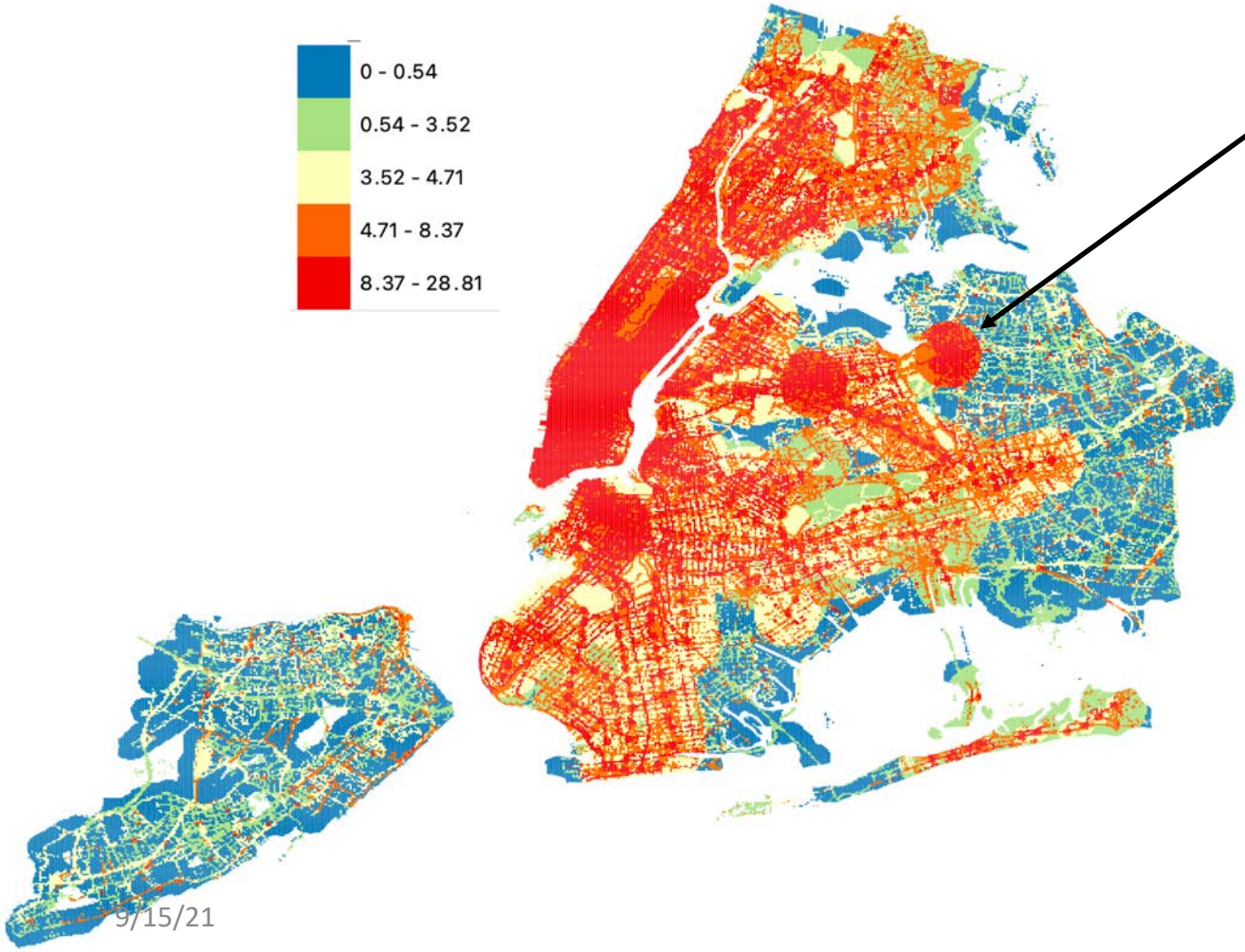
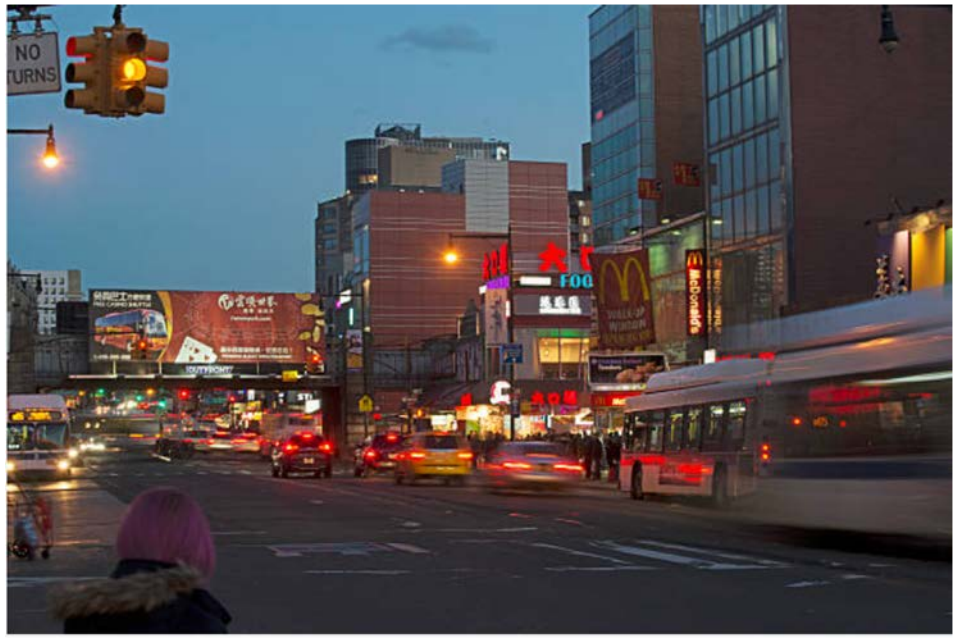


