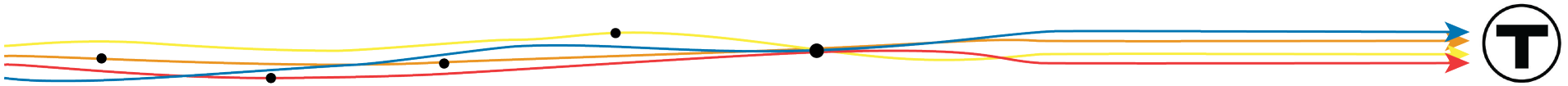
Identifying Low-Income Communities in the Boston-Metro Area in Need of Increased Transit Access

Michael Dowd : GIS Final Project – MIT Fall 2012

Outline

- 1. Question
- 2. Summary
- 3. Significance
- 4. Study Area
- 5. Data
- 6. Methodology
- 7. Findings
  - Transit Score
  - Low Income Block Groups
  - Selected Neighborhoods
- 8. Policy Implications
- 10. Further Research



Summary

- Project Description

  A transit score was created to allow analysis of transit accessibility in the Boston Metro area, specifically the MBTA RTA Zones A & B. This score was then examined as it related to low Income block groups to identify areas in need of greater transit access. Selected areas with a concentration of low income block groups with transit scores less than 40 (scale of 100) were then briefly examined. Finally, the Score is discussed in regard to the impact of future transit development and possible policy considerations.

  - Low Income Block Group Map – Slide 14
  - Transit Score – Slide 13
  - Selected Area Maps – Slide 17 & Appendix.

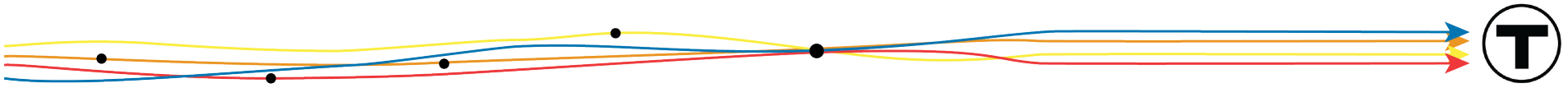
- Conclusions

  The transit score is a useful tool for visualizing transit accessibility in the area. Used in conjunction with other demographic measures, such as income as in this case, it allows for the identification of areas where specific transit interventions may be justified.

  Interventions could include:

  - Transit Expansion
  - Service Alterations
  - Service Integration
  - Targeted Subsidies for alternative modes

- In addition it can be used to investigate the relationship between transit accessibility/proximity on demographic factors, economic indicators, and environmental measures.
- Please see Slide 19 for suggestions of further research.



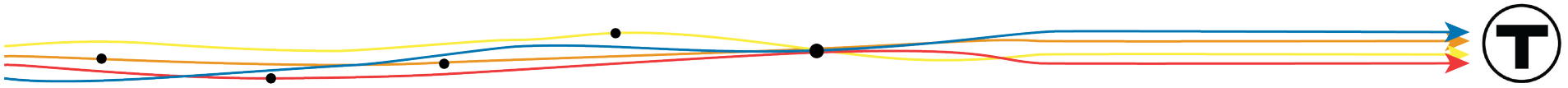
Question

- What communities in the Boston Metro-Area are in need of greater transit access?

How is need defined?

- Income?
- Education?
- Employment/Unemployment?
- Access to personal transportation?
- Travel Time?

In "Need" defined: Block groups with median incomes ≤ 80% of county median income.

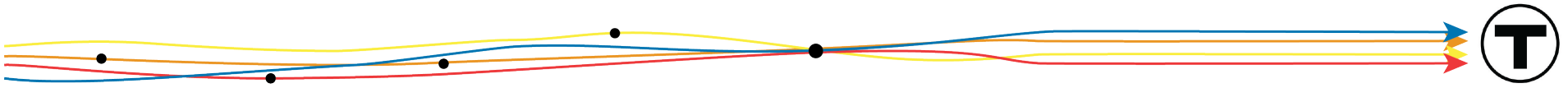


Significance

Why is transit access important?

- Transit Allows for Access to:
  - Work
  - Social Connections
  - Services
  - Recreation

Good transit access creates opportunities.



Study Area

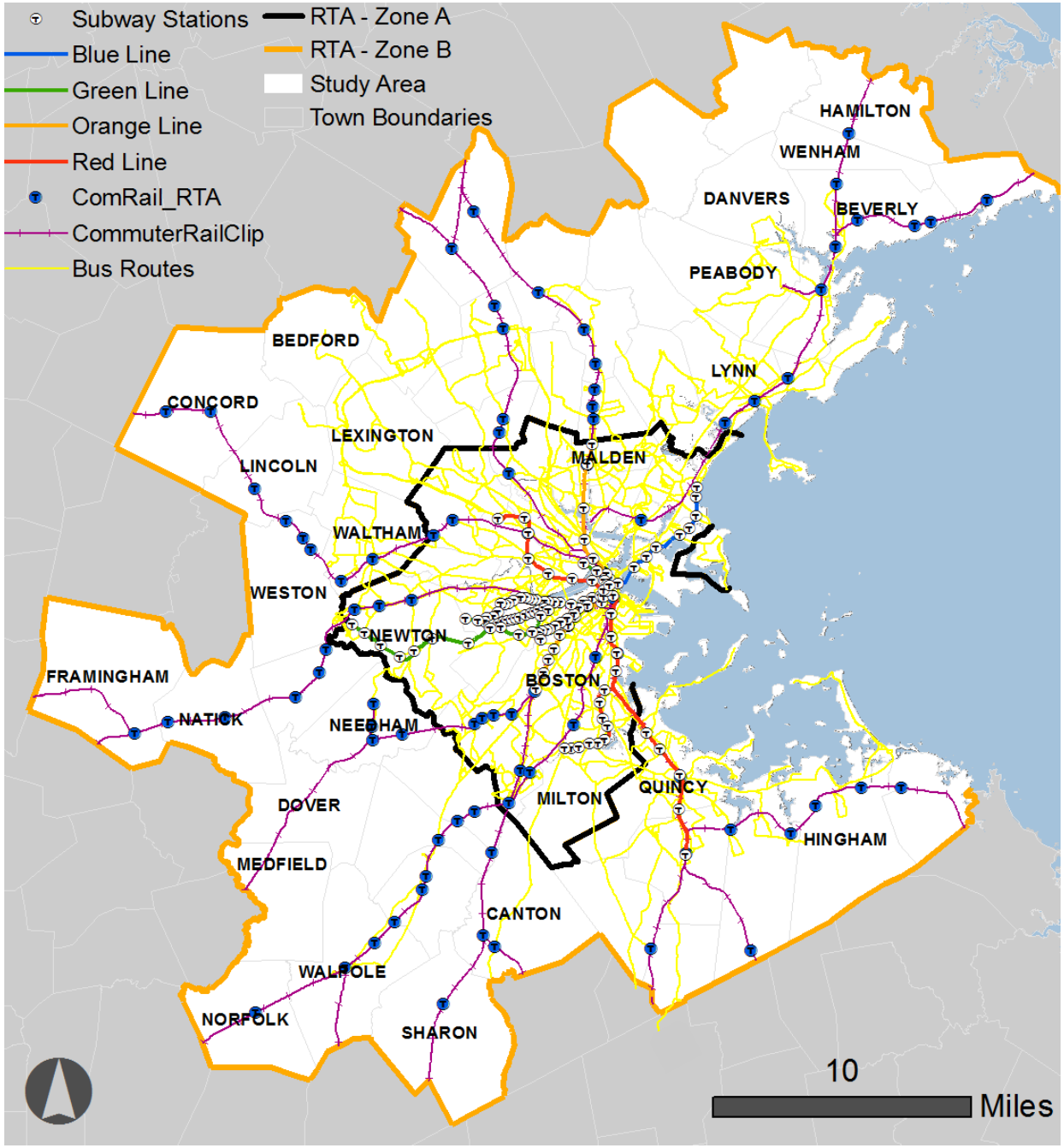
Boston Metro-Area defined:
The MBTA Regional Transportation Authority Zones A & B

Modes of Transit Included:

- •Subway
- •Bus
- •Commuter Rail

Modes of Transit Excluded:

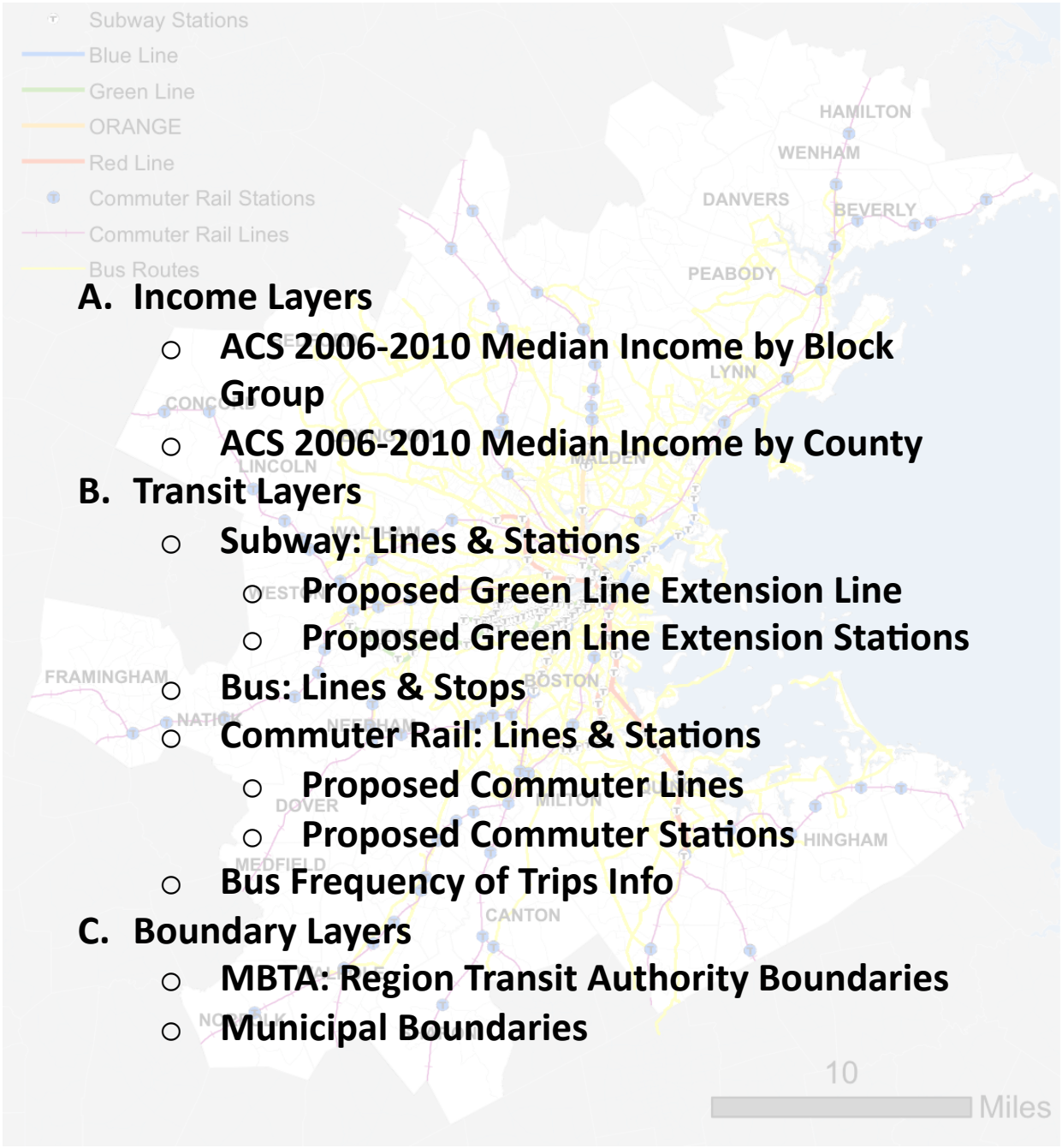
- •Private Buses
- •Ferries
- •Shuttles



Data:

Source:

- **US Census**
- **MassGIS**
- **MBTA**
- **MAPC**
- **MassDOT**



A. **Income Layers**
   - **ACS 2006-2010 Median Income by Block Group**
   - **ACS 2006-2010 Median Income by County**
B. **Transit Layers**
   - **Subway: Lines & Stations**
     - **Proposed Green Line Extension Line**
     - **Proposed Green Line Extension Stations**
   - **Bus: Lines & Stops**
   - **Commuter Rail: Lines & Stations**
     - **Proposed Commuter Lines**
     - **Proposed Commuter Stations**
   - **Bus Frequency of Trips Info**
C. **Boundary Layers**
   - **MBTA: Region Transit Authority Boundaries**
   - **Municipal Boundaries**

Methodology (in brief)

Low Income Block Groups

Step 1:
Collect income data and join to block group

Step 2:
Determine percent of block group median income by county median income.

Step 3:
Clip to RTA Boundary

Step 4:
Map Results

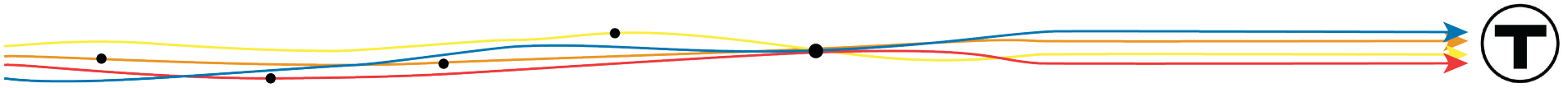
Transit Score

Step 1:
Collect and map:
- Subway: Stations & Lines
- Commuter Rail: Stations & Lines
- Bus Stops & Lines

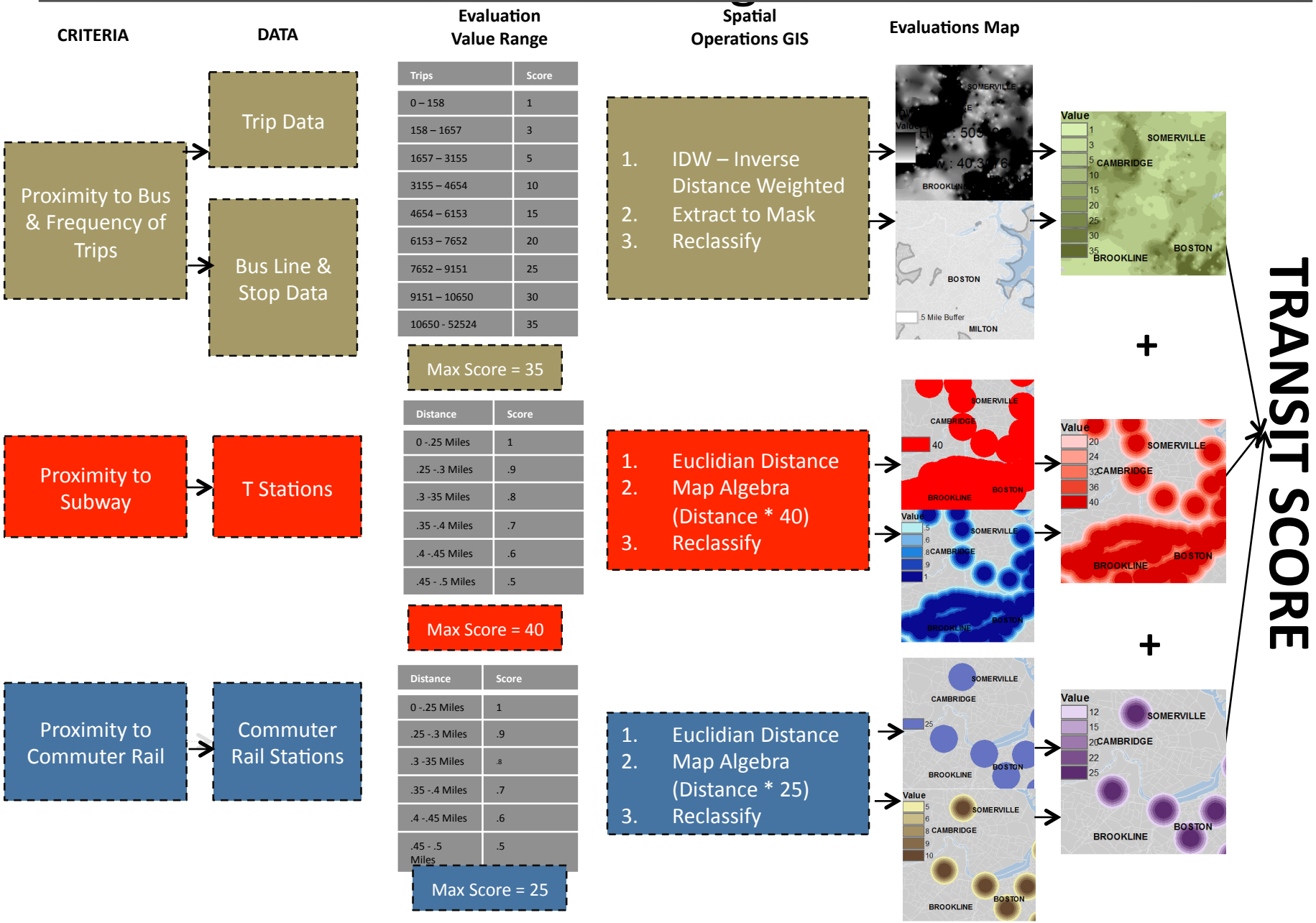
Step 2: Determine Range of Scores
- Scale of 0-100
- Subways: 40
- Buses: 35
- Commuter Rail: 25

