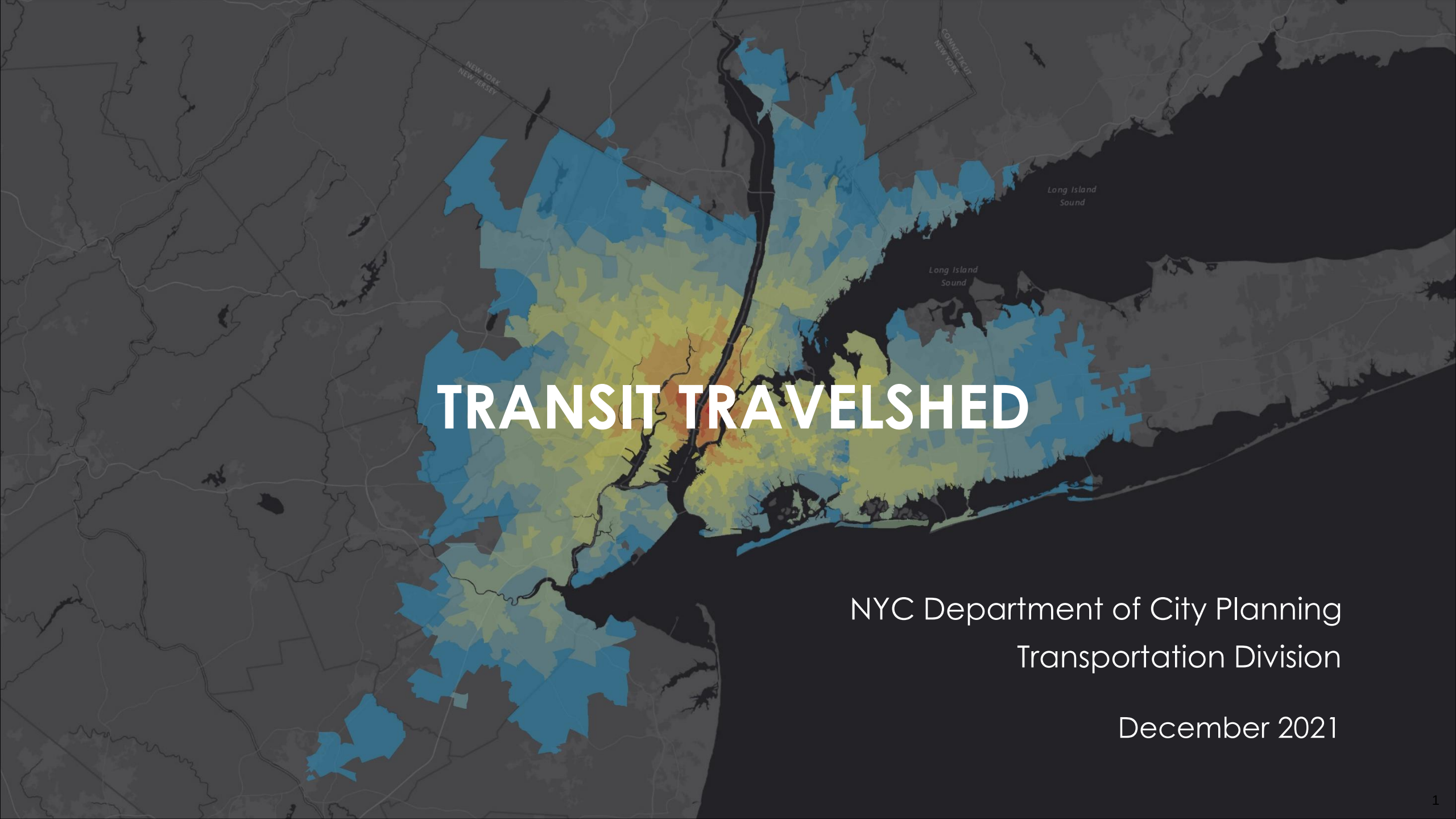


TRANSIT TRAVELSHED

NYC Department of City Planning
Transportation Division

December 2021

Transit Travelshed Model

Trip Routing and Travelshed Tool:

