NYC Congestion Pricing - ReConsidered

Shruti + Taylor + Mengxi + Berkhan

Project Prompt

How would congestion charging affect property prices in New York City?

Negative Effects

- Automobiles contribute more to 50% of the nitrogen oxide, 30% of the volatile organic compounds and 20% of the PM10 in US1, which have detrimental health effects.
- According to the 2015 Urban Mobility report, across 471 urban areas in US, **congestion causes Americans to spend 6.9 billion hours more on the road and waste 3.1 billion gallons of fuel, leading to a net loss of $160 billion**. This amounts to an average annual congestion cost of $960 per commuter, an outlay that has increased more than twofold since 1980s.
(Schrank et al., 2015)

Case Studies

London

Implemented: 2003
Area: Central London
Method: automatic license plate recognition
Schedule: weekdays with weekends and public holidays free
Pricing: fixed pricing according to schedule
Impact: 44% less cars entering into central london since implementation (as of 2015)

Singapore

Implemented: 1975 first implemented, 1998 redesigned
Area: Singapore CBD and central areas
Method: automatic license plate recognition
Schedule: peak-hours
Pricing: variable pricing based on historical traffic data and real-time feeds
Impact: 15% decrease of vehicles during rush hour with increased use of public transit

Stockholm

Implemented: 2007
Area: Central Stockholm
Method: automatic license plate recognition
Schedule: weekdays with weekends and public holidays free
Pricing: fixed pricing according to schedule
Impact: 9% decrease in congestion as of 2012

- **Mostly focused on areas over circumstance**

Plans for New York

PlaNYC Proposal

Date: 2008

Plan: Toll access to Manhattan below 60th st.

Reaction:

- Strong opposition from outer-boroughs
- Fears that areas bordering congestion pricing zone would become congested as motorists avoid tolls.

MoveNY Proposal

Date: 2015

Plan: Redistribute toll prices across NY, charge varies according time of day

Reaction:

- Strong opposition from outer-boroughs, especially from residents without access to public transit

Fix NYC Proposal

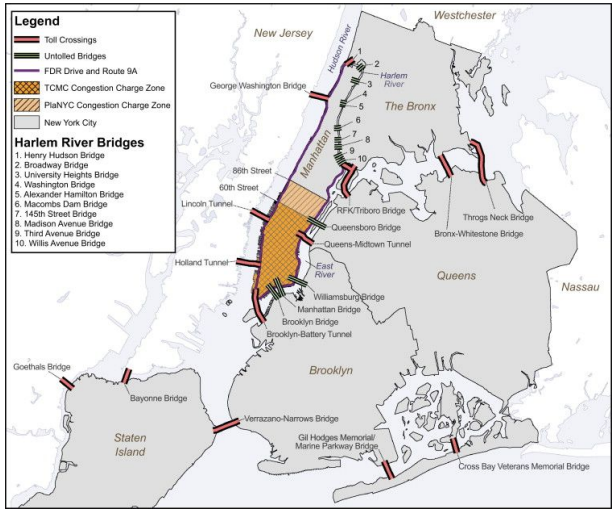
Date: 2017

Plan: Tolling select areas during select times of day, surcharge on rideshares, i.e. Uber

Reaction:

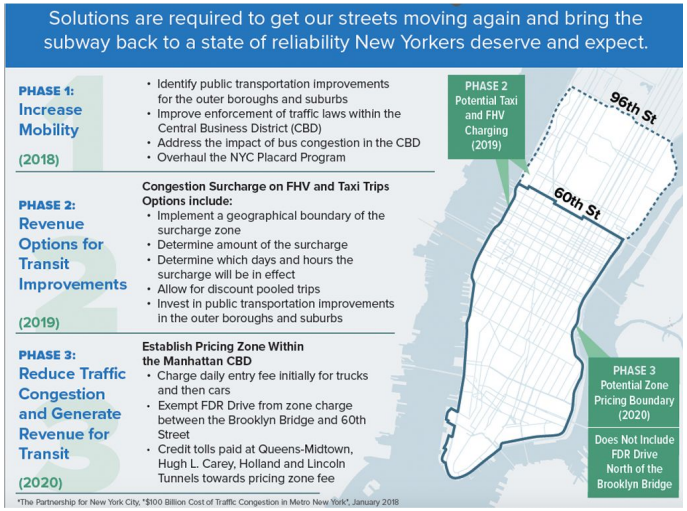
- Strong opposition from outer-boroughs, especially from residents without access to public transit
- Perceived as a tax on the middle-class, not on the wealthy