Step 3: Determine Bus Trip Frequency
- Acquire trip data
- Input in Excel
- Join to bus stops

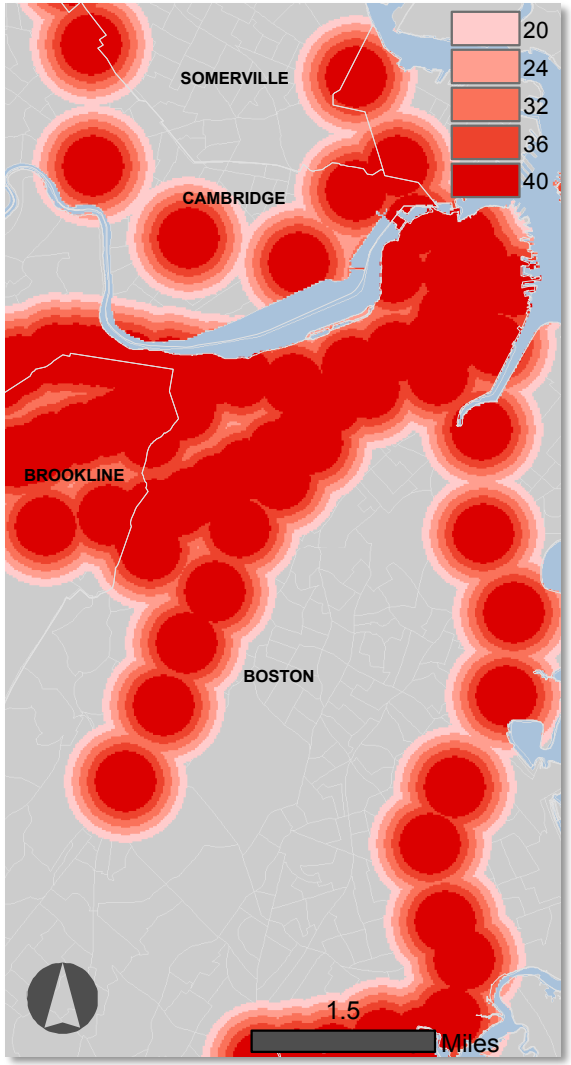
Step 4: Next Slide →



Transit Score: Workflow Diagram



Transit Score : Creation



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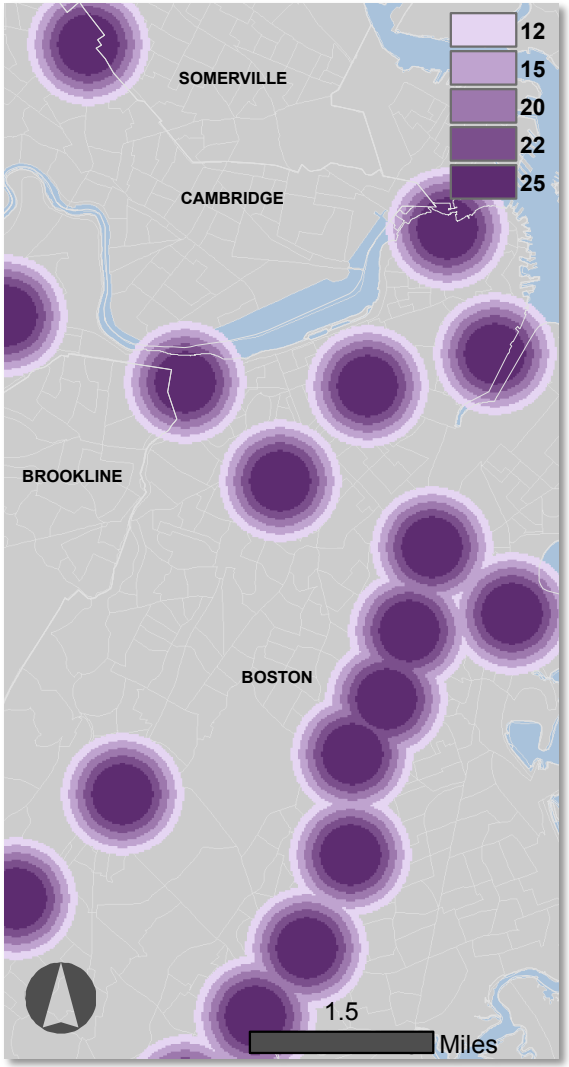

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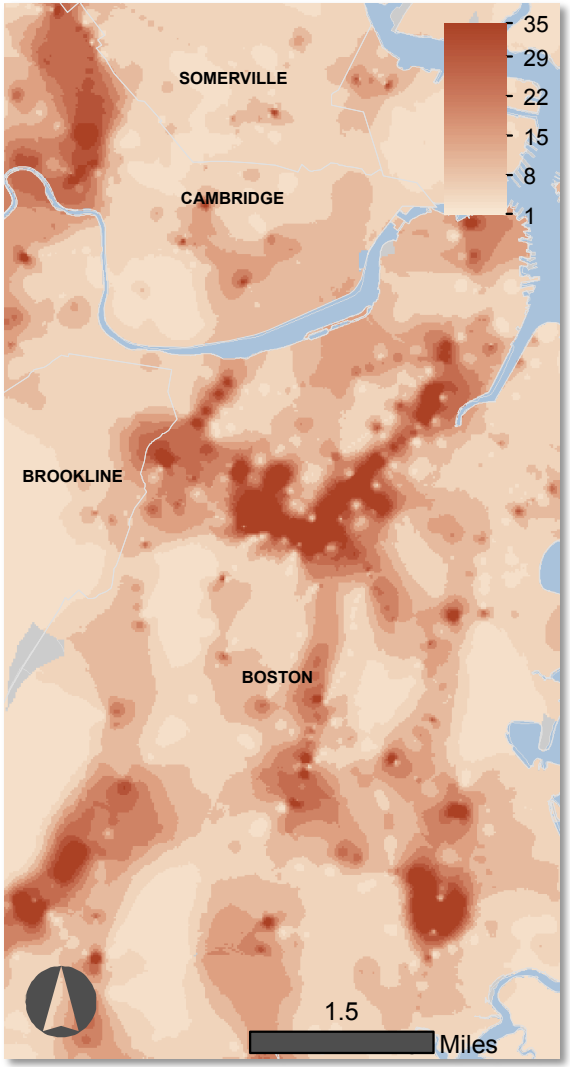
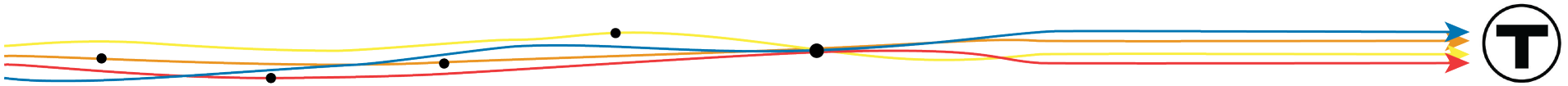