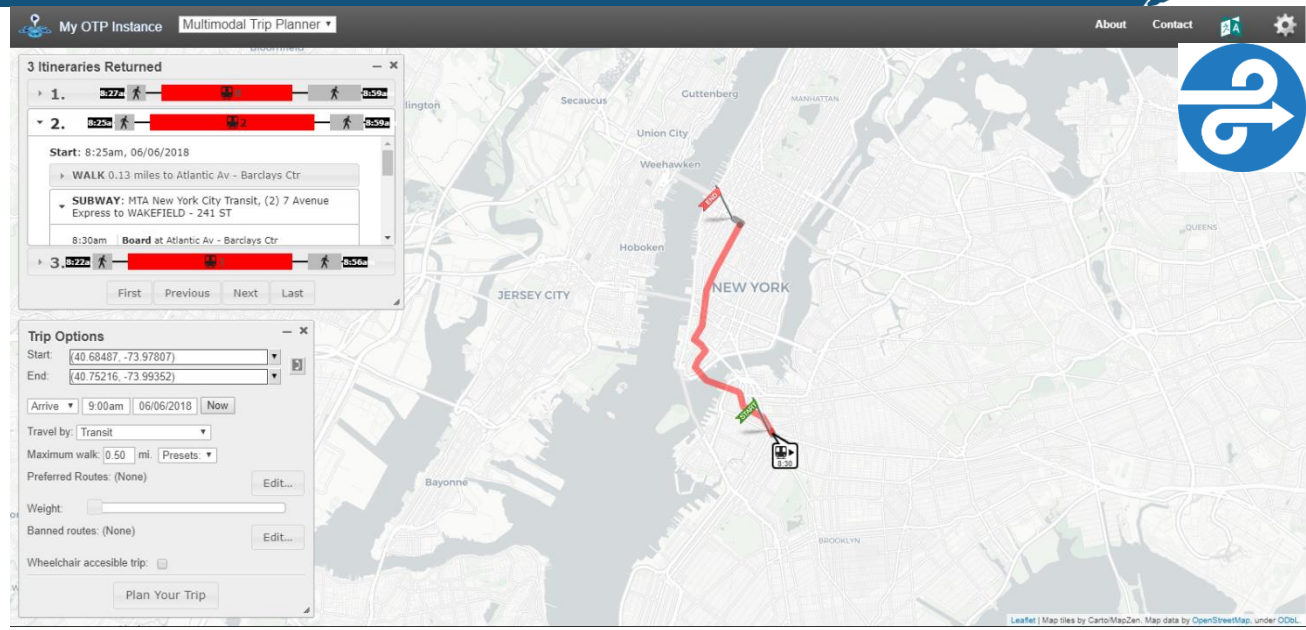
- OpenTripPlanner

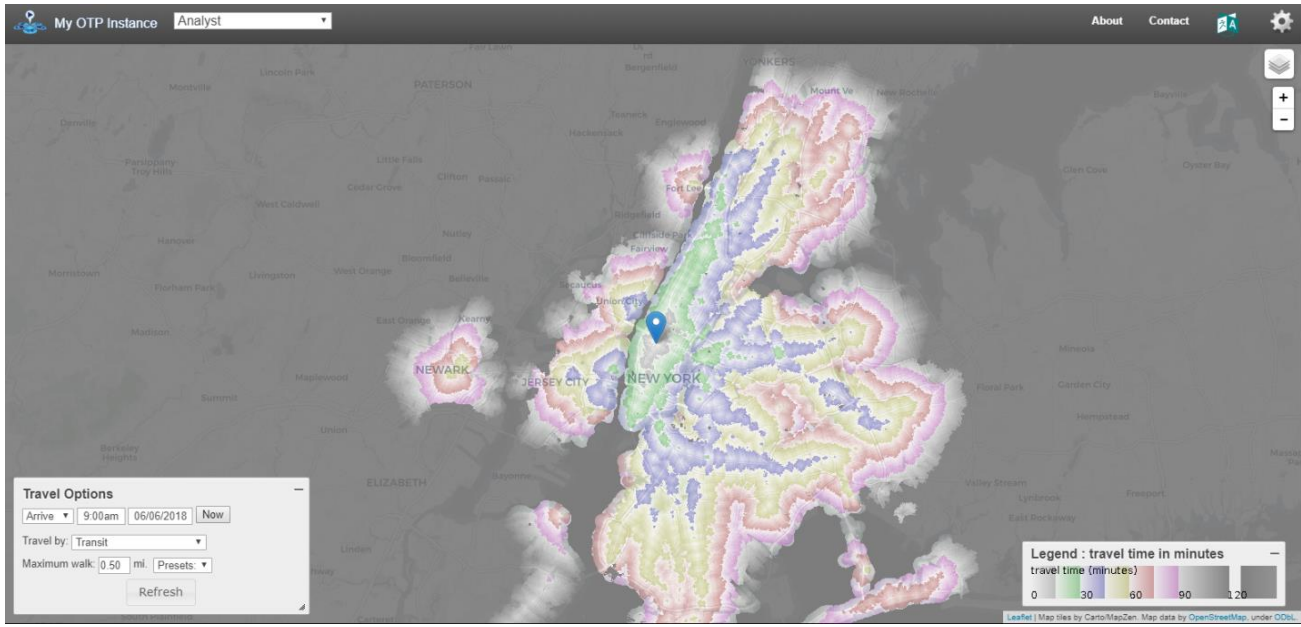
Input Data:

- Street Network: OpenStreetMap
- Transit Network: General Transit Feed Specification (GTFS) schedule data published by transit agencies

Parameters/Assumptions:

- Interested locations
- Modes to include
- Typical travel date
- Departure/arrival time
- Maximum walking distance
- Maximum number of transfers
- Maximum pre-transit driving time
- Penalty for congestion and parking
- Clamped initial wait time
- Isochrone cutoff points
- Travel time assignment
- Travel time aggregation method
- Model outputs





http://www.opentripplanner.org/

Transit Travelshed Model

Model Input Data:

Street Network: OpenStreetMap

- New York; New Jersey; Connecticut; Pennsylvania

Transit Network: GTFS schedule data published by transit agencies

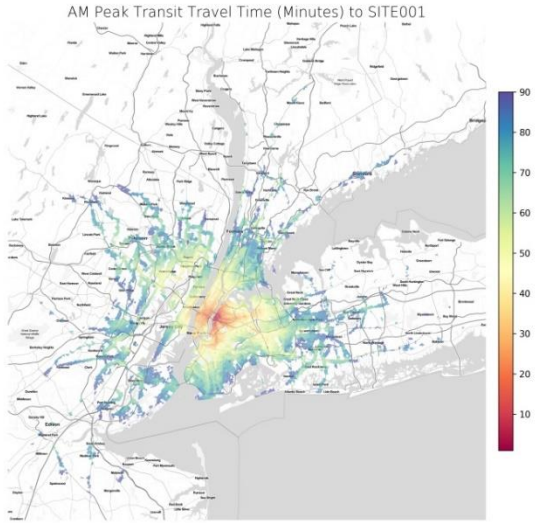
- New York:
  - MTA NYCT (Subway + Bus)
  - MTA Long Island Railroad
  - MTA Metro-North Railroad
  - Port Authority Trans-Hudson (PATH)
  - JFK AirTrain
  - NYC DOT Staten Island Ferry
  - NYC Ferry
  - Seastreak Ferry
  - NY Waterway
  - Nassau Inter-County Express (NICE)
  - Suffolk County Transit
  - Westchester County Bee-Line System
  - Tappan Zee Express
  - Ulster County Area Transit (UCAT)
  - Capital District Transportation Authority (CDTA)
  - Rochester-Genesee Regional Transportation Authority (RTS)
  - Niagara Frontier Transportation Authority (NFTA)
- New Jersey:
  - New Jersey Transit (Bus + Rail)
- Connecticut:
  - Connecticut Transit
  - Shore Line East
  - 9 Town Transit
  - Norwalk Transit District
- Pennsylvania:
  - Port Authority Transit Corporation (PATCO)
  - Southeastern Pennsylvania Transportation Authority (SEPTA) (Bus + Rail)
  - Monroe County Transit Authority (Pocono Pony)
  - Rabbit Transit
  - Centre County Transit Authority (CATA)
  - Port Authority of Allegheny County
  - Erie Metropolitan Transit Authority (EMTA)
- Rhode Island:
  - Rhode Island Public Transit Authority (RIPTA)
- Delaware:
  - Delaware Transit Corporation (DART)