Plans for New York



PlaNYC Proposal

MoveNY



Fix NYC Proposal

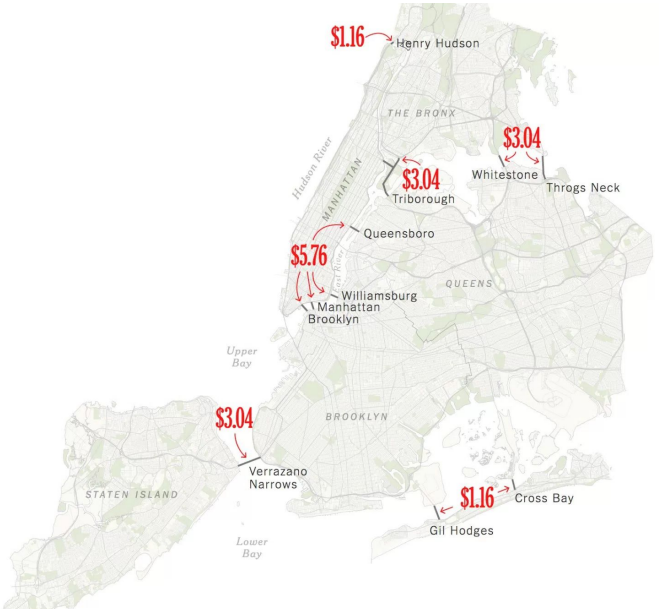
Adjusted Prompt

How to impose congestion charge *equitably* and *sustainably in* New York City?

Alternative to Bridge Tolls

- Tolls at bridges disproportionately affect outer-borough residents, who are also less likely to have convenient access to public transit compared to those who live on Manhattan

- We are interested in a more dynamic form of congestion charging that is decentralised and is based on circumstance



Factors Affecting Congestion

Identify potential areas of congestion along heavily trafficked routes

Collect data to identify potential sites vis-a-vis 3 factors:

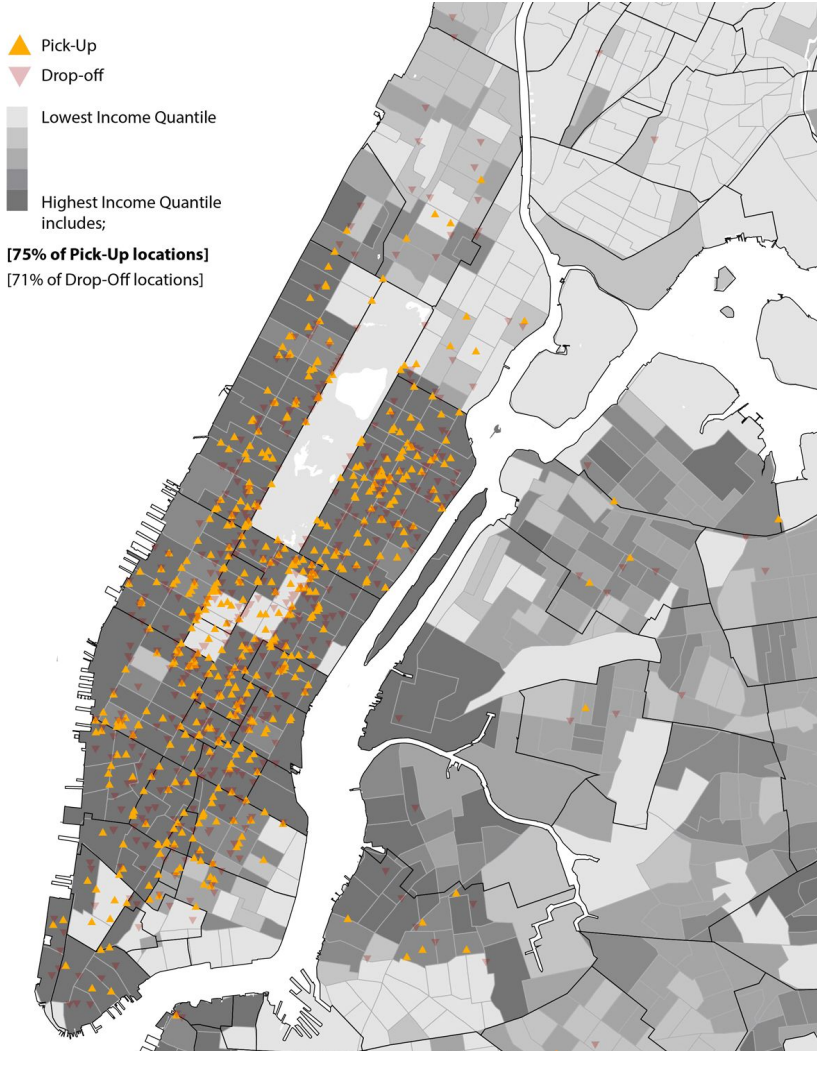
a. area median income
b. subway stops
c. air pollution

