Transit Impacts on Jobs, People and Real Estate

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University of Arizona
Rocky Mountain Land Use Institute
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Arthur C. Nelson  Kristina Currans  Robert Hibberd
## Research Results of More than 50 Transit Systems ...

<table>
<thead>
<tr>
<th>Light Rail Transit</th>
<th>Year</th>
<th>Bus Rapid Transit</th>
<th>Year</th>
<th>Street Car Transit</th>
<th>Year</th>
<th>Commuter Rail Transit</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norfolk</td>
<td>2011</td>
<td>Reno</td>
<td>2010</td>
<td>Tampa</td>
<td>2002</td>
<td>Portland</td>
<td>2009</td>
</tr>
<tr>
<td>Phoenix</td>
<td>2008</td>
<td>Salt Lake City</td>
<td>2008</td>
<td>Tucson</td>
<td>2014</td>
<td>Salt Lake City</td>
<td>2008</td>
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<tr>
<td>Pittsburgh</td>
<td>1984</td>
<td>San Antonio</td>
<td>2012</td>
<td>San Diego</td>
<td></td>
<td></td>
<td>1995</td>
</tr>
<tr>
<td>Portland</td>
<td>1986</td>
<td>San Diego</td>
<td>2014</td>
<td>San Jose-Bay Area</td>
<td>1988</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sacramento</td>
<td>1987</td>
<td>Seattle</td>
<td>2010</td>
<td>San Jose-Stockton</td>
<td>1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>1999</td>
<td>Stockton</td>
<td>2007</td>
<td>Seattle-Tacoma</td>
<td>2000</td>
<td></td>
<td></td>
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<tr>
<td>San Jose</td>
<td>1987</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Seattle</td>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Louis</td>
<td>1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
... in More than 30 Metropolitan Areas
Six Elements

• How transit should affect the location of jobs and people, and how real estate rents should respond → Chris Nelson

• Typology of different landscapes served by transit stations → Robert Hibberd

• How transit stations influence shifts in the regional share of jobs, people and housing → Robert Hibberd

• How transit station proximity influences household transportation budgets → Chris Nelson

• The effect of transit station proximity on real estate rents, and the extent to which outcomes are consistent with theory → Chris Nelson

• Implications for transit and land use planning.
How transit should affect the location of jobs and people, and how real estate rents should respond

Unless transit stations serve other purposes, their effectiveness can be measured by:

• Numbers of kinds of jobs attracted to them;
• Number of and kinds of people and households attracted to them but our research will explode a few myths; and
• How real estate rents perform with respect to transit station distance.

Research leads to insights based on theoretical expectations with implications for transit and land use planning.
Place Typologies
Developing TOD Place Typologies

• Review of white and academic literatures
• Framed Around: Bertolini’s (1999) node-place model
  • **Transit** or Node: transportation, transit quality (FRT systems)
  • **Oriented**: distance in between, scale
  • **Development** or Place: built environment measures

Guiding Principles

1. Typologies must **capture existing variation in the built environments** using similar dimensions of development, as studied in academia and applied in practice.
   • Identify common measures and proxies of the built environment

2. Categories must be **mutually exclusive and collectively exhaustive** so that potential systems outside of our study might be able to classify their contexts within our framework.
   • Consider the practical application of comparing real world contexts with results

3. Typologies must **enable comparison of similar built environment patterns** across metropolitan areas.
   • Explore the role of place type in market response across regions
## Methods Considered & Evaluated

<table>
<thead>
<tr>
<th>Method</th>
<th>Complexity</th>
<th>Support Known Measures of Place</th>
<th>Easy to Classify in Practice</th>
<th>Compare Environments Across Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Classification</td>
<td>Not Possibly on National Scale</td>
<td>Yes</td>
<td>Yes/ Difficult for larger areas</td>
<td>Possible</td>
</tr>
<tr>
<td>Thresholds/ Qualifying Criteria</td>
<td>Low</td>
<td>Limited</td>
<td>Yes</td>
<td>Limited</td>
</tr>
<tr>
<td>Scaling and Weighting*</td>
<td>Moderate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Factor and/or Cluster Analysis</td>
<td>Moderate/ Difficult</td>
<td>Yes</td>
<td>Difficult</td>
<td>Possible/ Challenging</td>
</tr>
</tbody>
</table>