Transit Travelshed Model

Model Parameters/Assumptions:

- **Interested locations:**
  - If interested in residence place/workplace Census Tract, use weighted centroid based on Census Block level LEHD residence place/workplace private primary job data
  - Snapped to the closest intersection
- **Modes to include:**
  - Walk; rail; subway; bus; ferry
- **Typical travel date:**
  - 06/06/2018
- **Departure/arrival time:**
  - If outbound, depart between 7 am and 10 am with 10 mins' interval
  - If inbound, arrive between 7 am and 10 am with 10 mins' interval
- **Maximum walking distance:**
  - 0.5 mile for each trip leg
- **Maximum number of transfers:**
  - 3 (i.e. 4 boardings)
- **Clamped initial wait time:**
  - If outbound, do not clamp initial wait time
  - If inbound, clamp all the early arrival time
- **Isochrone cutoff points:**
  - 0 mins to 120 mins with 2 mins' interval
- **Travel time assignment:**
  - Assign the travel time to each Census Block based on where the centroid of the Census Block is located in the travelshed bands
- **Travel time aggregation method:**
  - For both temporal and geographical aggregation, take the median travel time while disregarding the travel time longer than 120 mins
- **Model outputs:**
  - Travel time (0 min-120 mins; 999=longer than 120 mins) to/from the interested locations for each Census Block and Tract
  - csv table, ESRI shapefile, and automated map

blockid	SITE001
340030050005000	41
340030050005012	39
340030050005013	41
340030050005023	37
340030050005025	37
340030050005028	37
340030050005031	41
340030050005034	45
340030050005036	39
340030050005037	37



Transit Travelshed Index Models

- **Transit Mobility Index:**

$$Acre_{T0\sim T60}$$

- **Access to Population Index:**

$$\sum \frac{Population^{**}}{Travel\ Time^2} = \frac{Population_{T0\sim T10}}{(\frac{0+10}{2})^2} + \frac{Population_{T10\sim T20}}{(\frac{10+20}{2})^2} + \frac{Population_{T20\sim T30}}{(\frac{20+30}{2})^2} + \frac{Population_{T30\sim T40}}{(\frac{30+40}{2})^2} + \frac{Population_{T40\sim T50}}{(\frac{40+50}{2})^2} + \frac{Population_{T50\sim T60}}{(\frac{50+60}{2})^2}$$