Flushing



Annual subway ridership: **17.5M people**
Flushing-Main St.

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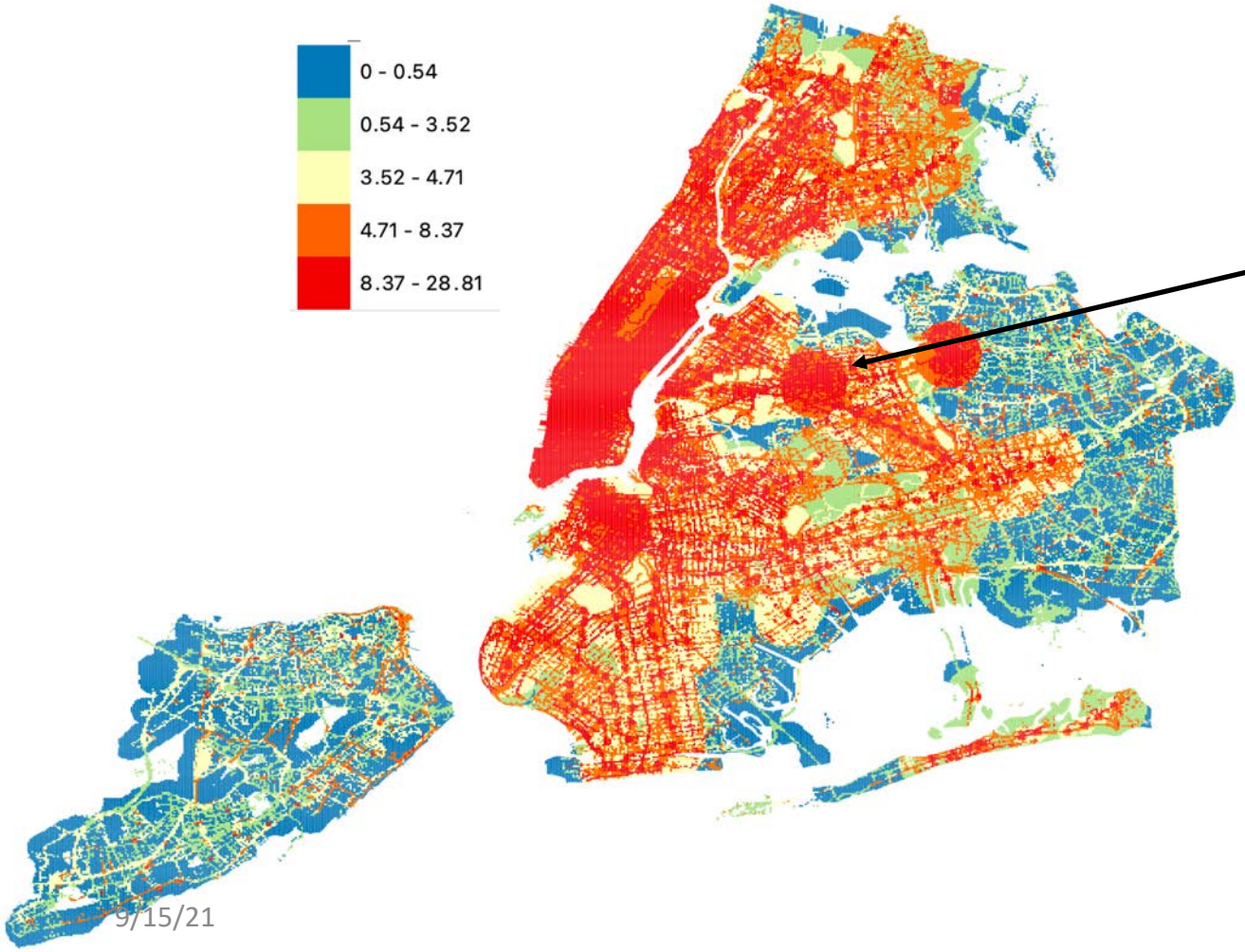