* Based on an approach by Gehrke & Clifton (2016) conducted in California

### Built Environment Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Calculated from Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs per acre</td>
<td>Longitudinal Employer-Household Dynamics</td>
</tr>
<tr>
<td>Proportion of jobs that are retail and entertainment</td>
<td>Longitudinal Employer-Household Dynamics</td>
</tr>
<tr>
<td>Total population per acre</td>
<td>American Community Survey</td>
</tr>
<tr>
<td>Total households per acre</td>
<td>American Community Survey</td>
</tr>
<tr>
<td>Percent of households with no kids</td>
<td>American Community Survey</td>
</tr>
<tr>
<td>Percent of owner occupied housing</td>
<td>American Community Survey</td>
</tr>
<tr>
<td>Intersections per square mile</td>
<td>Smart Location Database, 2014, Variable: D3b</td>
</tr>
<tr>
<td>Proportion of intersections with four approaching streets</td>
<td>Smart Location Database, 2014, Variable: D3bmm4, and D3bmm3</td>
</tr>
</tbody>
</table>

**Notes:**
All data are measured at the block-group level.
# Place Types – High/Mod/Low/Poor Mix/Accessible Areas

<table>
<thead>
<tr>
<th>Mix/Accessible: Label: Jenks/Scaling Scores: Place Types</th>
<th>Poor (Poor MA)</th>
<th>Low (Low MA)</th>
<th>Moderate (Mod MA)</th>
<th>High (High MA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs per acre</td>
<td>0.42</td>
<td>1.38</td>
<td>3.26</td>
<td>8.11</td>
</tr>
<tr>
<td>Proportion of jobs that are retail and arts</td>
<td>0.06</td>
<td>0.17</td>
<td>0.25</td>
<td>0.27</td>
</tr>
<tr>
<td>Total population per acre</td>
<td>4.45</td>
<td>10.97</td>
<td>28.33</td>
<td>72.85</td>
</tr>
<tr>
<td>Total households per acre</td>
<td>1.71</td>
<td>4.19</td>
<td>11.04</td>
<td>26.96</td>
</tr>
<tr>
<td>Percent of households with no kids</td>
<td>0.71</td>
<td>0.66</td>
<td>0.63</td>
<td>0.51</td>
</tr>
<tr>
<td>Percent of owner occupied housing</td>
<td>0.83</td>
<td>0.63</td>
<td>0.40</td>
<td>0.22</td>
</tr>
<tr>
<td>Intersections per square mile</td>
<td>45.78</td>
<td>78.98</td>
<td>112.58</td>
<td>149.81</td>
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<tr>
<td>Proportion of intersections with 3 to 4 vertices</td>
<td>0.10</td>
<td>0.26</td>
<td>0.45</td>
<td>0.70</td>
</tr>
</tbody>
</table>
Jobs and People
Shift in Share of Jobs – Economic & Wage Groups

Question:

Is there a link between transit station proximity and change in workers by economic sector and wage groups across a hierarchy of station area land use mix and accessibility types from 2010 to 2016?
Shift in Share of Jobs – Economic & Wage Groups

BRT Low MA Economic Change 2010-2016

LQ Trend 2010-2016 (LQ 2016 / LQ 2010)

<table>
<thead>
<tr>
<th>Income Groups</th>
<th>0.125</th>
<th>0.25</th>
<th>0.375</th>
<th>0.50</th>
<th>0.625</th>
<th>0.75</th>
<th>0.875</th>
<th>1.00</th>
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<tbody>
<tr>
<td>Upper Income Jobs</td>
<td>1.85</td>
<td>1.01</td>
<td>0.61</td>
<td>1.36</td>
<td>0.57</td>
<td>0.74</td>
<td>0.88</td>
<td>1.92</td>
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<tr>
<td>Middle Income Jobs</td>
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<td>1.11</td>
<td>1.04</td>
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<td>1.34</td>
<td>1.70</td>
<td>0.95</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Bus Rapid Transit - Low MA
Shift in Share of Jobs – Economic & Wage Groups