- **Access to Job Index:**

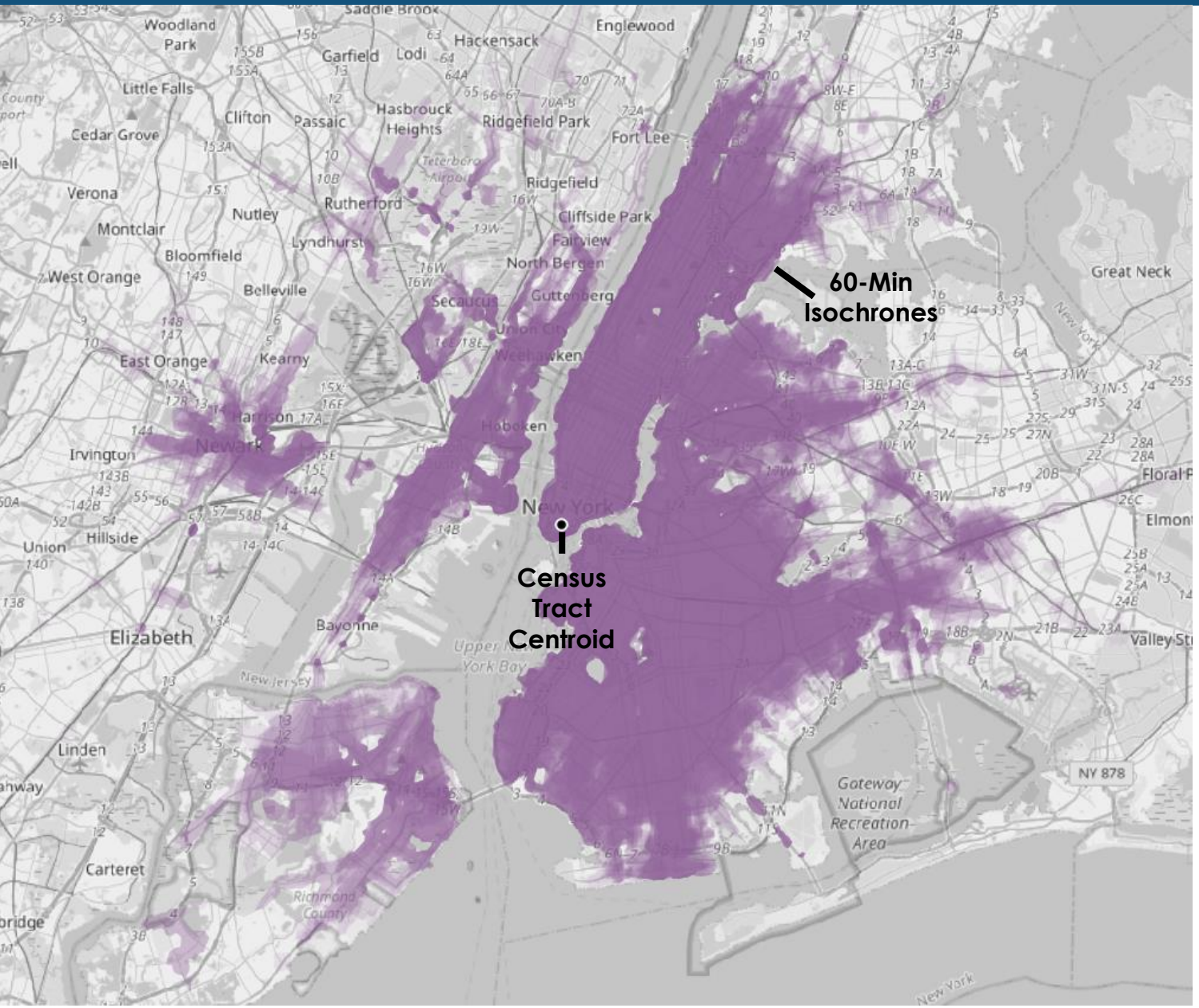
$$\sum \frac{Job^{*}}{Travel\ Time^2} = \frac{Job_{T0\sim T10}}{(\frac{0+10}{2})^2} + \frac{Job_{T10\sim T20}}{(\frac{10+20}{2})^2} + \frac{Job_{T20\sim T30}}{(\frac{20+30}{2})^2} + \frac{Job_{T30\sim T40}}{(\frac{30+40}{2})^2} + \frac{Job_{T40\sim T50}}{(\frac{40+50}{2})^2} + \frac{Job_{T50\sim T60}}{(\frac{50+60}{2})^2}$$