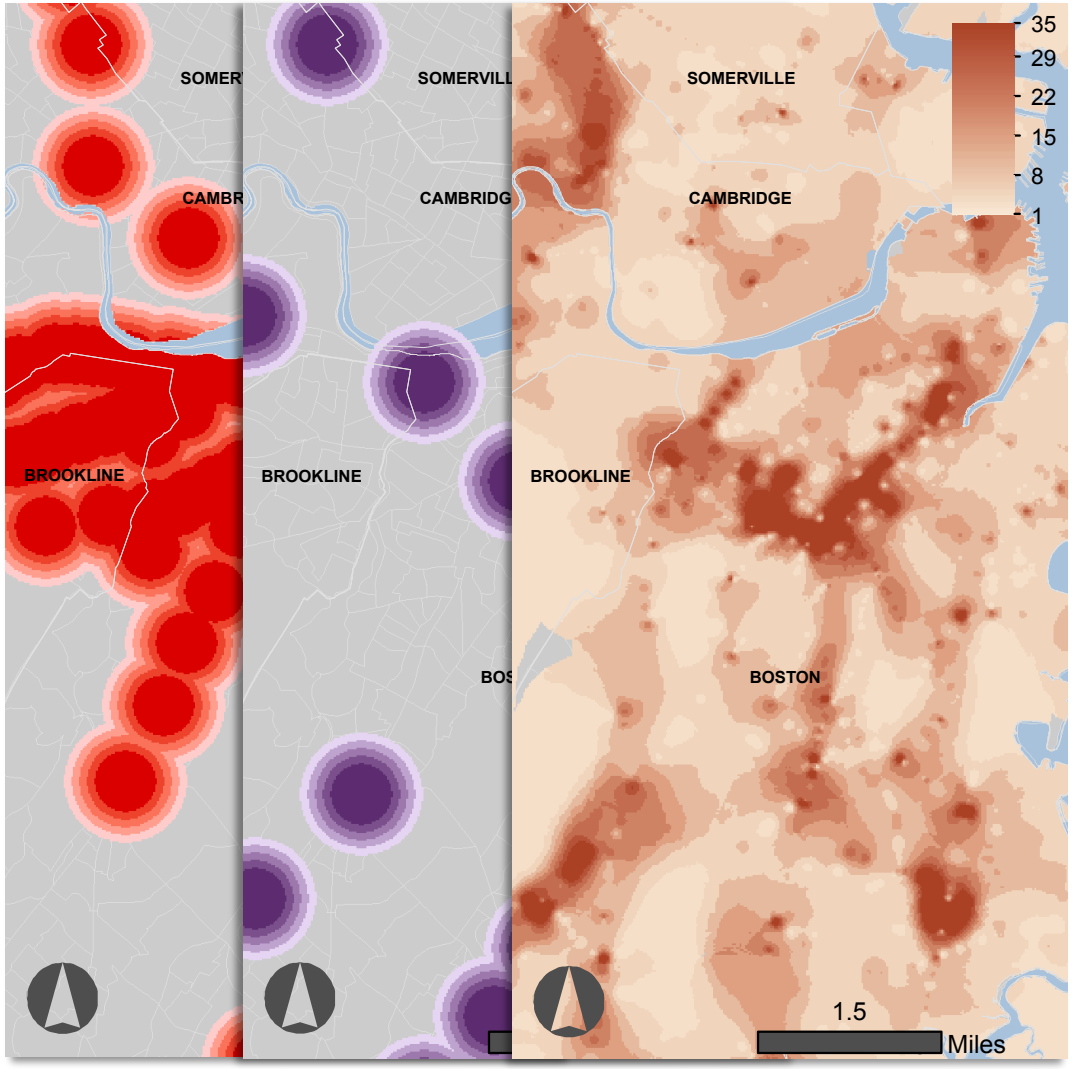
Subway Raster (40)

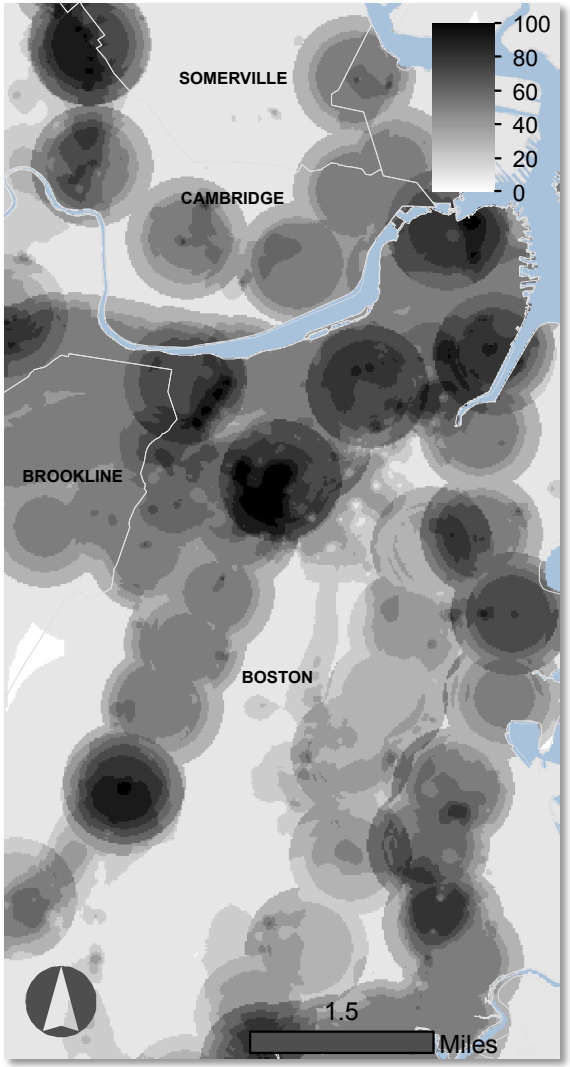
Commuter Rail Raster (25)

Bus Raster (35)



