Northeastern University
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Accessibility Ratings

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Introduction

- Importance of accessibility
- Defining accessibility
- Service area approach to studying accessibility to destinations (Michigan State University, Food Policy)
- Focus on municipalities & city government

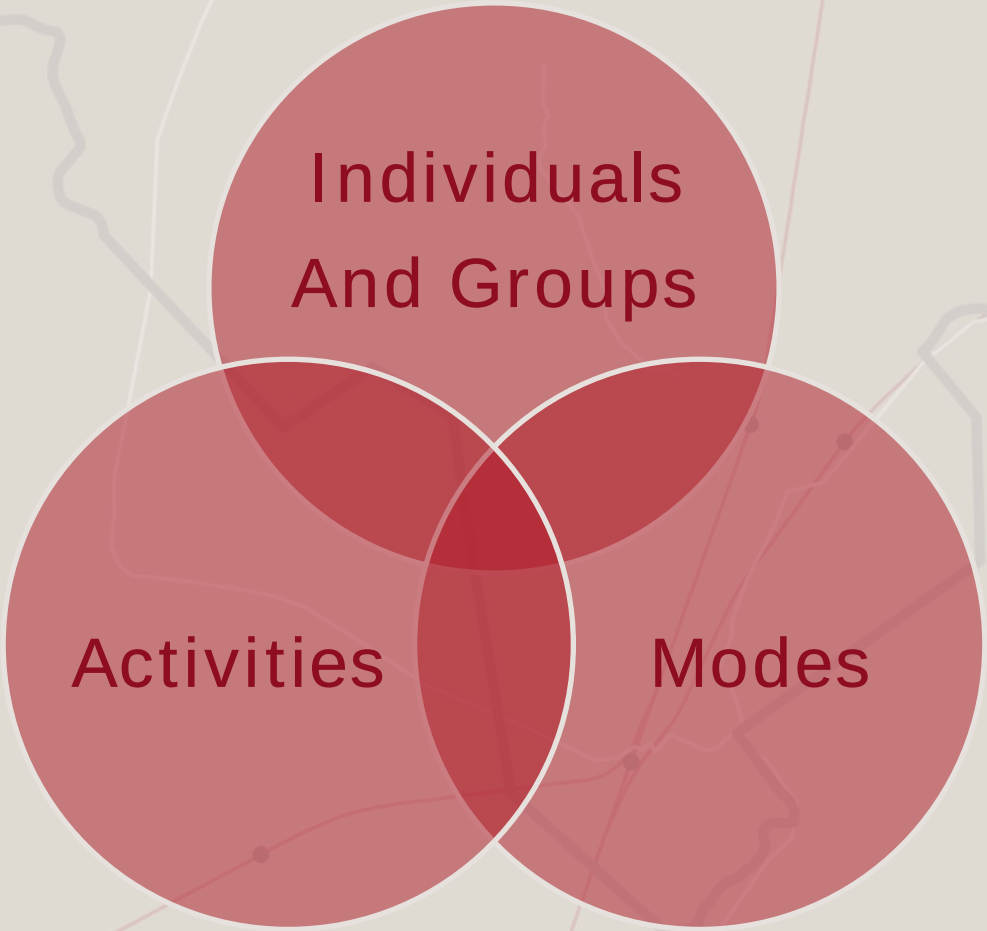
Why destination instead of origin?

- Market analysis approach to amenities, but adding a transportation spin
- Allows us to measure how many people have access to goods and services in each town, instead of how many goods and services people have access to.
- Can translate into municipalities altering land use adoption and regulatory control. For example, goods and services can easily be relocated or located to increase coverage and "market share", while residential land use can be increased around existing town centers, and other highly active regions to increase coverage and accessibility.

Objectives of this research

- Massachusetts based research, without LEHD data
- Opening up the spectrum of destinations beyond jobs
- Developing a performance metric for multiple modes of transportation, over a diverse geography
- Developing a performance metric for aggregating "accessibility" scores to rank cities and towns in Massachusetts.
- Approaching serious transportation questions with a severe limitation in data accessibility, without pushing (too many) assumptions

Aspects of Accessibility



Individuals and Groups

Population (2000): 6,349,097
Transit and CR Stops: 285
Colleges and Universities: 205
Hospitals & CHCs: 265

- Coverage measure – using a 250m^2 grid file, the proportion of total population in town covered in the accessibility buffer, calculated by mode for each unique activity.