Jackson Heights

Annual subway ridership: **17.0M people**
74- Broadway

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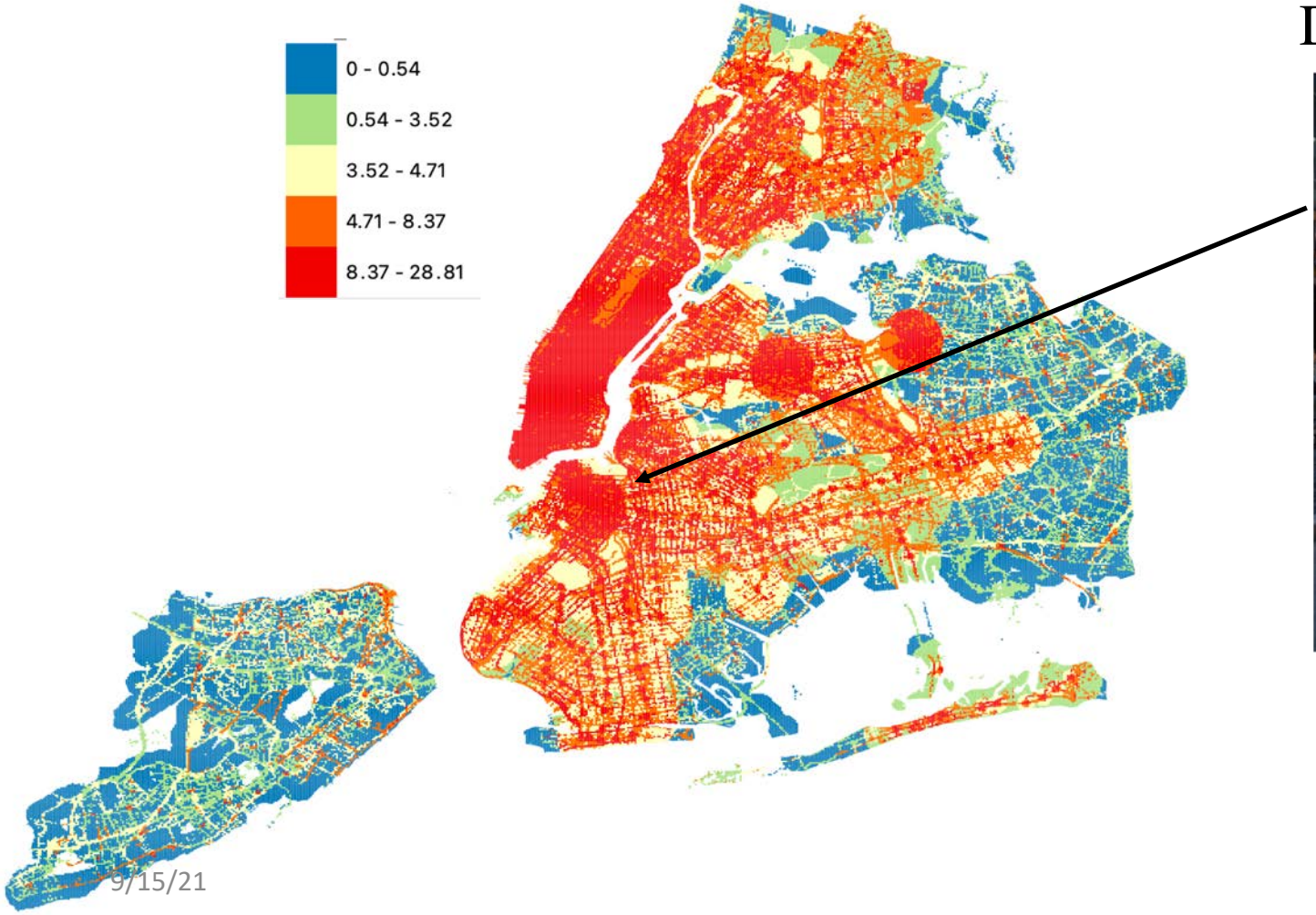