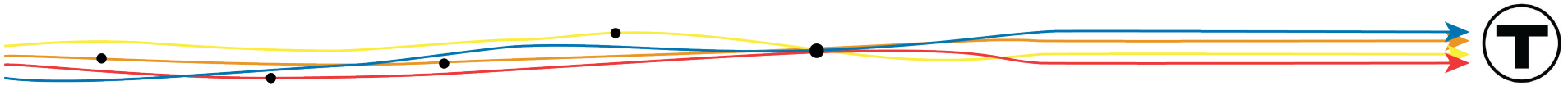
Transit Score : Creation





Subway Raster + Commuter Rail Raster + Bus Raster = Transit Score

Findings

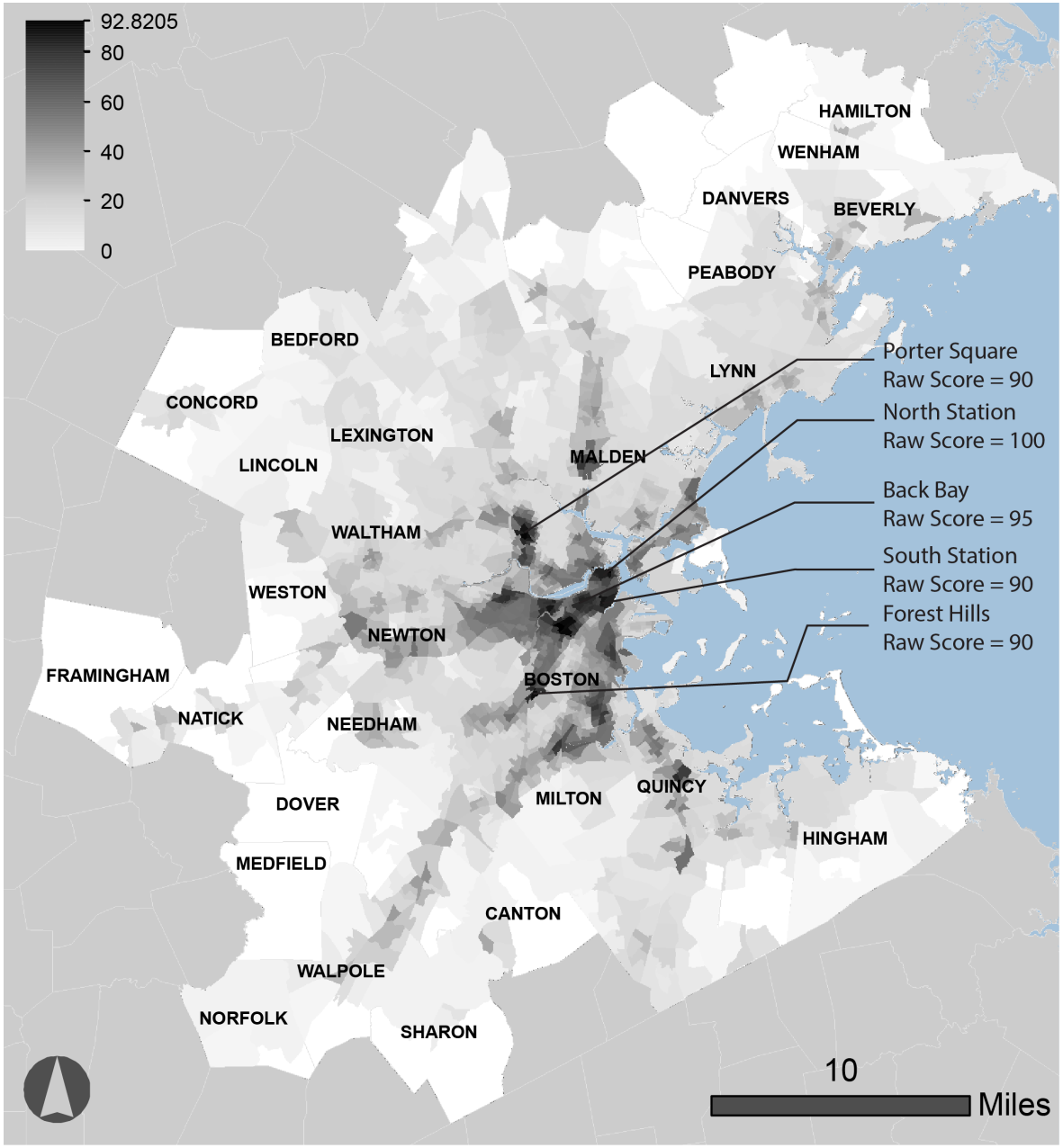


Transit Score : Mean by Block Group

Verifying Accuracy:

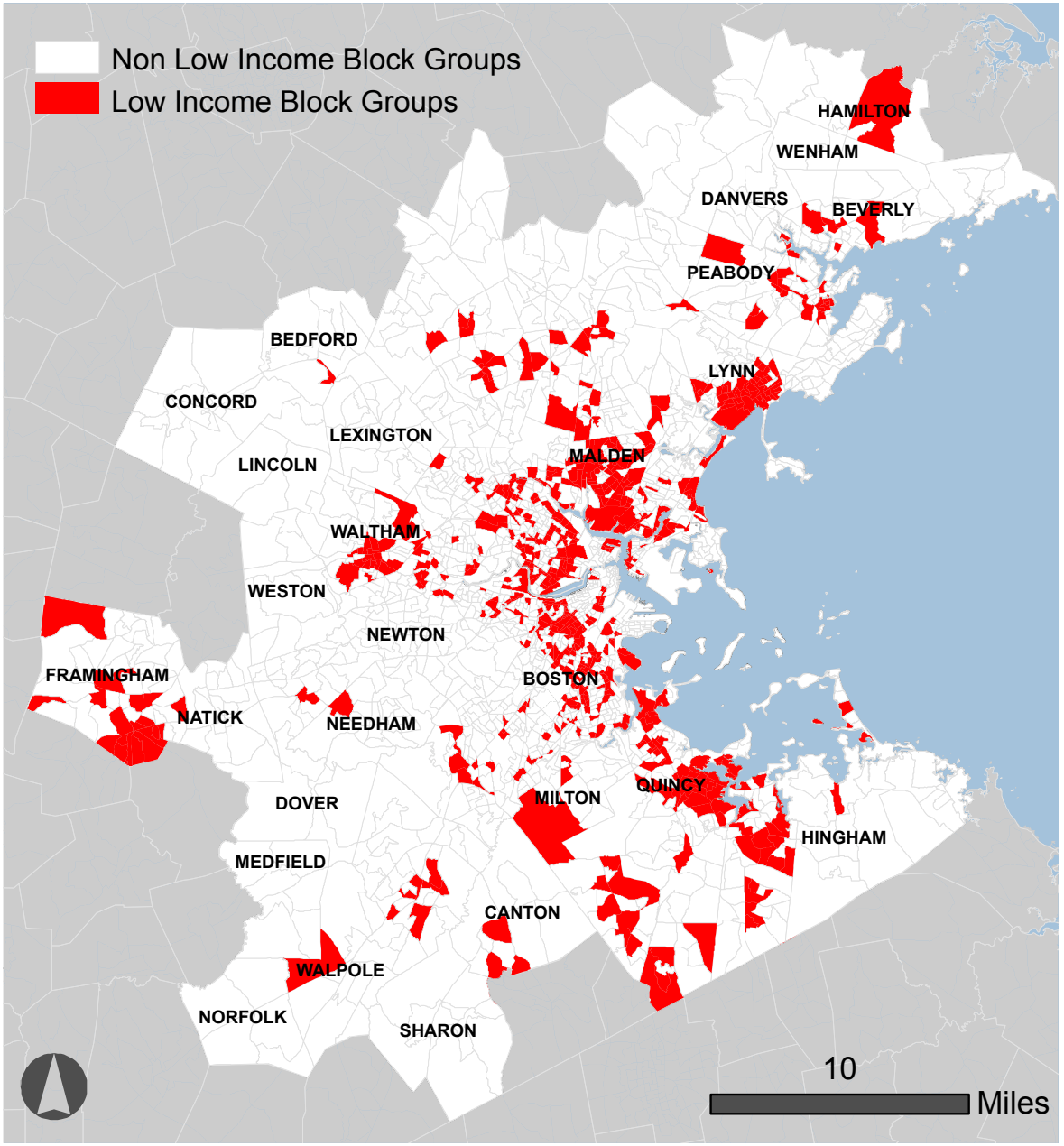
Highest Transit Scores:

- North Station
- South Station
- Forest Hill Station
- Back Bay/Copley
- Porter Square Station

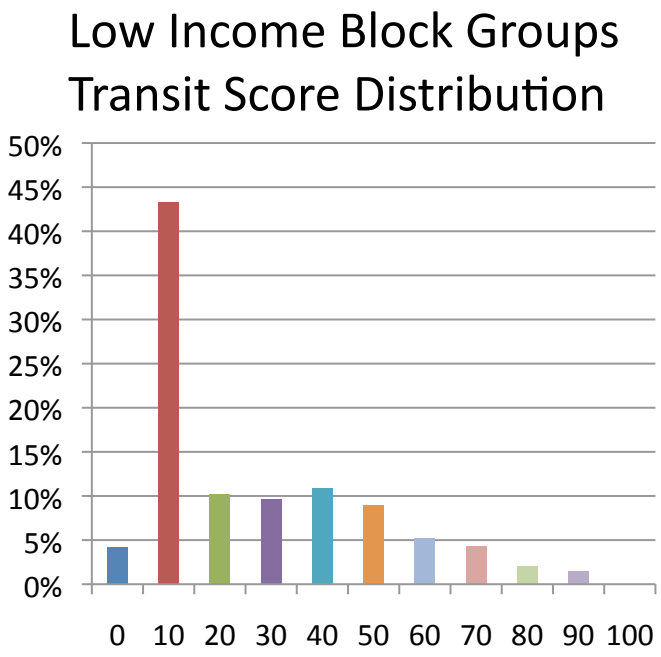


Findings: Low Income Block Groups

The population of low income block groups is equal to 26% of population of the study area.