Covered in the current analysis

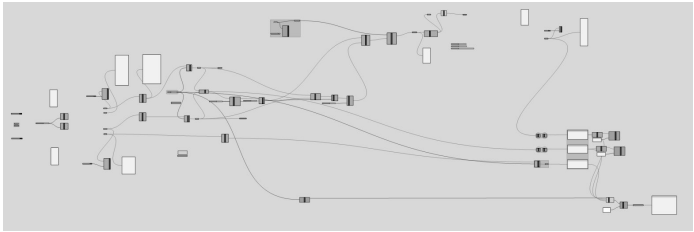
100 Random Taxi Trips / Median Income

- Exploring the drop offs and pickup locations vis-a-vis median income in NYC.

- More than **75%** of drop-off and pick-up locations are situated in high median income census tracts (top 20 percentile).



Methodology



Street Route

isolate street networks from ArcMap → import curves to rhino → DeCoding Spaces (Creating the network) → feed origin and destination, iterate through all possible pairs of origin -> destination → get resultant route and length

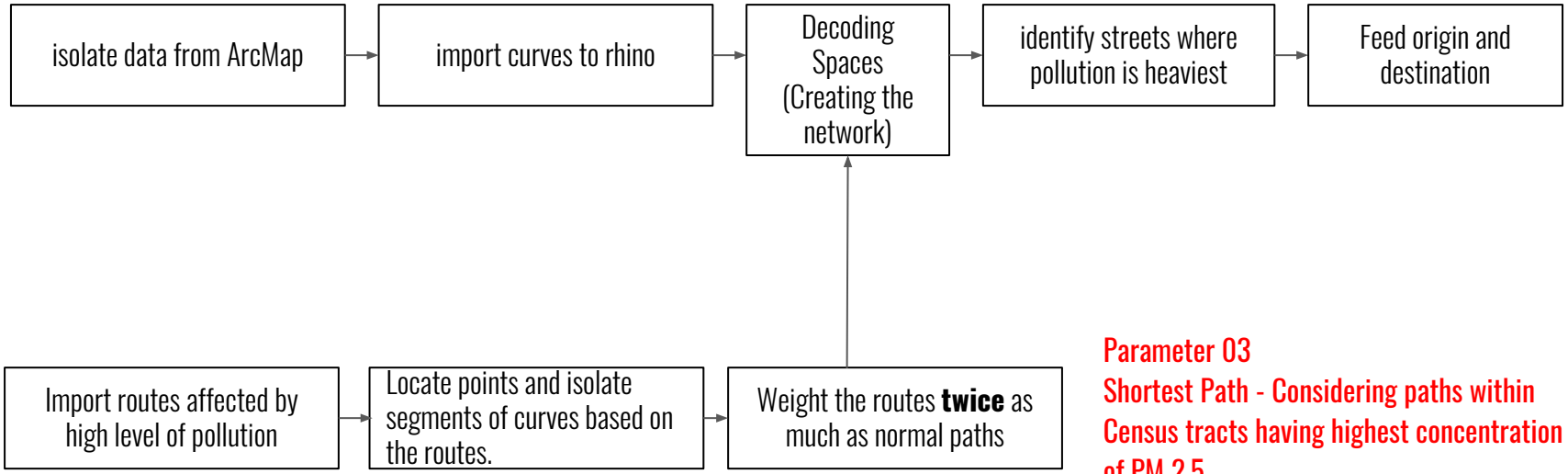
Parameter 01
Shortest Path - Street

Subway Route

isolate subway networks from ArcMap → import curves to rhino → DeCoding Spaces (Creating the network) → feed origin and destination, iterate through all possible pairs of origin -> destination → get resultant route and length

