Transit Demand Estimates

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Purpose

☐ To determine impact on ridership and revenues from new systems or any changes in service or policy.

☐ Need to know how demand estimates will be used. May not require an elaborate analysis. Just try it and find out level of demand.

☐ MPO or State DOT generally has expertise in demand forecasts, normally as part of a full scale system wide planning effort.
Travel Behavior

- Travelers are constrained by time, money, social and family conditions.
- Travelers will choose the mode which they believe will minimize the negative aspects of travel. Total time, waiting, walking, transferring, time, cost, discomfort, inconvenience.
- Choice and captive users consider different factors.

Fit method to the problem

- Demand estimates for a new start or major project need to use advanced methods as part of a regional travel simulation.
- Demand estimates for operational changes can use simplified methods and rules of thumb.
- Service should be designed to attract users – successful service/user oriented transit.
Elements of Successful Transit

- Concentrated trip ends: Activities that relate to transit should be located close to transit stops.
- Quality access system: Provide safe, direct and easy access to transit by pedestrians, bicyclists and automobile users. Minimize distances from vehicle door to buildings.
- Transit oriented street patterns: Permit through routing, direct service, few turns. Control through automobile traffic if necessary.
- Market orientation: Services are designed to maximize customer satisfaction and needs. Operate directly between origins and destinations without transfers, convenient schedules, competitive price, clean, comfortable vehicles, good user information.

User Oriented Transit

- Direct trip origin to destination
- No transfers
- Schedules match needs
- Reasonable cost
- Similar users
- Good access on both ends of the trip
Transit Ridership Forecasting Methods

- Two factors:
  - Market size – How many people could potentially use the service? This depends on location and quality of the access system.
  - Market share – What portion of potential users will actually use the service? This depends on the quality of service – frequency, travel times, costs.

Market size

- What is the maximum number of users that could make the trip?
- If the market size is small, the ridership will be small no matter how good the service.
- Must meet the six conditions for transit use – connectivity, access, schedule, knowledge, boarding, and security.
- Examples:
  - number of students at a university that live within walking distance of a bus route that they can take to their destination without a transfer,
  - number of employees who meet similar conditions
  - number of people who work in an area served by an express bus who pass a park and ride lot.
Transit propensity analysis

- See TCRP 27 “Transit Markets of the Future” and 28 “Building Transit Ridership
- Use geographic information systems and census data to identify locations of groups that are more likely to be transit users
- Weighted sum
  - Population density – high density
  - Race – non-white
  - Gender - female
  - Income – low income households
  - Auto Ownership - zero and one car households

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Atlanta

- Source: Regional Transit Action Plan
Demand Potential

- Demand greater than frequency provided
- Transit supportive land uses
- Environmental justice concern
- Congested highways

La Crosse, Wisconsin

- Based on locations of zero vehicle households, minority population and low income households
- Medium potential - within one standard deviation of average
- High or low – beyond one standard deviation

Fixed-Route Transit Propensity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Very Low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Vehicles</td>
<td></td>
<td>All of the variables fell below the lower limit</td>
<td>2 of 3 of the variables fell below the lower limit</td>
<td>4.4%-7.8%</td>
<td>2 of 3 of the variables exceeded the upper limit</td>
</tr>
<tr>
<td>Minority</td>
<td></td>
<td></td>
<td>5.0%-10.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poverty</td>
<td></td>
<td></td>
<td>4.4%-7.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7.2%-13.7%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
La Crosse

Source: http://www.lapc.org/Content/Plans/MTP/MTP.htm, Chapter 5
Appendix D

Market share

- What percent of the market is likely to use the transit service?
- Useful to do separate estimates of captive and choice users.
Simple Methods

- None: If it is a well designed service with a high potential market, simply begin the service and see who shows up.
- Rules of Thumb: First guess methods learned from working with the system. Based on past experiences, what do you expect the ridership to be?
- Non-committal survey: "Would you ride the bus if . ." Relies on stated intentions, known to badly overestimate ridership. Requires sophisticated data collection and analysis and current behavior to get good results.