- **Access to Labor Force Index:**

$$\sum \frac{Labor\ Force^{***}}{Travel\ Time^2} = \frac{Labor\ Force_{T0\sim T10}}{(\frac{0+10}{2})^2} + \frac{Labor\ Force_{T10\sim T20}}{(\frac{10+20}{2})^2} + \frac{Labor\ Force_{T20\sim T30}}{(\frac{20+30}{2})^2} + \frac{Labor\ Force_{T30\sim T40}}{(\frac{30+40}{2})^2} + \frac{Labor\ Force_{T40\sim T50}}{(\frac{40+50}{2})^2} + \frac{Labor\ Force_{T50\sim T60}}{(\frac{50+60}{2})^2}$$

* Job is using Census Block level LEHD 2017 wac S000 JT03 data
** Population is using ACS 2014-2018 data
*** Labor force is using Census Block level LEHD 2017 rac S000 JT03 data

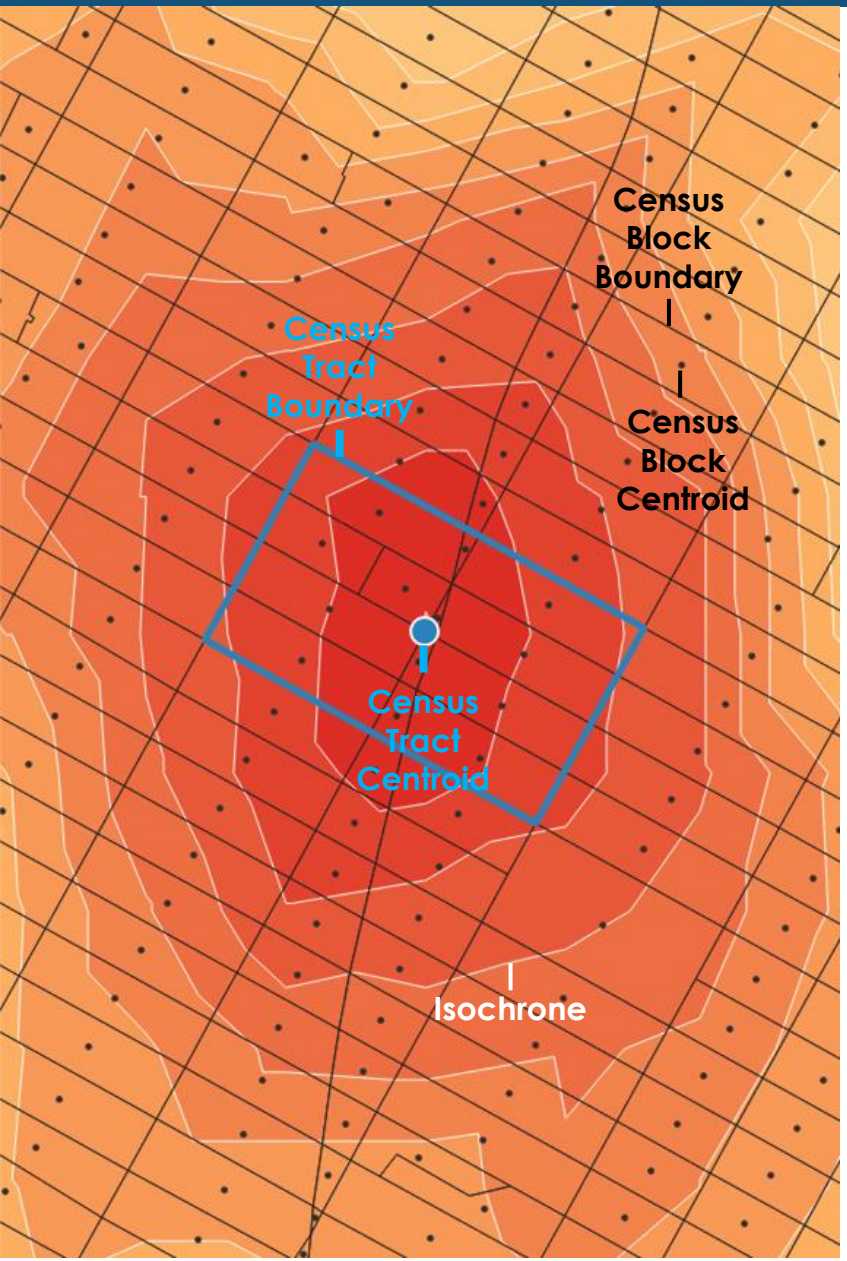
Example – Transit Mobility Index

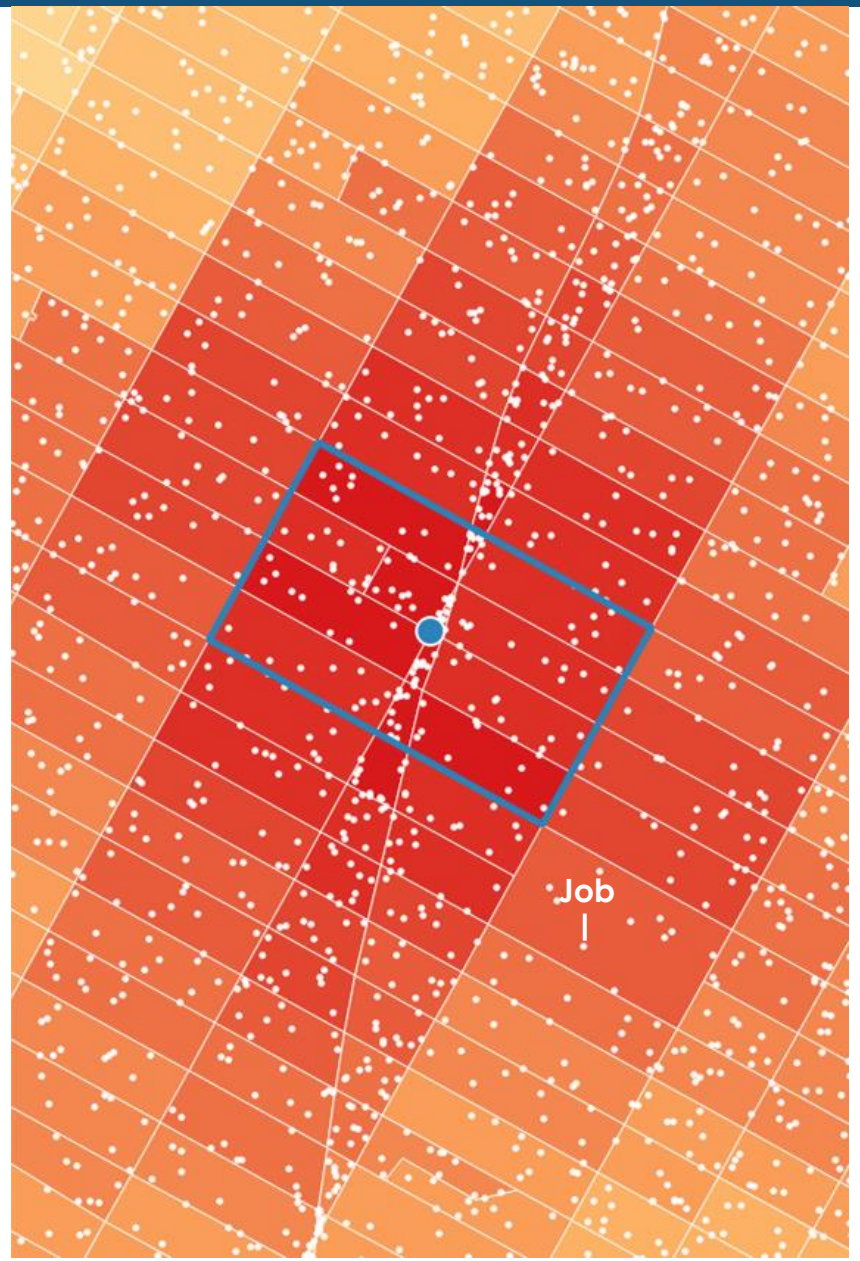


$$\textbf{\textit{Transit Mobility Index}} = Median(Acre_{T0700}, Acre_{T0710}, \ldots, Acre_{T1000})$$
$$= Median(88528, 91039, \ldots, 87737)$$
$$= 91040$$

- The Transit Mobility Index is based on the 60-min transit isochrones generated from a point between 7 and 10 am. The value of the index measures the areas that isochrones cover in acre and is calculated by taking the median of all isochrones.