Parameter 02
Shortest Path - Subway

Pollution

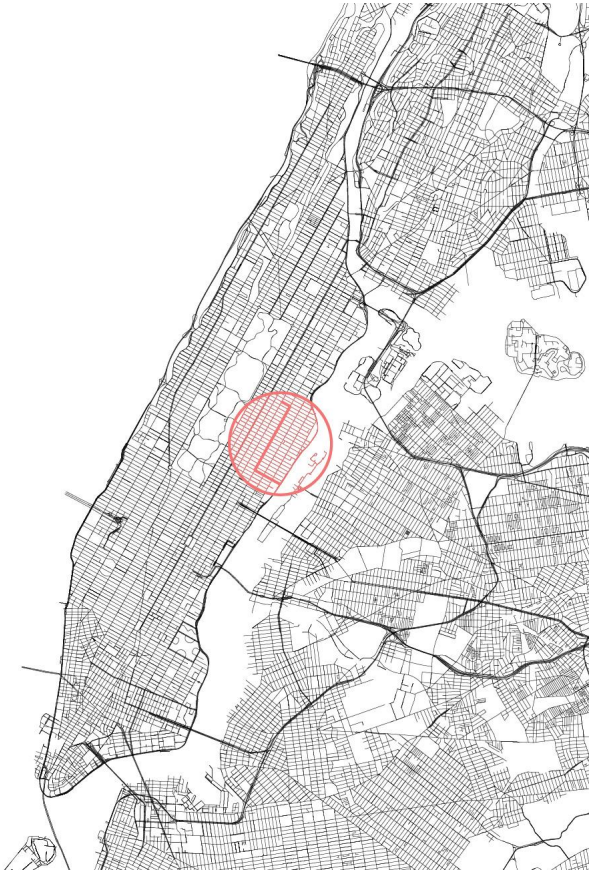


Parameter 03
Shortest Path - Considering paths within Census tracts having highest concentration of PM 2.5

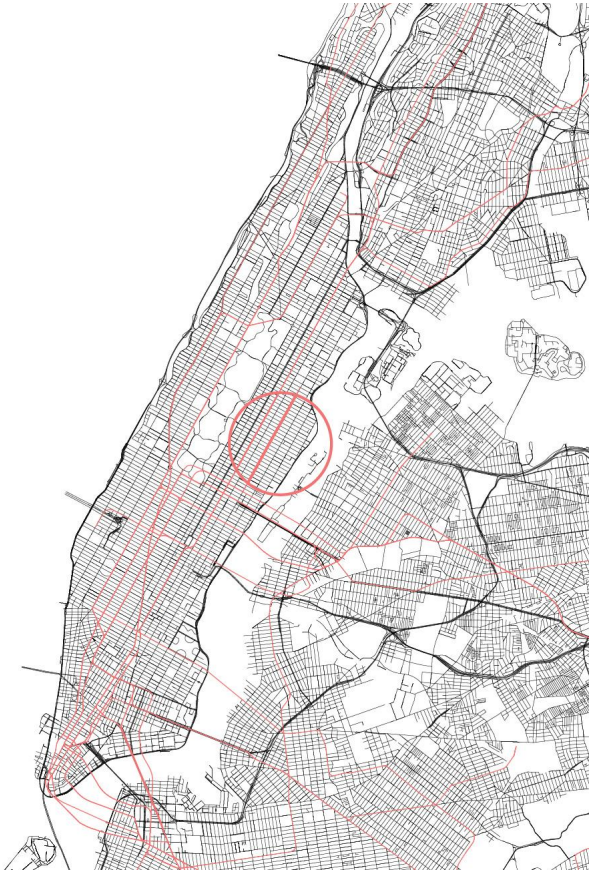
Exploring alternate routes based on parameters of interest:

- Euclidean Distance
- Shortest Path based on Streets
- Shortest Path based on Subway
- Path optimised for the Pollution data.