Downtown Brooklyn

Annual subway ridership: **30M+ people**
10+ Stations: Jay St – MetroTech, Atlantic av.-metro center, …

Trip distribution

Model input variables:

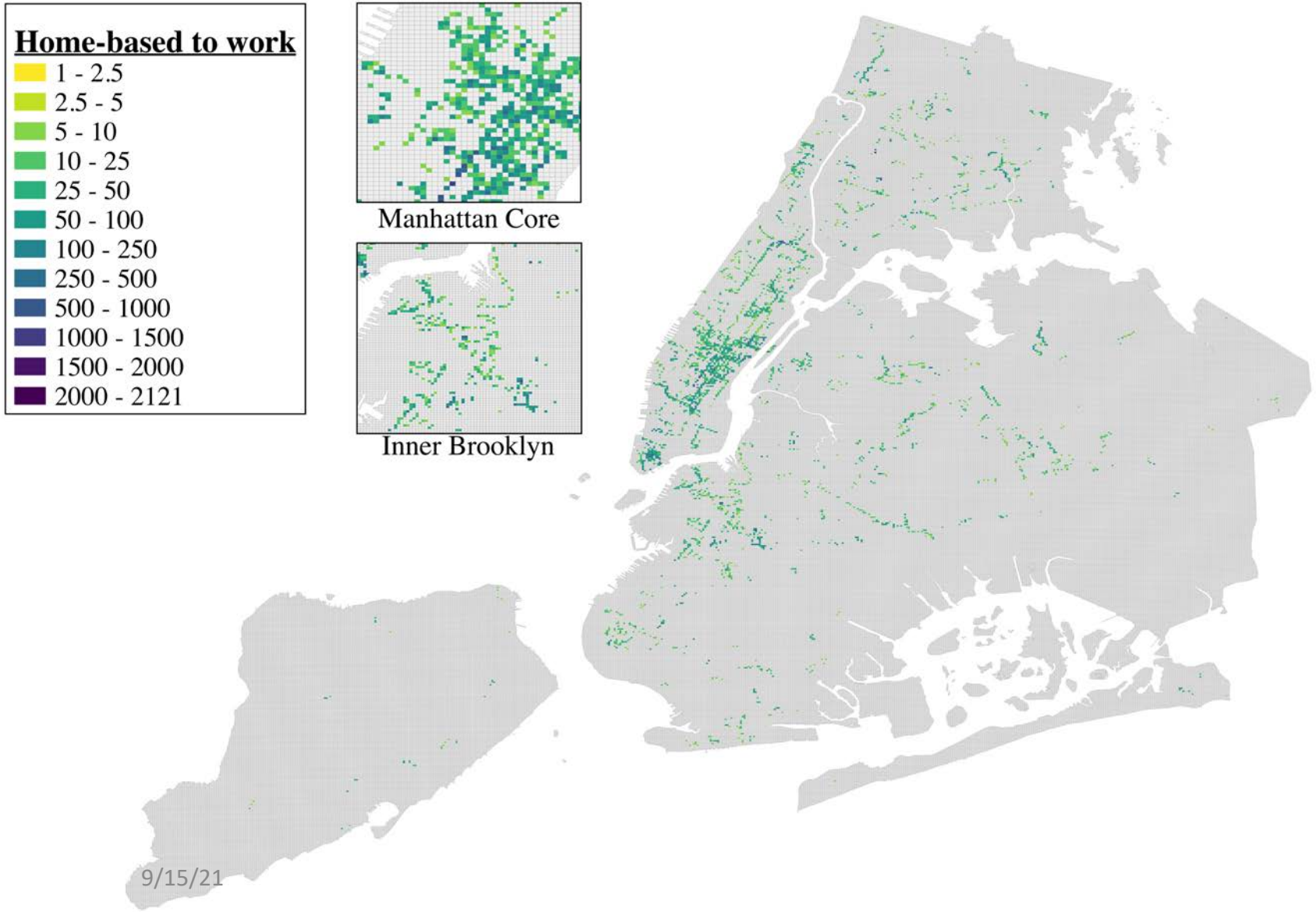
- Socio-economic variables
- Road composition of NYC
- PIE
- Type of trips

