# 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 that 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

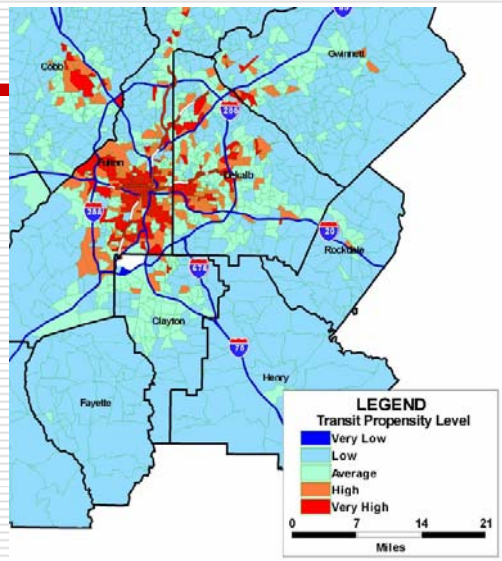
# Transit propensity analysis

- 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



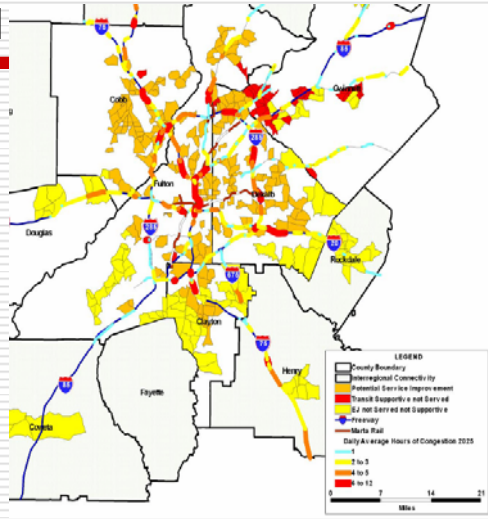
# Atlanta

- Source: Regional Transit Action Plan http://www.grta.org/rtap/pubs.htm chapter 3, June 2003



# Demand Potential

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






# La Crosse, Wisconsin

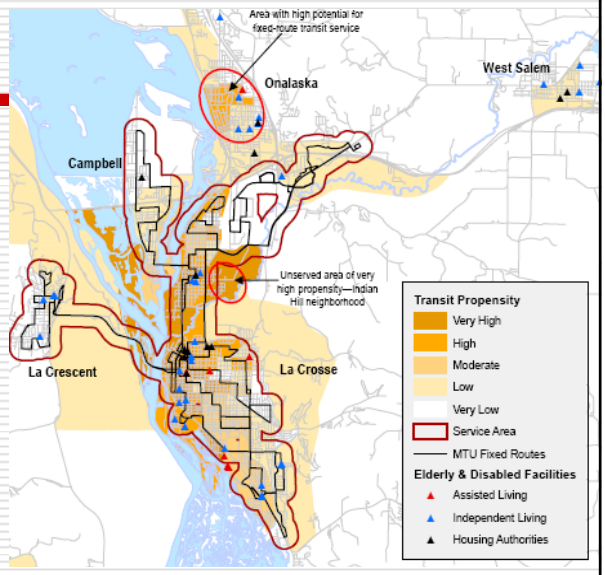
- Based on locations of zero vehicle households, minority population and low income households
- Medium potential - within one standard deviation of average
- High or low – beyond one standard deviation

**Fixed-Route Transit Propensity**

| Variable | Very Low | Low | Moderate | High | Very High |
|---|---|---|---|---|---|
| 0 Vehicles | All of the variables fell below the lower limit | 2 of 3 of the variables fell below the lower limit | 5.0%-10.4% | 2 of 3 of the variables exceeded the upper limit | All of the variables exceeded the upper limit |
| Minority | | | 4.4%-7.8% | | |
| Poverty | | | 7.2%-13.7% | | |

# 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

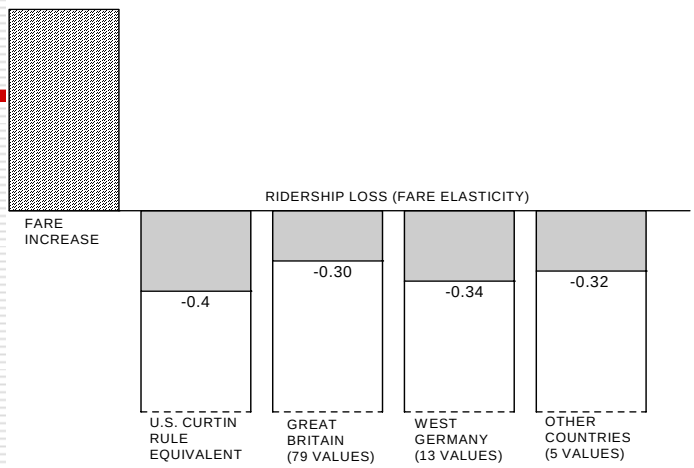
- Shrinkage Ratio: percent change in ridership divided by percent change in something (headway, fare, gasoline price, etc.).
- Different ridership groups and trip purposes may have different numbers.
- Source: see TCRP Report 95: "Traveler Response to Transportation System Change"
  - extensive case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

SMALL URBAN AREAS
SPARSE TRANSIT SERVICE
FEEDER SERVICE
LOW COST OF DRIVING
LOW TRANSIT MODE CHOICE
OFF-PEAK
WEEKENDS

**RIDERSHIP MOST SENSITIVE TO FARE CHANGES**

**Observed Differential Responses to Fare Changes**

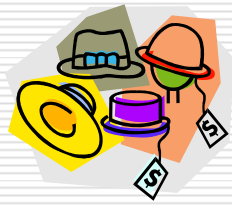


# AVERAGE FARE ELASTICITIES- 1

- 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
- Source: Patronage Impacts of Changes in Transit Fares and Services, 1980.





# Service elasticities

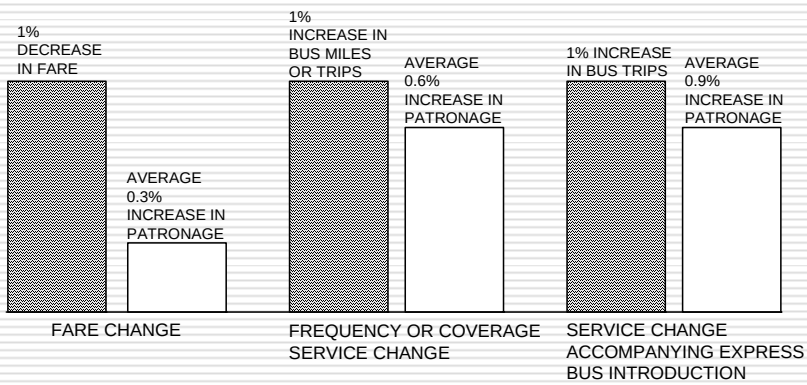



Figure 17. Patronage increases attributable to transit system changes.

# TCRP headway elasticities

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

| Original Service Level (Headway) | Number of Observations | Arc (Mid-point) Elasticity | Standard Deviation |
|---|---|---|---|
| Less than 10 minutes | 7 | -0.22 | ±0.10 |
| 10 to 50 minutes | 6 | -0.46 | ±0.18 |
| Greater than 50 min. | 10 | -0.58 | ±0.19 |
| All observations | 23 | -0.44 | ±0.22 |

**Source:** Lago, Mayworm and McEnroe (1981).



# 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.