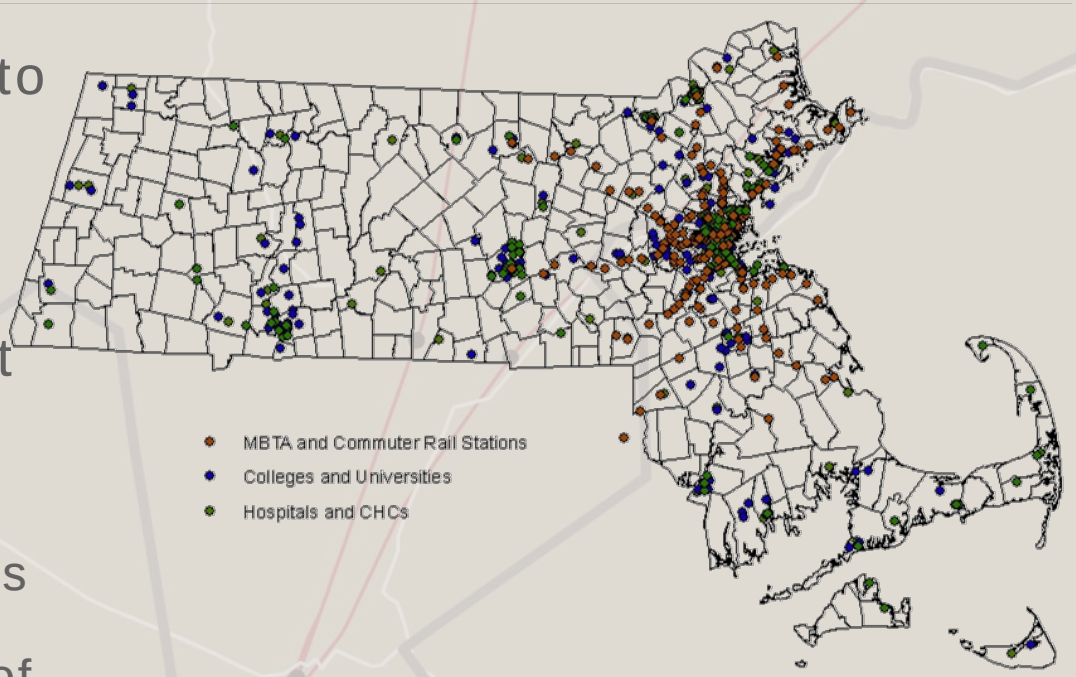
- Only the relevant population is considered in each step of the analysis
  - Hospitals: total population
  - Schools: population between 5 and 18
  - Higher Education Institutes: population over 18
  - Transit: total population

- Town boundaries – accessibility buffers cross over town boundaries, and accessibility of surrounding towns increases, even if the activity is not directly located within the boundary.