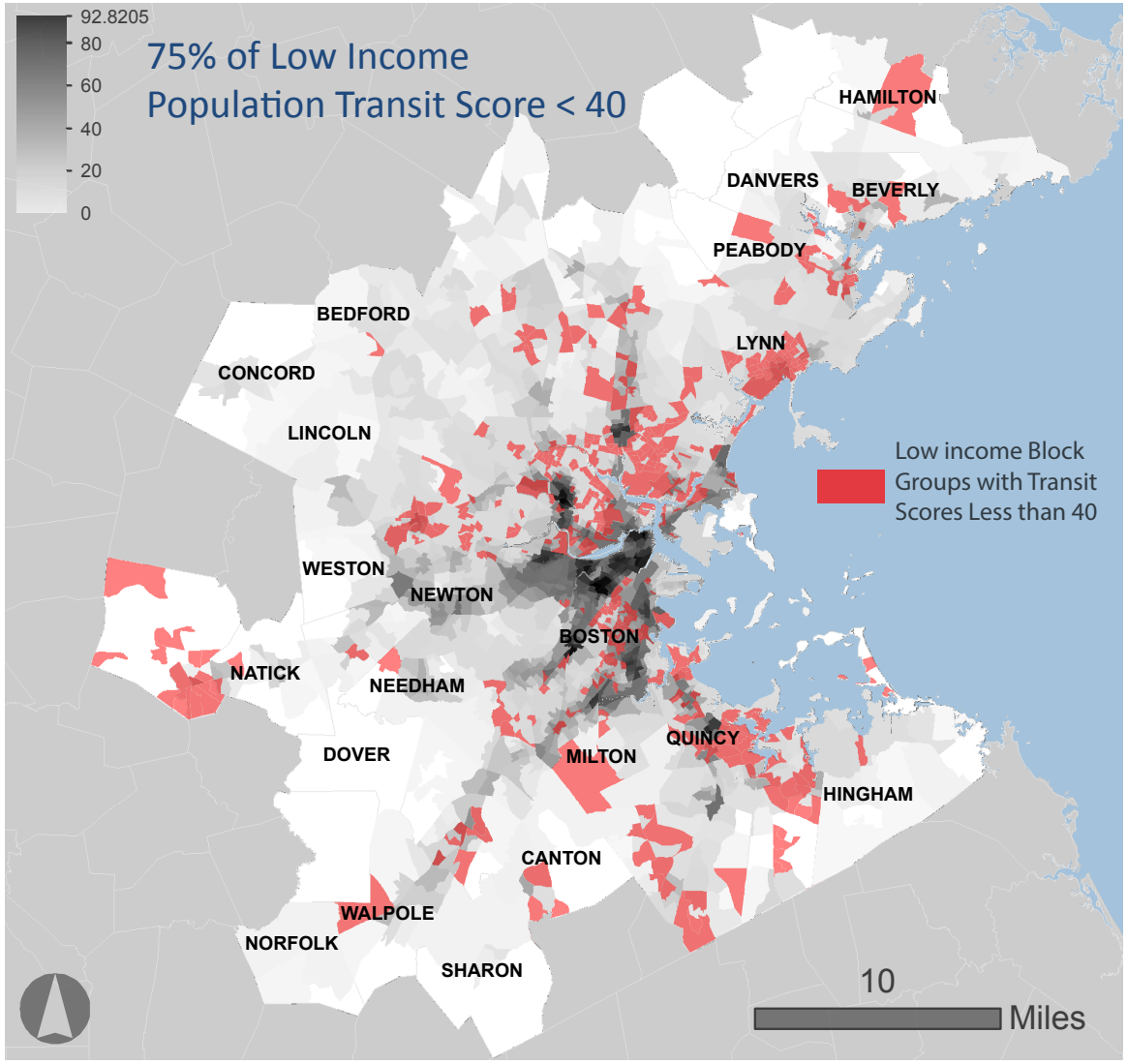


Low Income Block Groups Transit Score < 40



What constitutes low accessibility in this index?

TS < 40



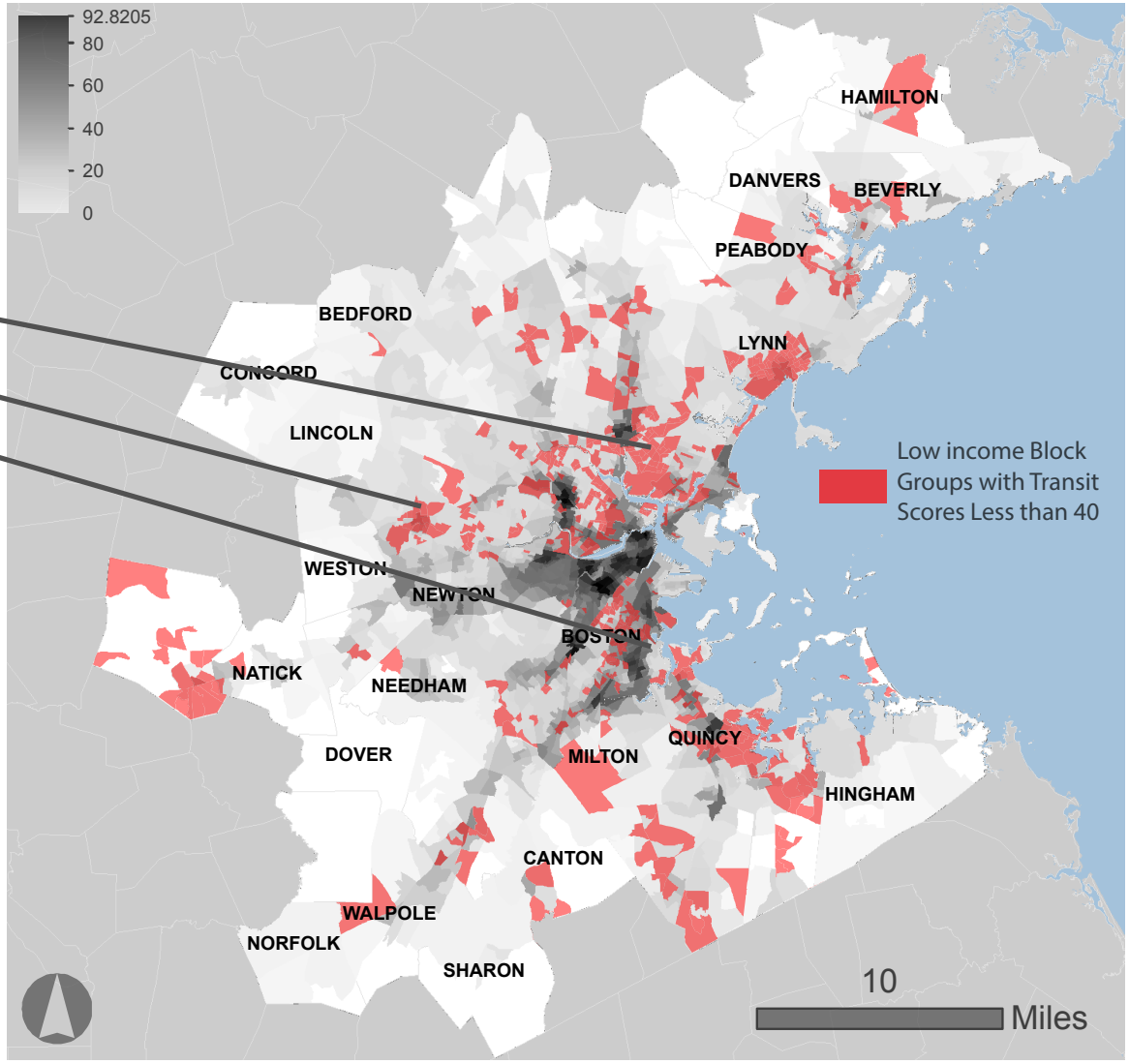
Low Income Block Groups Transit Score < 40

Selected Areas:

Somerville/Medford*

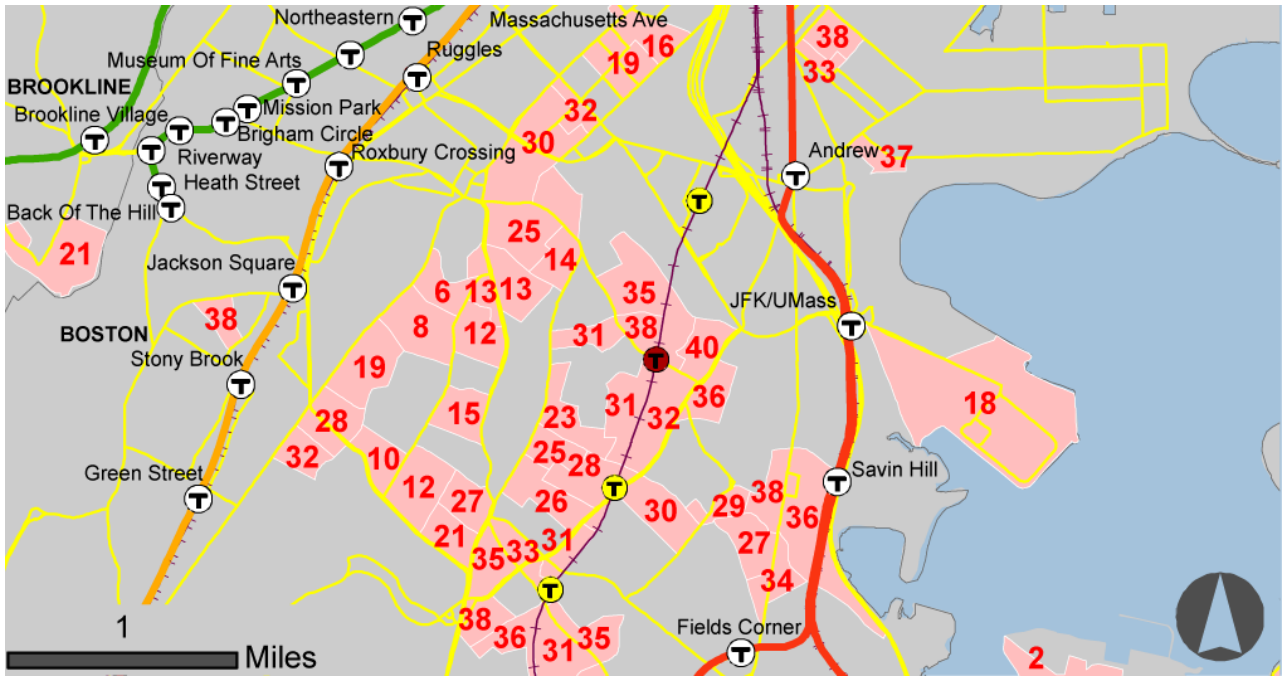
Waltham*

South End/Roxbury



* Waltham & Somerville/ Medford Maps Located in Appendix

Selected Area : South End/Roxbury



- **Silver Line does not offer comparable access**
- **Expanded commuter rail will increase access**
- **Consider free transfers from Commuter Rail to Subway/Bus for inner core residents.**
- **Support introduction of light rail into the area.**

Red Numbers Indicate Transit Score

- Subway Stations
- Commuter Rail Stations
- Blue Line
- Commuter Rail Lines
- Green Line
- Bus Routes
- Orange Line
- Proposed Commuter Line Stations
- Red Line
- Proposed Green Line Stations

Low Income/Transit Score Less than 40

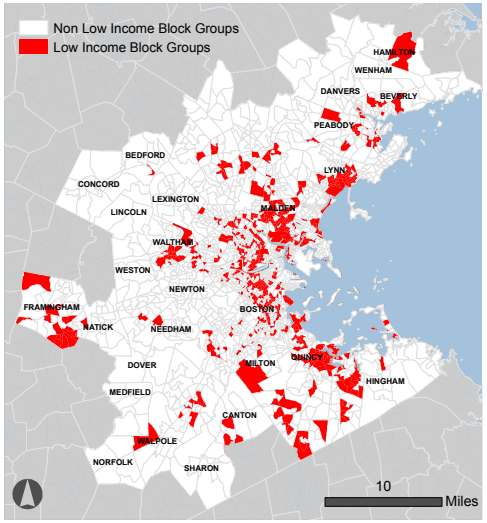
Conclusion

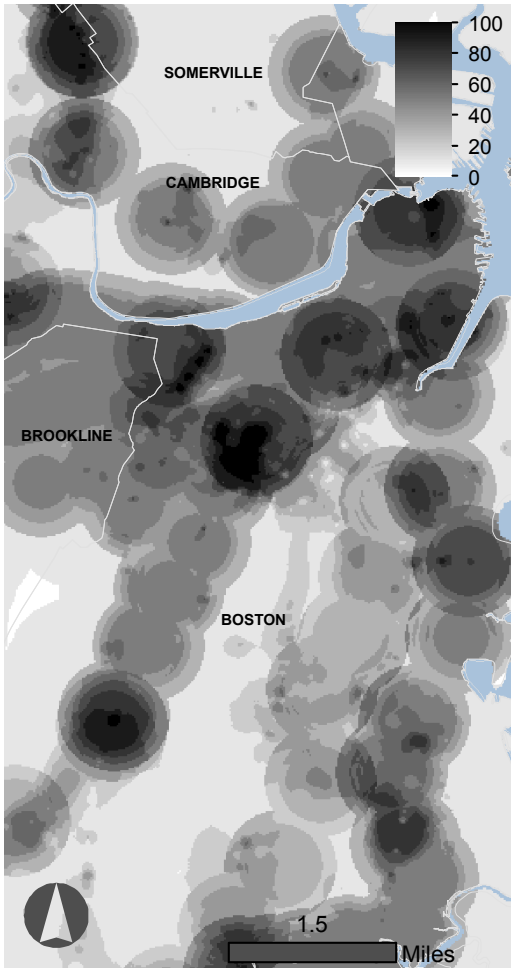
Transit Score Use for Policy/Operations:

1. Identify areas with limited transit access
2. Research implications of transit accessibility
   a) Demographics
   b) Mode Choice
   c) VMT
3. Prioritize areas in need of possible:
   a) Transit Expansion
   b) Service Alteration
   c) Service Integration