Mode split analysis

- As part of a regional travel forecast, mode split models provide estimates of transit use
- Tend to not be used for route level demand estimates, simpler methods are used.
- Can provide estimates of elasticities if well calibrated with good data.
Similar Route Method

- Find a similar route and make adjustments for any differences, e.g. population density, automobile ownership, route length, headway difference. Adjustment factors must be derived or assumed.

Elasticity (shrinkage ratio) Method

- Shrinkage Ratio: percent change in ridership divided by percent change in something (headway, fare, gasoline price, etc.).
- Different ridership groups and trip purposes may have different numbers.
- Source: see TCRP Report 95: “Traveler Response to Transportation System Change”
  - extensive case study data on how transit ridership changes in response to other changes.
  - [http://www.tcrponline.org/bin/publications.pl](http://www.tcrponline.org/bin/publications.pl) search for 95
Example

- Current Ridership = 4,000,000
- Current Fare = $0.75
- Current Revenues = $3,000,000
- Fare Elasticity = -0.3
- New Fare = $1.00
- % Fare Increase = 33.3%
- % Ridership Change = -0.3 * 33.3% = -10%
- New Ridership = 3,600,000 (10% decrease)
- New Revenues = $3,600,000 (20% increase)

FIGURE 20. MEAN BUS FARE ELASTICITY VALUES

Note: Values from some fare decreases are included in the foreign data, but fare increases predominate.
Ridership least sensitive to fare changes

- Large dense cities
- Rapid transit
- High cost of driving
- High transit mode choice
- Peak period

Ridership most sensitive to fare changes

- Small urban areas
- Sparse transit service
- Feeder service
- Low cost of driving
- Low transit mode choice
- Off-peak
- Weekends

Observed Differential Responses to Fare Changes

Average fare elasticities - 1

- Type of fare change
  - Fare increase -0.34
  - Fare decrease -0.37

- City size
  - Populations greater than 1 million -0.24
  - Populations 500,000 to 1 million -0.30
  - Populations less than 500,000 -0.35

- Transit mode
  - Bus -0.35
  - Rapid rail -0.17

- Time period
  - Peak -0.17
  - Off-peak -0.40
AVERAGE FARE ELASTICITIES -2

- Income Group
  - Low - 0.19
  - Medium - 0.25
  - High - 0.28

- Age Group
  - 1-16 years - 0.32
  - 17-24 years - 0.27
  - 25-44 years - 0.18
  - 45-64 years - 0.15
  - More than 65 years - 0.14

- Trip Purpose
  - Work - 0.10
  - School - 0.19
  - Shop - 0.23


Service elasticities

1% DECREASE IN FARE
1% INCREASE IN BUS MILES OR TRIPS
AVERAGE 0.3% INCREASE IN PATRONAGE
FARE CHANGE

1% INCREASE IN PATRONAGE
SERVICE CHANGE
ACCOMPANYING EXPRESS BUS INTRODUCTION

Figure 17. Patronage increases attributable to transit system changes.
TCRP headway elasticities

Table 9-2  Bus Route Headway Elasticities Stratified by Original Service Level

<table>
<thead>
<tr>
<th>Original Service Level (Headway)</th>
<th>Number of Observations</th>
<th>Arc (Mid-point) Elasticity</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10 minutes</td>
<td>7</td>
<td>-0.22</td>
<td>±0.10</td>
</tr>
<tr>
<td>10 to 50 minutes</td>
<td>6</td>
<td>-0.46</td>
<td>±0.18</td>
</tr>
<tr>
<td>Greater than 50 min.</td>
<td>10</td>
<td>-0.38</td>
<td>±0.19</td>
</tr>
<tr>
<td>All observations</td>
<td>23</td>
<td>-0.44</td>
<td>±0.22</td>
</tr>
</tbody>
</table>


Acknowledgements

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- The opinions expressed are the product of independent university work and not necessarily those of the sponsoring agencies or of the agencies supplying data for the project.