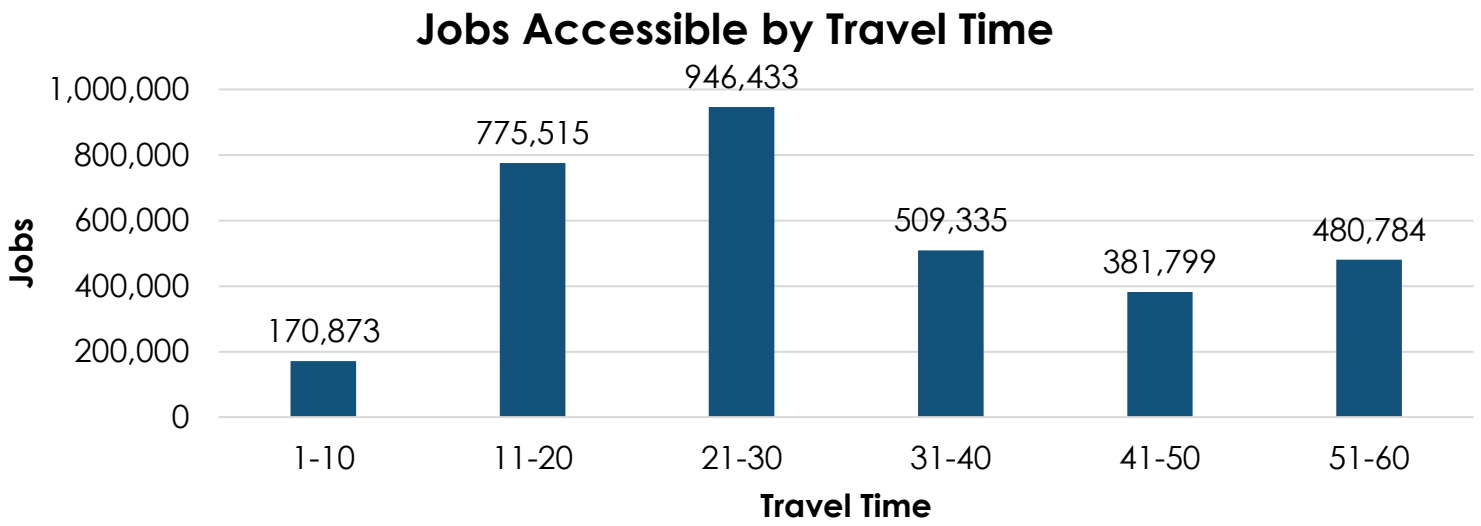
Example – Access to Job Index





- Before calculating the Access to Job Index, the transit isochrones generated through OTP are translated into the median travel time from the Census Tract centroid to Census Block centroids between 7 and 10 am.
- The jobs data are then overlayed in order to compute the number of jobs accessible by transit from the Census Tract centroid in each travel time band.

Example – Access to Job Index



$$\textbf{\textit{Access to Job Index}} = \sum \frac{Job}{Travel\ Time^2}$$

$$= \frac{170873}{(\frac{0+10}{2})^2} + \frac{775515}{(\frac{10+20}{2})^2} + \frac{946433}{(\frac{20+30}{2})^2} + \frac{509335}{(\frac{30+40}{2})^2} + \frac{381799}{(\frac{40+50}{2})^2} + \frac{480784}{(\frac{50+60}{2})^2}$$

$$= 12559$$

- The Access to Job Index is calculated by using a weighting mechanism based on the transit travel time. Therefore, jobs that are accessible with longer travel time have less influence on the final index compared to the jobs closer to the origin.