Towards land-use supported Frequent Transit Services
The case study of Vancouver, British Columbia
Presentation Outline

- Context
- Research Framework
- Analysis
- Results
- Conclusions
- Policy Implications
Context

• Transport 2040
  – The long-term strategy for the regional transportation system

• Key goal:
  – The majority of jobs & housing in the region are located along the Frequent Transit Network
TransLink’s Frequent Transit Network (FTN)

- Service at least every 15 minutes, daytime & evening, all week
- Established in 2007
- An organizing framework for coordinating land use & transport in the region
- Central to creating more transit-oriented communities
Initiatives to Support FTN

- Develop guidelines for Transit-Oriented Communities
- Update of Transit Service Guidelines

Desire to incorporate more guidance on land use that is supportive of FTN service
Research Framework: Purpose & Limitations

Purpose

• Understand the relationships between key land use variables and transit ridership for FTN corridors
• Inform the development of transit-supportive land use guidelines related to FTN

Limitations

• Influence of transfers in ridership data
• Complexity of urban systems
Research Framework: FTN Typology

- Focused on frequent bus corridors (not routes)

### Focus of Study

<table>
<thead>
<tr>
<th>Transit Service Type</th>
<th>10 min or better corridors</th>
<th>15 min or better corridors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent Local Stop</td>
<td>#3 Main St</td>
<td>#319 Scott Rd</td>
</tr>
<tr>
<td>Frequent Limited Stop</td>
<td>#99 B-Line</td>
<td>#97 B-Line</td>
</tr>
<tr>
<td>Frequent Limited Stop w/Exclusive ROW</td>
<td>Expo Line Millennium Line</td>
<td>Canada Line branches</td>
</tr>
</tbody>
</table>
Analysis: Hypotheses

Within 400-metre walking distance to/from FTN bus stops:

- FTN concentrates more businesses & employment than the rest of the transit network.
- Higher population, occupations and retail floorspace correspond to higher transit ridership.
- There are identifiable thresholds for the previous that correspond to FTN levels of service.
Analysis: Methodology

- Process and align data using GIS
- Analysis using Statistics:
  - Descriptive Analysis
  - Test of Distribution
  - Paired Samples Test
  - Correlations (Pearson’s Product)
  - Histograms & Scattergrams
- Evidence relationships mathematically and graphically
- Provide more insight with data overlay
Analysis: Preliminary

- Comparison of Businesses and Employment in/out of FTN
Analysis: Main methodology

- Data Coding and Capture (Data Models)
Results:
Correlations

Correlations of M-F Ridership for:
- Population Density
- Occupations
- Retail floorspace (+ Saturday)

Analysis per time period for:
- Corridors
- Corridor-side
- Bus Stops (contribution)
Correlated FTN corridors:
Population Density & Boardings Early Evening

Legend
Pearson’s Coefficient
\( r \geq 0.25 \) / \( \alpha \leq 0.05 
- 0.250 - 0.300
- 0.301 - 0.400
- 0.401 - 0.500
- 0.501 - 0.600
- 0.601 - 0.700
- 0.701 - 0.800
- 0.801 - 0.900
- 0.901 - 1.000
- Non-correlated

Population Density
Hab/ha

0
1 - 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 150
151 - 200
201 - 250
251 - 300

Road Network
Correlated FTN corridors:
Occupation & Alightings Early Evening

Legend
Pearson's Coefficient
$r \geq 0.25 / \alpha \leq 0.05$
- 0.250 - 0.300
- 0.301 - 0.400
- 0.401 - 0.500
- 0.501 - 0.600
- 0.601 - 0.700
- 0.701 - 0.800
- 0.801 - 0.900
- 0.901 - 1.000
Non-correlated

Occupational Density
Persons/ha
- 0
- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 125
- 126 - 150
- 151 - 200
- 201 - 250
- 251 - 900

Road Network
Correlations of land use and ridership in time periods:

- Higher with corresponding peak period (i.e., population & boardings in AM Peak).
- Evidence some importance of the midday and early evening.
- Progressively increase/decrease throughout the day from/towards the peaks.
- Consistent with reality: evidence of data and analysis robustness.
Results: Thresholds

FTN Type
- 10 min
- Mixed 10/15 min
- 15 min
- OFTN Candidate
- Near Term FTN Candidate

Identified Thresholds
- 10-minute FTN corridor: 70-75 persons/ha
- 15-minute FTN corridor: 50-55 persons/ha
Results: Thresholds

FTN Type
- 10 min
- Mixed 10/15 min
- 15 min
- FTN Candidate
- Near Term FTN Candidate

Identified Thresholds
10-minute FTN corridor:
- 50-55 emp+students
- ≤ 20 persons/ha

15-minute FTN corridor:
- 15-35 emp+students
- ≤ 10 persons/ha
Results: Profiles

Profiles of NS03 FTN Corridor: Population @ Ridership Periods
NS03 FTN Corridor - Arbutus: Population Density @ Peak Periods
NS03 FTN Corridor - Arbutus: Occupation @ Peak Periods
EW01 FTN Corridor – 4th/6th - UBC: Population Density @ Peak Periods
Conclusions: Hypotheses

Hypothesis: FTN concentrates more businesses & employees than the rest of the transit network.

• True for employment, not conclusive for businesses (same proportion)
• Pointing towards larger employers next to FTN
• Businesses data may be affected by economic slowdown (2008-2010)
Conclusions: Hypotheses

Hypothesis: Higher population/occupation/retail floorspace correspond to higher transit ridership.

- Relatively true for most of the corridors/corridor-sides except retail floorspace.
- Relationships are dependent on the time period:
  - Boardings in morning peak & alightings in afternoon peak/early evening.
  - Lesser though consistent for land use and boardings/alightings at midday and early evening.
Conclusions: Hypotheses

Hypothesis: There is an identifiable threshold in population & occupation corresponding to FTN LOS.

• Identified land use thresholds to FTN service levels (corridor and corridor-side levels)
• For population: 70 to 75 persons/ha for the 10-min and 50 to 55 persons/ha for the 15-min.
• For occupation not as clear: Apparent threshold for 10-min is 50-55 employees + students and 15-35 for 15-min. Roughly correspond to 20 persons/ha for the 10-min and 10 persons/ha for the 15-min.
• Consistent with current literature for population. No equivalent for occupations
Policy Implications

Importance of densities & mixed land use in land use policy for FTN corridors

• Identified population and occupation densities to help developing FTN land use policy.
• Consideration for locating high occupation densities at intersections with other FTN or concentrated in urban centers.
• Mixed land use in anchors at both ends and ideally in the middle of FTN Corridors.
• Other components to be considered to support FTN levels of service: Street connectivity, pedestrian accessibility, demand management, etc.
Thank you

Questions?