**CRT Poor MA Economic Change 2010-2016**

- **Percent Change**
  - Arts-Ent-Rec
  - Health
  - Education
  - Office
  - Knowledge
  - Retail-Lodg-Food
  - Light Industry
  - Manufacturing
  - Lower Inc Jobs
  - Middle Inc Jobs
  - Upper Inc Jobs

**LQ Trend 2010-2016 (LQ 2016 / LQ 2010)**

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<td>1.23</td>
<td>0.93</td>
<td>1.26</td>
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<tr>
<td>Lower Income Jobs</td>
<td>0.94</td>
<td>1.12</td>
<td>1.02</td>
<td>0.69</td>
<td>0.85</td>
<td>0.74</td>
<td>0.82</td>
<td>0.79</td>
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</tbody>
</table>

**Commuter Rail Transit - Poor MA**

17
Shift in Share of Jobs – Economic & Wage Groups

LRT Mod MA Economic Change 2010-2016

<table>
<thead>
<tr>
<th>Economic Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts-Ent-Rec</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td></td>
</tr>
<tr>
<td>Education</td>
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<tr>
<td>Office</td>
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</tr>
<tr>
<td>Knowledge</td>
<td></td>
</tr>
<tr>
<td>Retail-Lodg-Food</td>
<td></td>
</tr>
<tr>
<td>Light Industry</td>
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</tr>
<tr>
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</tr>
</tbody>
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Light Rail Transit - Mod MA
Shift in Share of Jobs – Economic & Wage Groups

SCT High MA Economic Change 2010-2016

-400% -300% -200% -100% 0% 100% 200% 300% 400% 500%

Percent Change

Arts-Ent-Rec
Health
Education
Office
Knowledge
Retail-Lodg-Food
Light Industry
Manufacturing
Lower Inc Jobs
Middle Inc Jobs
Upper Inc Jobs

LQ Trend 2010-2016 (LQ 2016 / LQ 2010)

<table>
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<td>1.08</td>
<td>1.33</td>
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</tr>
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</table>
Shift in Share of People by Demographics

Research Question:

- Relative to the counties within which transit systems operate ("transit counties"), are there shifts in the regional share of people over time with respect to FRT station proximity, particularly with respect to change in people by demographics.
Shift in Share by Households

Research Question:

• Relative to the counties within which transit systems operate ("transit counties"), are there shifts in the regional share of housing over time with respect to FRT station proximity, particularly with respect to change in households.
Shift in Share by Households - BRT

**Poor MA** Total HH loss of 9,000.
- HH with Kids -82% at the half-mile DB but gained at the station.
- HH age 25 to 44: -63% cum. @ 0.5-mile DB.

**High MA** gained 13,000 households.
- HH with Kids gained 5,450 households, 6.8% of the regional growth, which was 40.6% of half-mile DB growth.
Low MA added nearly 8,000 households.
- HH with Kids grew at the half-mile radius.
- They gained 4,000 householders under 25.
- One-person HH and HH age 65 or above gained to half-mile DB.

High MA Modest gain in some HH types.
- HH age 25-44 gained at the highest rate.
Shift in Share by Households - LRT

**Poor MA** - HH age 65 or above gained 3.8%.

**Low MA** - HH age 65 and over gained at 17%, growing at 43% that of total HH.

**Mod MA** place types gained total households at 5% rate, capturing 41,400 of the region’s 841,000-strong household increase.
Mod MA gained 2.2% rate growth for the total population.
  • Two-plus adult HH with no children captured 5% of the regional share in growth while growing at a rate of 77%.

High MA grew 11,000 households, 5% of 225,000 at the regional level.
  • Householders 25 to 44 declined significantly at the cumulative half-mile DB. all other household types gained 3 to 6% of regional share.
Household Budgets & Real Estate Markets
How transit station proximity influences household transportation budgets

Research Question

Do transportation costs as a share of median household decline generally and over time with respect to light rail transit station proximity controlling for other factors?
Implications for Transit and Land Use Planning

• All HH types realize transportation cost savings with respect to LRT station proximity.