Uses Beyond Policy

- Citizen information tool

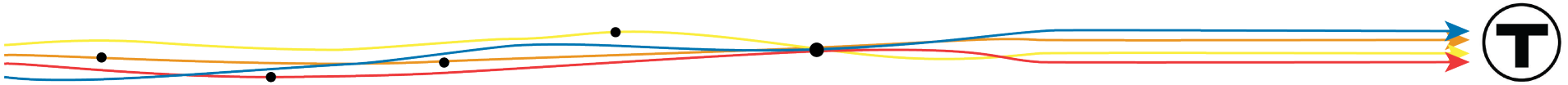




Further Research

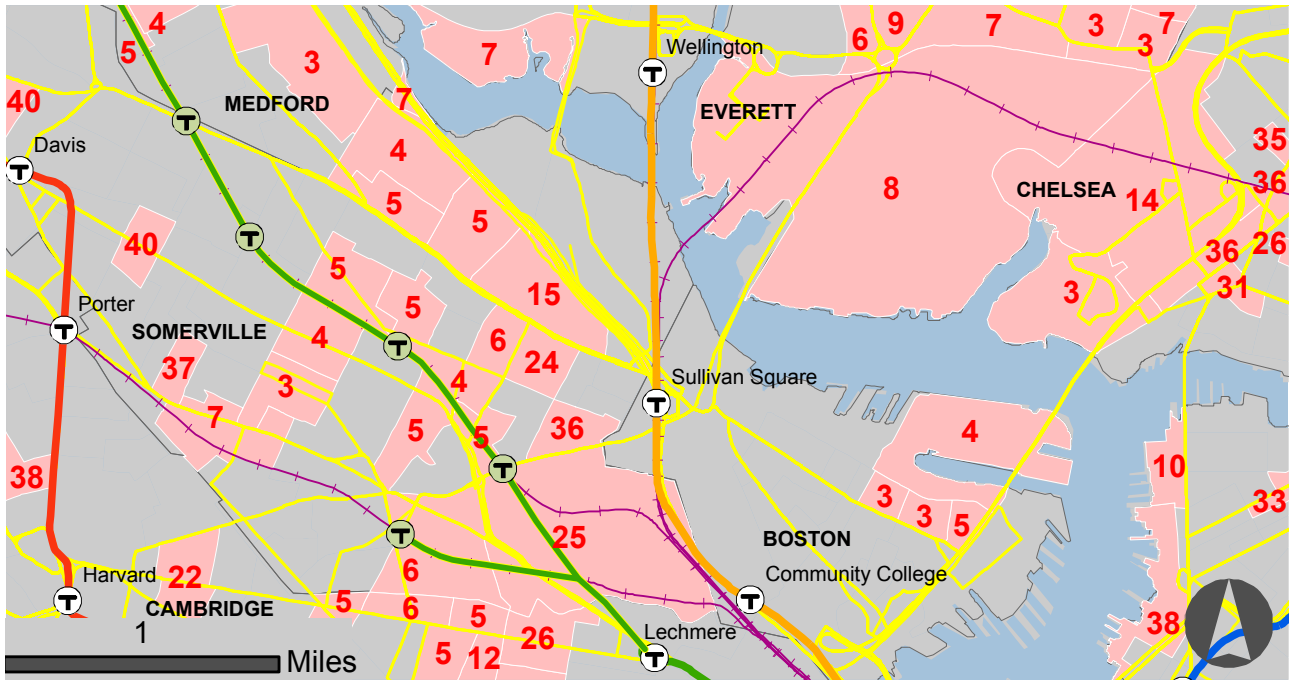
1. Frequency of All Modes
   - Subway
   - Commuter Rail
2. Relation to Vehicle Ownership Rates
3. Comparison to Other Measures Of Transit Accessibility
4. Travel Time
5. Destination Factors
6. Density
7. Interviews
   - Transit Experience
   - Perceived Accessibility

Thank You



Appendix

Selected Area : Somerville/Medford



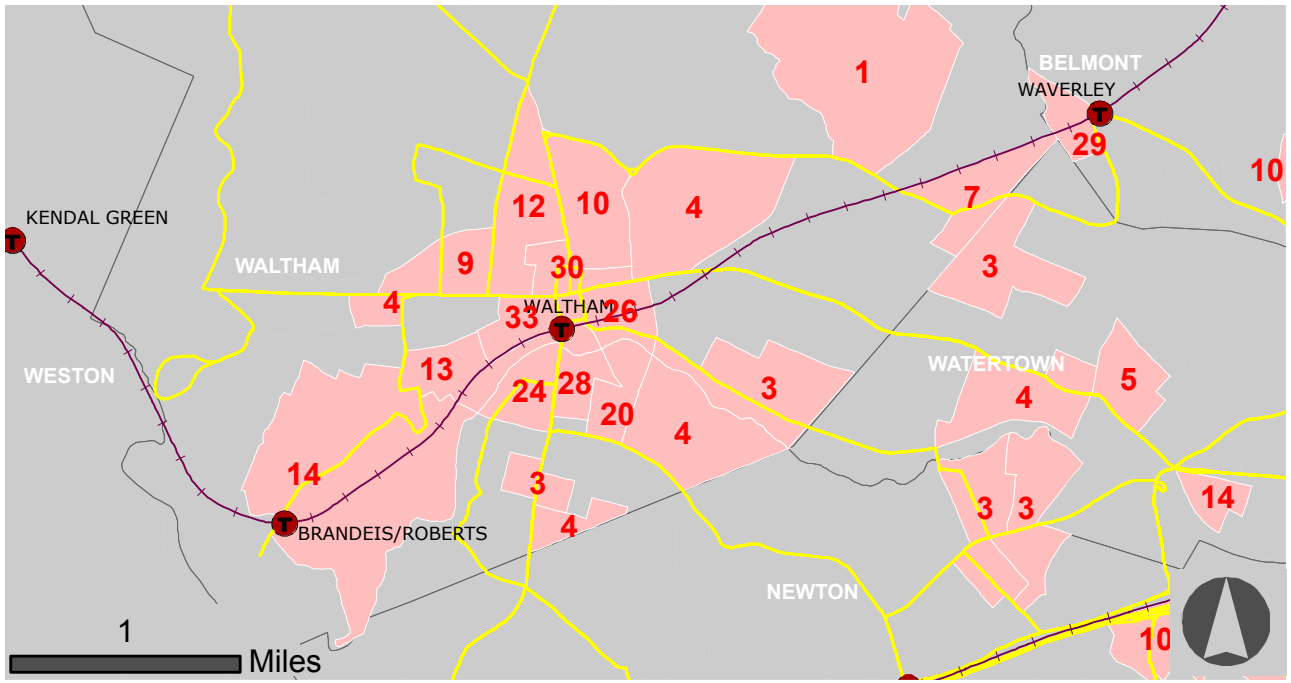
Red Numbers Indicate Transit Score

- Subway Stations
- Blue Line
- Green Line
- Orange Line
- Red Line
- Commuter Rail Stations
- Commuter Rail Lines
- Bus Routes
- Proposed Commuter Line Stations
- Proposed Green Line Stations

Low Income/Transit Score Less than 40

- **Green Line Extension will Increase Transit access in this area.**
- **Bus routes should be created/adjusted to maximize access to the new line**

Selected Area : Waltham



- **Subsidize commuter rail passes for low income suburban residents.**

- **Support policies that assist/sustain personal vehicle transport.**

Red Numbers Indicate Transit Score

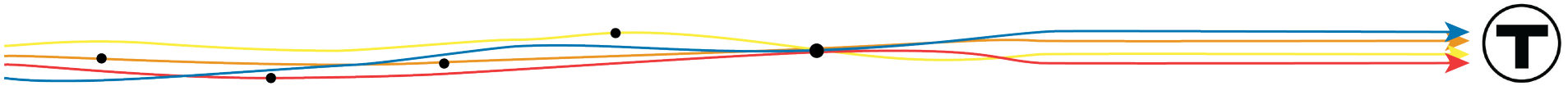
Subway Stations	Commuter Rail Stations
Blue Line	Commuter Rail Lines
Green Line	Bus Routes
Orange Line	Proposed Commuter Line Stations
Red Line	Proposed Green Line Stations

Low Income/Transit Score Less than 40

Methodology

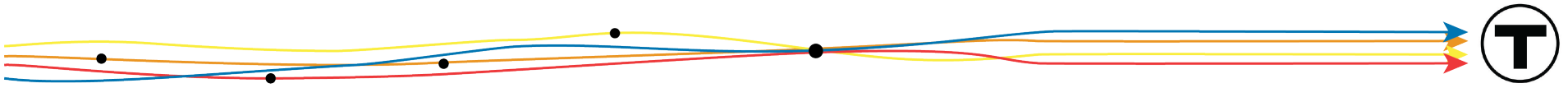
- 1. Determine Low Income Block Groups
  - Block Group Median Income
  - County Median Income
  - Determine Percentage of Block Group Median Income by County Median Income
  - Isolate Block Groups at or below 80% of Median Income
  - Clip to RTA Boundary

- 2. Subway & Commuter Rail Scores
  - Subway layers
    - Use Subway Stations for Euclidian distance analysis
    - Assign Stations Score
    - Map Algebra
    - Reclassify
  - Commuter Rail
    - Use Commuter Rail Stations for Euclidian distance analysis
    - Assign Stations Score
    - Map Algebra
    - Reclassify



Methodology

- 3. Bus Stops & Lines
  - Determine which Bus Lines operate at which stop
    - Spatial Join Bus Lines to Bus Stop Points (One to Many)
    - Dissolve Stops by route
  - Determine number of trips per stop
    - Using MBTA trip frequency document
    - Input into Excel
    - Clean Data
    - Import table into ArcMap
  - Determine Frequency of Trips
    - Join trip table to Bus Stops
    - Create Unique Identifier (X/Y)
    - Dissolve by unique identifier
    - Run IDW tool on points
    - Extract to Mask
- 4. Create Transit Score – See Work Flow Diagram



Methodology

- 5. Transit Score Operations
  - Determine Mean Transit Score by Block Group
    - Output Zonal statistics by table
    - Join to block groups
- 6. Isolate Low Income Block Groups with Low Transit Score
    - Select by Attribute Transit score < 40
    - Export Selected Items