Route Index 6

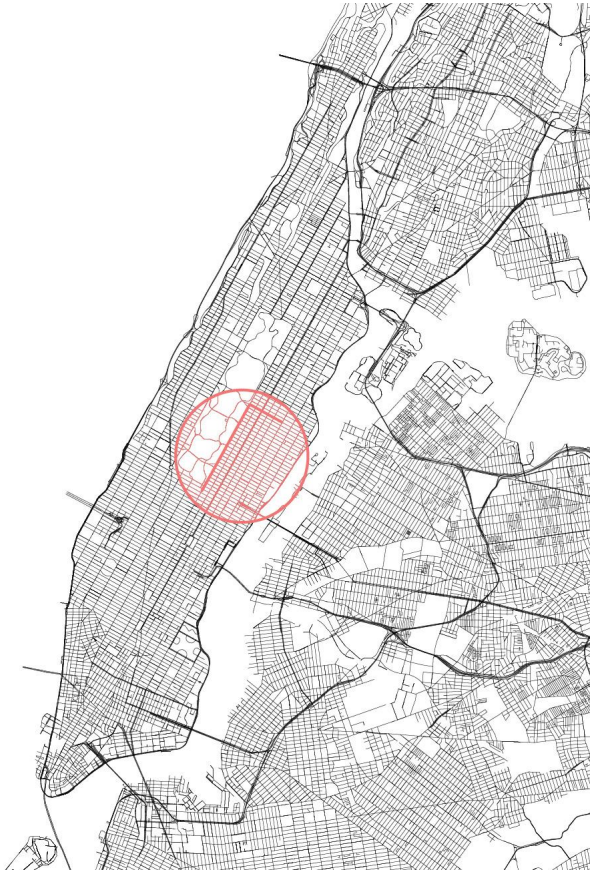


Street Route

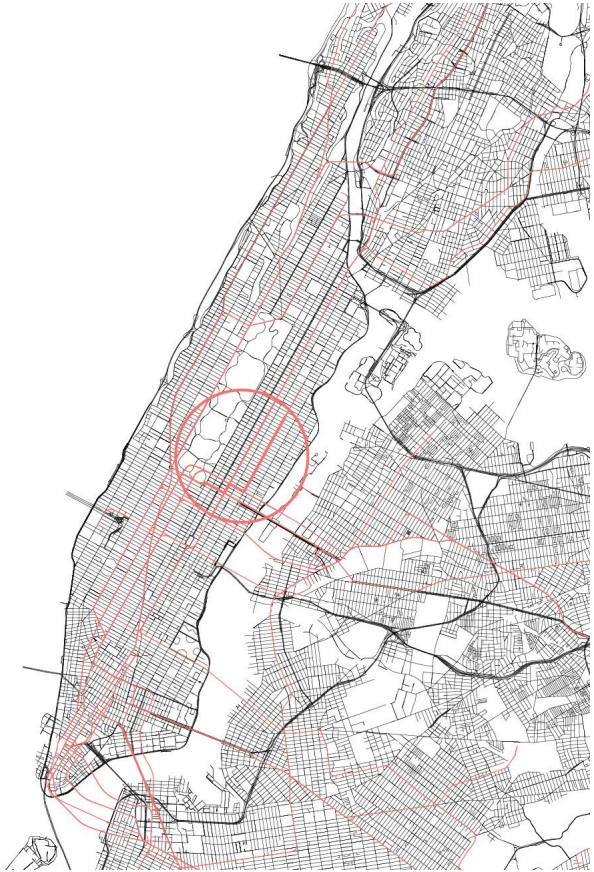


Subway

Route Index 7

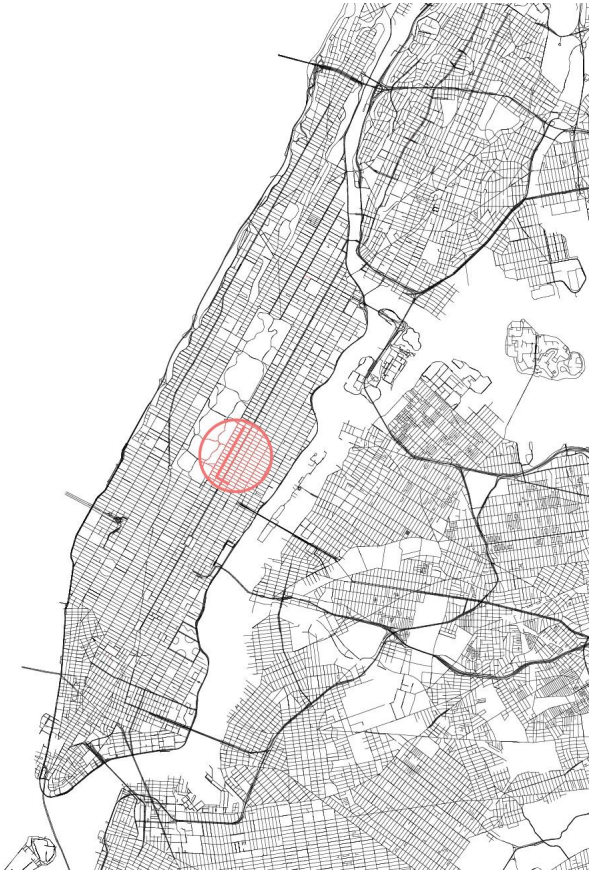


Street Route

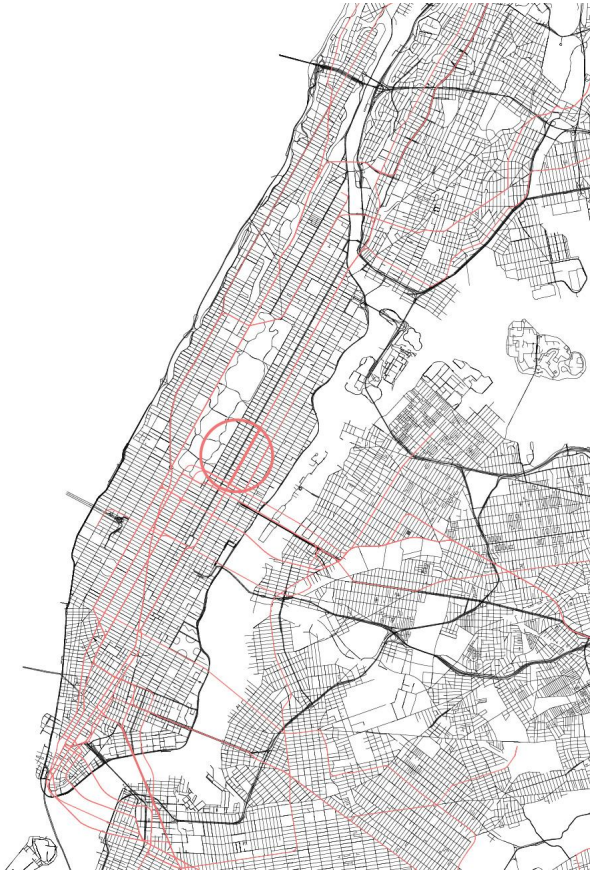


Subway

Route Index 8

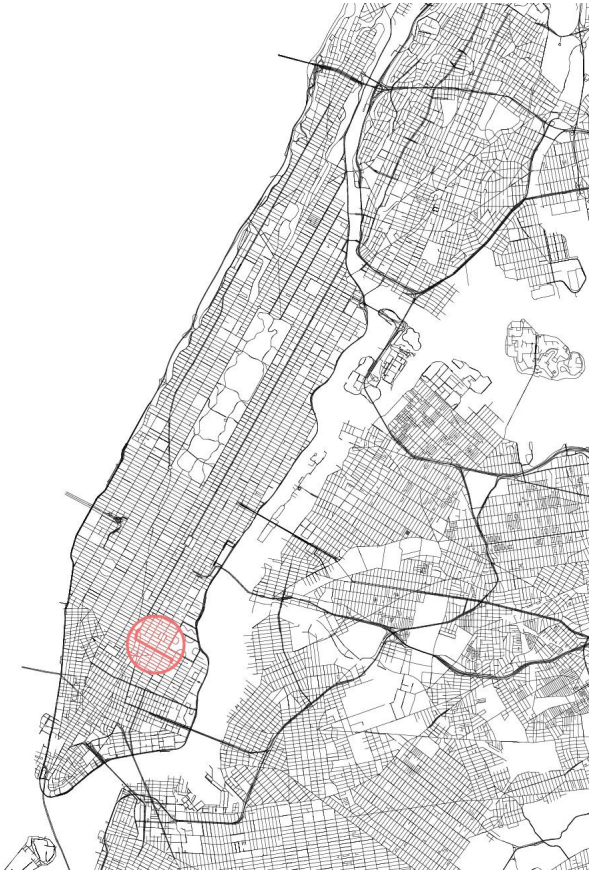


Street Route

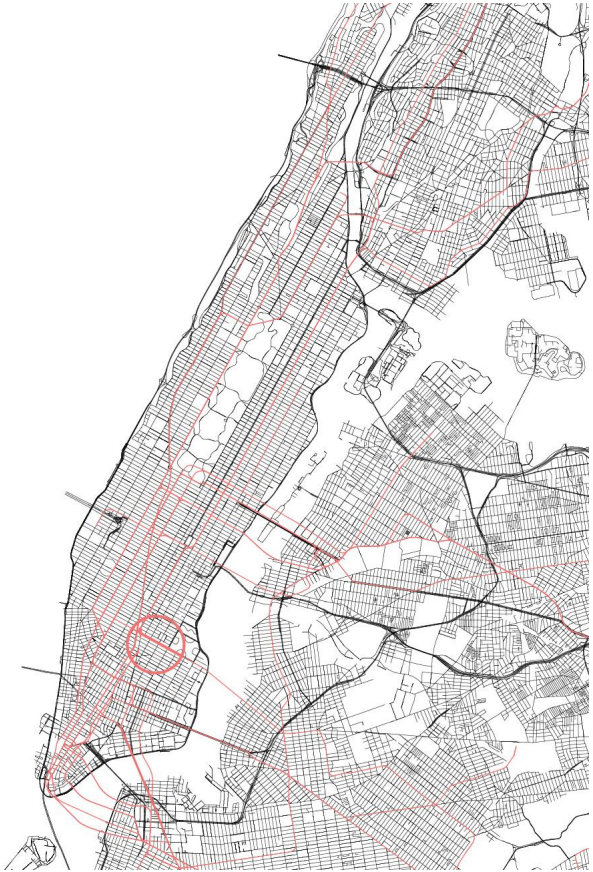


Subway

Route Index 9



Street Route

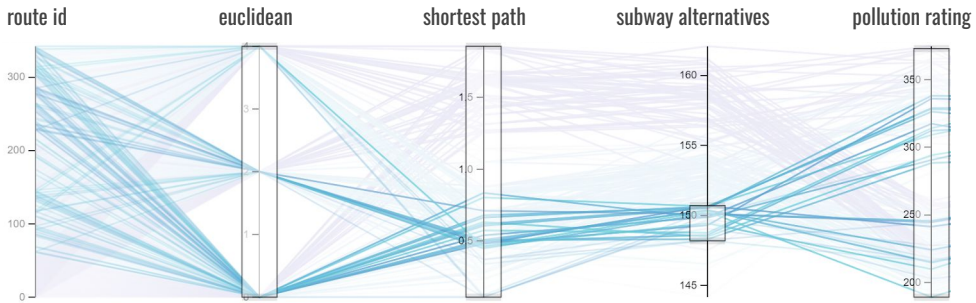


Subway

CSV. to Design Explorer (in process)

Route ID	Euclidean	Shortest Path	Subway Alternatives	Pollution Length
5	2440.02	3172.03	5342.06	3172.03