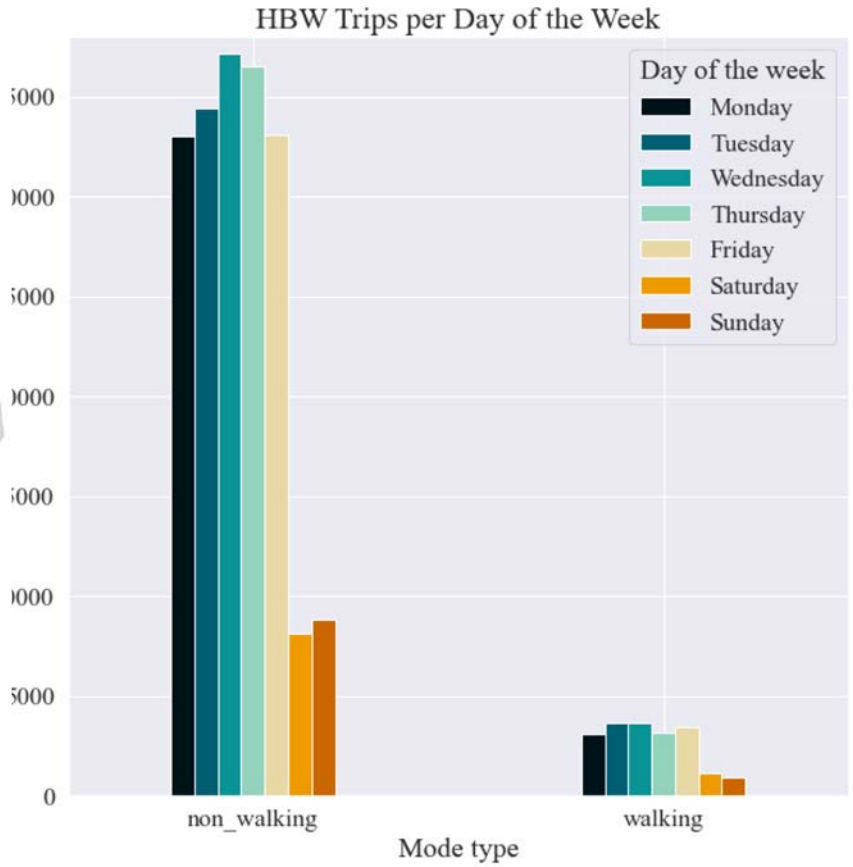
How do these variables affect the **probability of walking in a PAZ**?

Trip purposes used for model estimation

Home-based to Work (HBW)	Home-based Other (HBO)	Non-home-based (NHB)
	HB - Recreation	NHB - Recreation
	HB - Other	NHB - Other
	HB - School	NHB - School