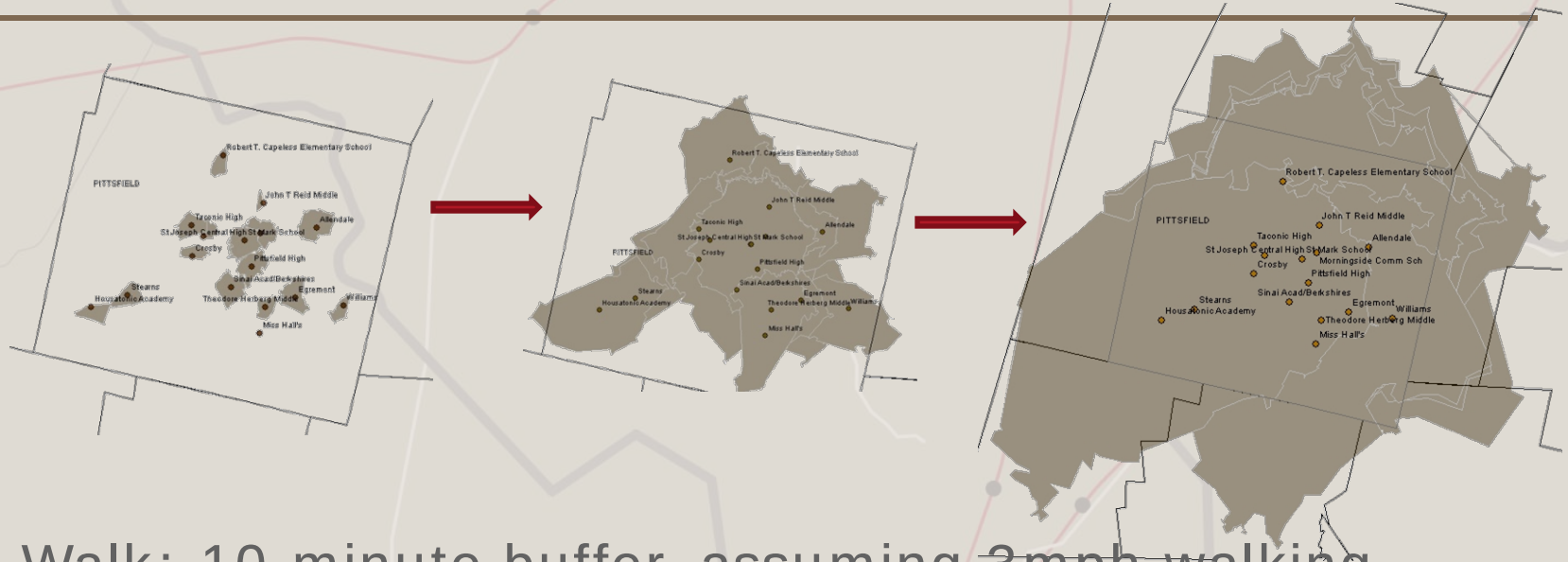
Activities

- Service Area Analysis – measuring accessibility based on location of destinations allows us to measure the access residents have to a particular activity.

- Attractiveness – weight amenities
  - Hospitals: number of choices
  - Schools: equal weights
  - Higher Education Institutions: number of choices
  - Commuter and Transit: frequency during the day



Modes: Travel Time and Speeds



- Walk: 10 minute buffer, assuming 3mph walking speed, avoiding highways
- Bike: 10 minute buffer, assuming 10mph biking speed, avoiding highways
- Drive: 10 minute buffer, incorporating various speed limits based on road classification

Weighted Cumulative Coverage

$$\mathcal{A}_{(D,M)} = \alpha_D \sum_{i=1}^{I} \beta_d * \frac{p}{P}$$

$\mathcal{A}_{(D,M)}$ Accessibility of a type of Destination (e.g. schools) in a given Municipality

β_d Binary threshold for accessibility (10 minute buffer)

α_D Attractiveness/quality of destination type in the town

$\frac{p}{P}$ Population within the accessible threshold compared to total population in the municipality

Summed over each instance (i) of a destination in the municipality, and calculated for each type of destination and each travel mode for each town

Overall Rank

$$\mathcal{R}_{(M)} = \sum_{D=1}^{n} \frac{\mathcal{A}_{(D,M)}}{\mathcal{A}_{(D)}}$$

$\mathcal{R}_{(M)}$ A municipality's general measure/rank of accessibility

$\frac{\mathcal{A}_{(D,M)}}{\mathcal{A}_{(D)}}$ A municipality's share of the total accessibility to destination type, summed over all destination types, calculated by travel mode

Each municipality ends up with three rankings:

- accessibility by walking
- accessibility by biking
- accessibility by driving

Results: Boston

	Driving	Walking	Biking
Hospitals	.96	.99	.99
Schools	.33	.59	.39
Higher Education Institutes	.83	.99	.93
Commuter and Transit Nodes	.67	.89	.79
Total	2.79	3.46	3.1

Results: Three Examples

	Boston			Weston			Pittsfield		
	Driving	Walking	Biking	Driving	Walking	Biking	Driving	Walking	Biking
Hospitals	.96	.99	.99	.02	0	0	.02	0	.01
Schools	.33	.59	.39	.33	.09	.25	.33	.32	.36
Higher Education Institutes	.83	.99	.93	.15	.01	.05	.02	0	.02
Commuter and Transit Nodes	.67	.89	.79	.33	.11	.21	0	0	0
Total	2.79	3.46	3.1	.83	.21	.51	.37	.32	.39

Results: Relative Rankings

	Boston			Weston			Pittsfield		
	Driving	Walking	Biking	Driving	Walking	Biking	Driving	Walking	Biking
Rank	2.79	3.46	3.1	.83	.21	.51	.37	.32	.39

Driving

Boston: 7.54

Weston: 2.24

Pittsfield: 1

Walking

Boston: 16.48

Pittsfield: 1.52

Weston: 1

Biking

Boston: 7.95

Weston: 1.31

Pittsfield: 1

Next Steps

- Expand approach to all of Massachusetts to establish a state average and compare all municipalities
- Account for an overlay of activities (where schools and hospitals are both accessible by the same population)
- Add transit as a mode in addition to destination
- Establish alternate/additional measure of attractiveness

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