• As will be seen next, transportation cost savings can be capitalized into higher rents with respect to transit station proximity.

• Lower/middle income HHs can be squeezed out of locations near transit stations.

• One solution is to increase the supply of housing for all HH types near transit stations.
The effect of transit station proximity on real estate rents

Research Questions

Is there an association between commercial real estate rent (per square foot) and proximity to rail transit stations holding other factors including place typology constant?

If there is an association, is there evidence of negative externality or amenity effects with respect to transit station proximity?
The effect of transit station proximity on real estate rents—Theory

*Downward* Sloping Rent with respect to transit station proximity

This is **GOOD** because the market values station proximity as an **amenity**.
The effect of transit station proximity on real estate rents—*Theory*

*Upward* Sloping Rent with respect to transit station proximity

This is **BAD** because the market values station proximity as an **externality**.
The effect of transit station proximity on real estate rents—Theory

*Ambiguous (no)* Sloping Rent with respect to transit station proximity

This is also **BAD** because the market does not value station proximity.
The effect of transit station proximity on real estate rents—*Theory*

*Convex* Sloping Rent with respect to transit station proximity

This is **GOOD** because the market values station proximity close to stations as an **amenity** before station externality effects are revealed.
The effect of transit station proximity on real estate rents—Theory

*Concave* Sloping Rent with respect to transit station proximity

This is **BAD** because the market values station proximity close to stations as an *externality* before station amenity effects are revealed.
The effect of transit station proximity on real estate rents—Results for LRT
The effect of transit station proximity on real estate rents—*Results for SCT*

![Graph showing percent rent change from mean by SCT station distance band for Office, Multifamily, and Retail properties.]

- **Roughly Downward**: GOOD
- **Downward**: GOOD
- **Upward Nearby**: BAD
The effect of transit station proximity on real estate rents—Results for BRT

![Graph showing percent rent change from mean for different BRT station distance bands. The graph indicates that convex curves are associated with a good impact, while concave curves are associated with a bad impact. Mostly ambiguous results are observed at BRT stops.](image-url)
The effect of transit station proximity on real estate rents—Results for CRT

- Downward $\rightarrow$ GOOD
- Downward then Roughly Upward $\rightarrow$ MIXED
- Convex $\rightarrow$ BAD
- Ambiguous Close then Convex $\rightarrow$ BAD
The effect of transit station proximity on real estate rents

Implications for Transit and Land Use Planning

The real estate market is a good indicator of measuring the extent to which transit station planning, location, design and other factors will be effective in influencing land use patterns in desirable ways.

Future station planning can use our results to improve outcomes. Existing station performance may be informed by our analysis of real estate rent outcomes.
Overall Implications for Transit and Land Use Planning

**Place** matters →

Land use mix and mobility richness **improves transit outcomes** with respect to attracting jobs and people, and elevating real estate value.
Overall Implications for Transit and Land Use Planning

**Economic Group Matters** →

Change in jobs by economic groups varies by:

- Place Typology
- Transit System Type

Research provides insights into knowing which economic groups to target for station areas
Overall Implications for Transit and Land Use Planning

**Demographics** matters →

Usual suspect HHs attracted to station areas

- Singles and HHs without children

**Overlooked** opportunity to meet the demand for HHs with children

- Some metros attract more HHs w/children than other types

**Rethink** demographic assumptions because many are wrong

Considerable variation by Place Typology and system.
Overall Implications for Transit and Land Use Planning

**Real Estate Rent** matters →

Evaluating the **relationship between** real estate rents and key factors especially Place Typology and transit station distance can tell us:

How different kinds of real estate are **attracted to or repelled** by transit systems;

The extent to which stations are **amenities** that attract jobs and people; and

The extent to which station-based **externalities** repel markets and by implication jobs and people.
Final Report Available in April at

https://nitc.trec.pdx.edu/research/project/1253
Questions/Comments/Insights?

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