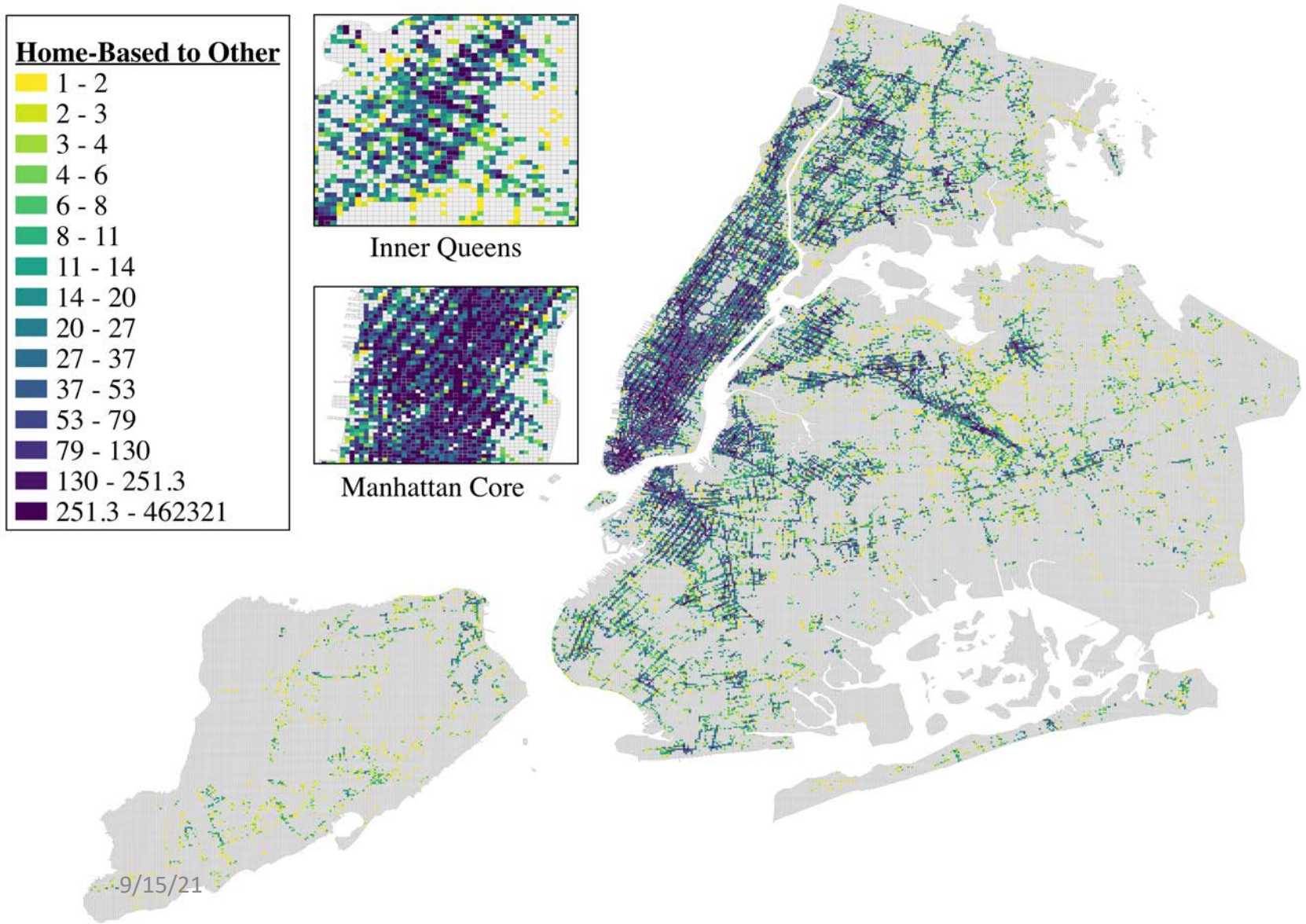
Trip distribution HBW





* Data shown from raw trips

Trip distribution HBO

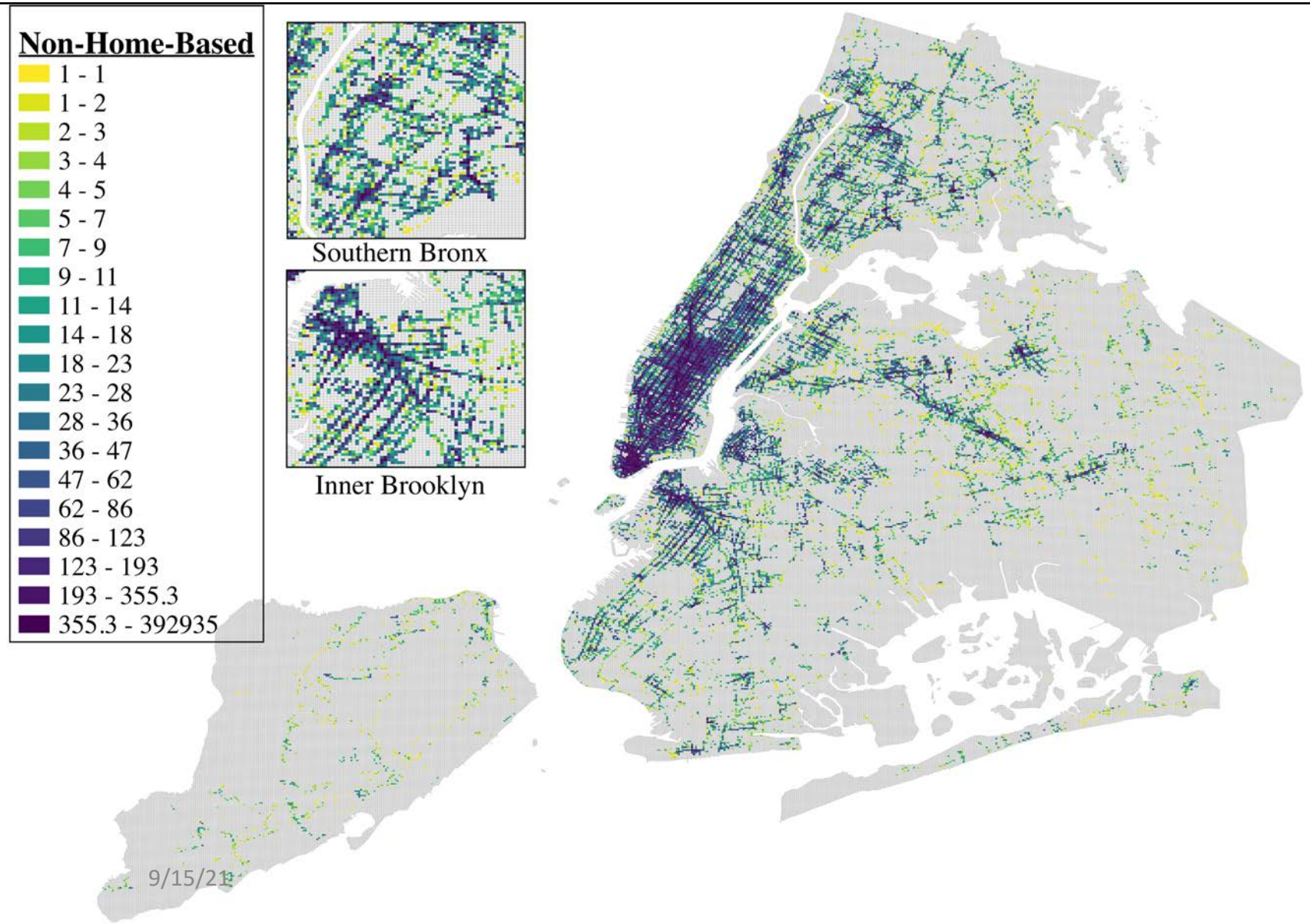


HBO trips per PAZ are more spread in the city.

In this case, the **PIE and road accessibility** have some of the most important **positive impacts** on the decision of people to walk in a PAZ.

The different origins and destinations seem to have a different effect on the decision to walk.

Trip distribution NHB



NHB trips per PAZ are also more widespread in the city.

In this case, the **PIE and the road access** have less impact than in the HBO trips, however it is still **an important measure**.

In this case socioeconomic variables such as **age, and household size** seem to have more positive impact in the number of trips recorded.

Final results and discussion

Trip distance has the same effect across all three models:
as the distance increases, the probability of a person walking diminishes.

Potential applications of this model:

- Refining of the proximity model using the PIE as a measure of the environment.
- Planning tool to analyze, at a PAZ level, where there is a deficiency in walking conditions and discover why.
- Use socio-economic results to understand the equity behind walking.

Limitations of this model:

- Even if the Pedestrian Analysis Zone (PAZ) is a small area, that captures movements at a sub-block level, a network level analysis would be more accurate.
- More walking data and with better data quality, currently unavailable, are necessary to refine and improve the outcomes of this model.

Thank you

Questions?

Carla A. Tejada Lopez
The City College of New York - ST112
ctejada001@citymail.cuny.edu