6	2501.01	3251.31	2200.34	3251.31
7	1978.24	2008.78	3493.59	6300.56
8	2501.5	3378.56	5400.56	4305.34
9	3500,1	4856.42	6230.02	5012.0
10	2133.0	3013.83	3201.89	6019.78
.....	.....	.....	.....	.....
97	5525.44	7008.09	7508,45	7209.09

Currently we are working on this iterative process



Controlling for parameters in Design Explorer

Charging

Rubric for charging

Class	Street Route Length : Subway Length	Pollution Rating (+/-)	Charge
A	0.5:1	+	$$$
		-	1.5 x ($$$)
B	1:1	+	$$
		-	1.5 x ($$)
C	1.5:1	+	$
		-	1.5 x ($)
D	2:1	+	None
		-	None

Moving Forward

Other parameters that Cost of Congestion (C) can depend on

Proximity to Subway Stops	S	$C \propto S$
Average Annual Daily Traffic (AADT)	T	$C \propto T$
Pedestrian Count	Ped	$C \propto Ped$
Density (Proxy F.A.R.)	D	$C \propto D$
Pollution (Proxy P.M. 2.5 concentration)	P	$C \propto P$

Moving Forward

Scenario building:

Simulate scenarios based on parameter matrix.

Locating areas for congestion charging along heavily trafficked routes by weighing impact of factors:

Possible simulations:

a. simulation 1: income+subway+pollution+bus
b. simulation 2: pedestrian+density+income
c. simulation 3: traffic count+pollution+pedestrian