III. Market Factors and Demand Analysis

Public Transport Planning and Regulation: An Introduction

Planning and Analysis Building Blocks

Schedule Building

Cost Analysis and Financial Planning

Performance Analysis

Measures & Standards

Service Monitoring and Data Collection

Network and Route Design

Fares and Revenue: Policy, Analysis, and Collection

Market Factors and Demand Analysis

Terminology and Basic Relationships

Focus of Discussion

Market Factors

- **The market for public transport (PT) is affected by a variety of factors**
- **No two cities or even neighborhoods are the same in terms of these factors**
- **Different combinations of factors generate the need for different types and levels of PT service**

Factors Affecting Market for Public Transport

- **Travel needs**
- **Land use**
- **Trip maker numbers and demographics**
- **PT service parameters**

Why is It Important to Understand Market Factors?

- **Helps in estimating PT ridership**
  - **Ridership is linked to public transport performance, revenue, financial sustainability**
  - **Ridership is a measure of benefits**
- **Essential for planning and design**
- **Facilitates performance analysis through peer comparisons**

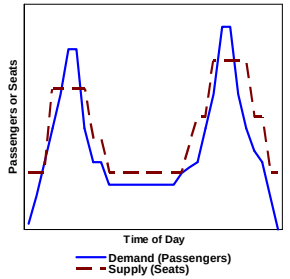
Travel Needs

- **Purpose**
- **Time-of-Day**
- **Nature of origin/destination**

Purpose Impacts PT Use

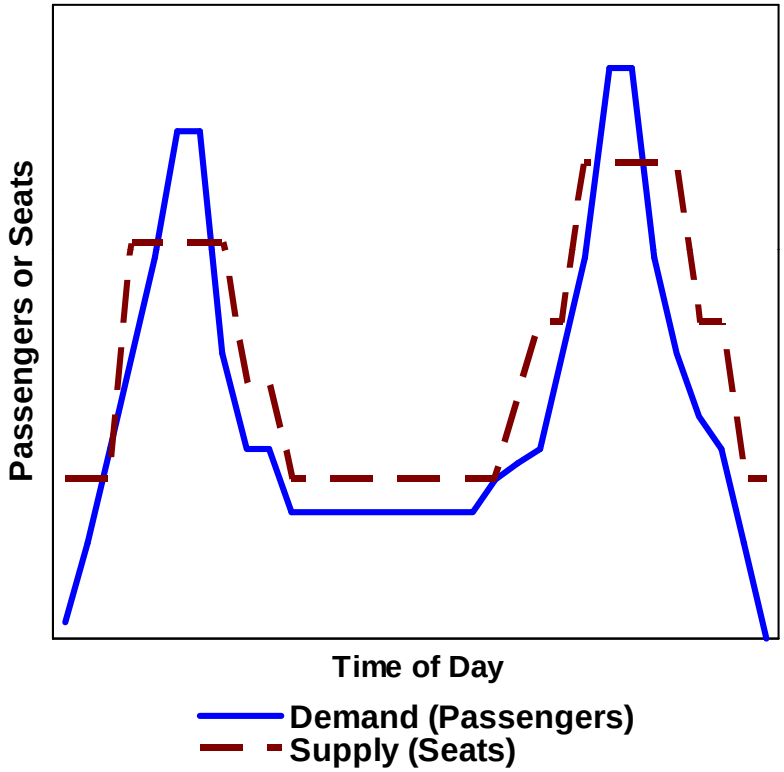
- **Non-Work**
  - **Shopping, personal business, medical, recreational, religious**
  - ***Occasional* trips — 1-3 times/week**
  - ***Discretionary* trips means users can forgo them, change timing or combine them**
  - **People often travel as *group,* e.g., family**
- **Work/School trips**
  - ***Recurring* (e.g., 5 days/week)**
  - ***Not-discretionary,* more tightly scheduled**
  - **Workers/students travel as *individuals***

Time-of-Day



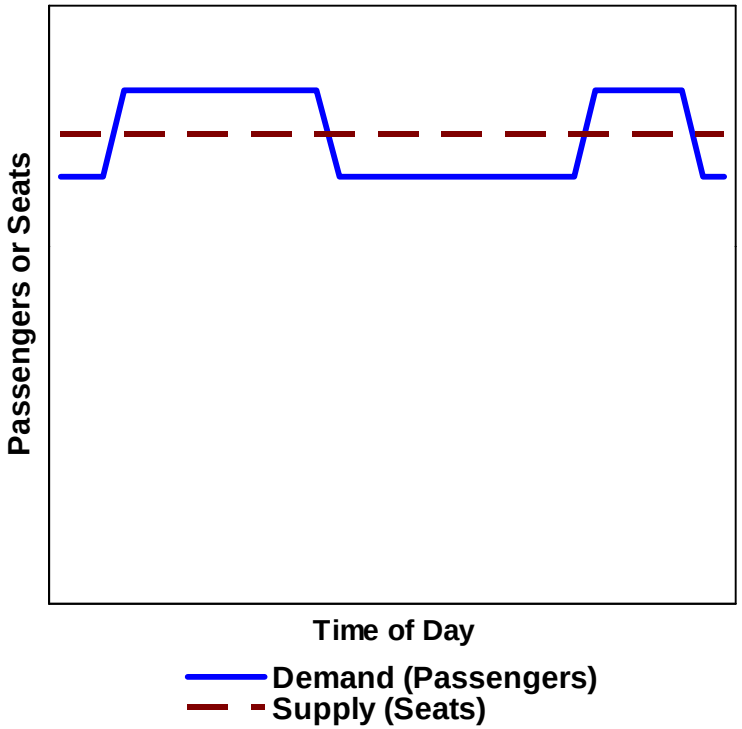
- *Peak* — Morning/Afternoon Commuting Hours
  - Higher demand/unit time
  - High percentage of work trips
  - More individual travel
  - *Choice* and *captive* riders
- *Off-Peak* — Midday, Evening, Weekend Hours
  - Lower demand
  - More non-work travel
  - More group travel
  - *Captive* riders

Time-of-Day Demand Affects Bus and Facility Utilization



- More peak, less off-peak service operated
- Inefficient use of buses and facilities
  - Low service hours/bus
  - Low passengers/bus
  - Unused capacity during off-peak periods
- There are strategies to address this problem

Some Areas Have “Flat” Demand



- **Relatively constant service operated**
  - **e.g., Casablanca**
- **Efficient use of buses and facilities**
  - **High service hours/bus**
  - **High passengers/bus**
  - **Capacity efficiently used during all periods**

Urumqi, China
2006 O/D Survey Results

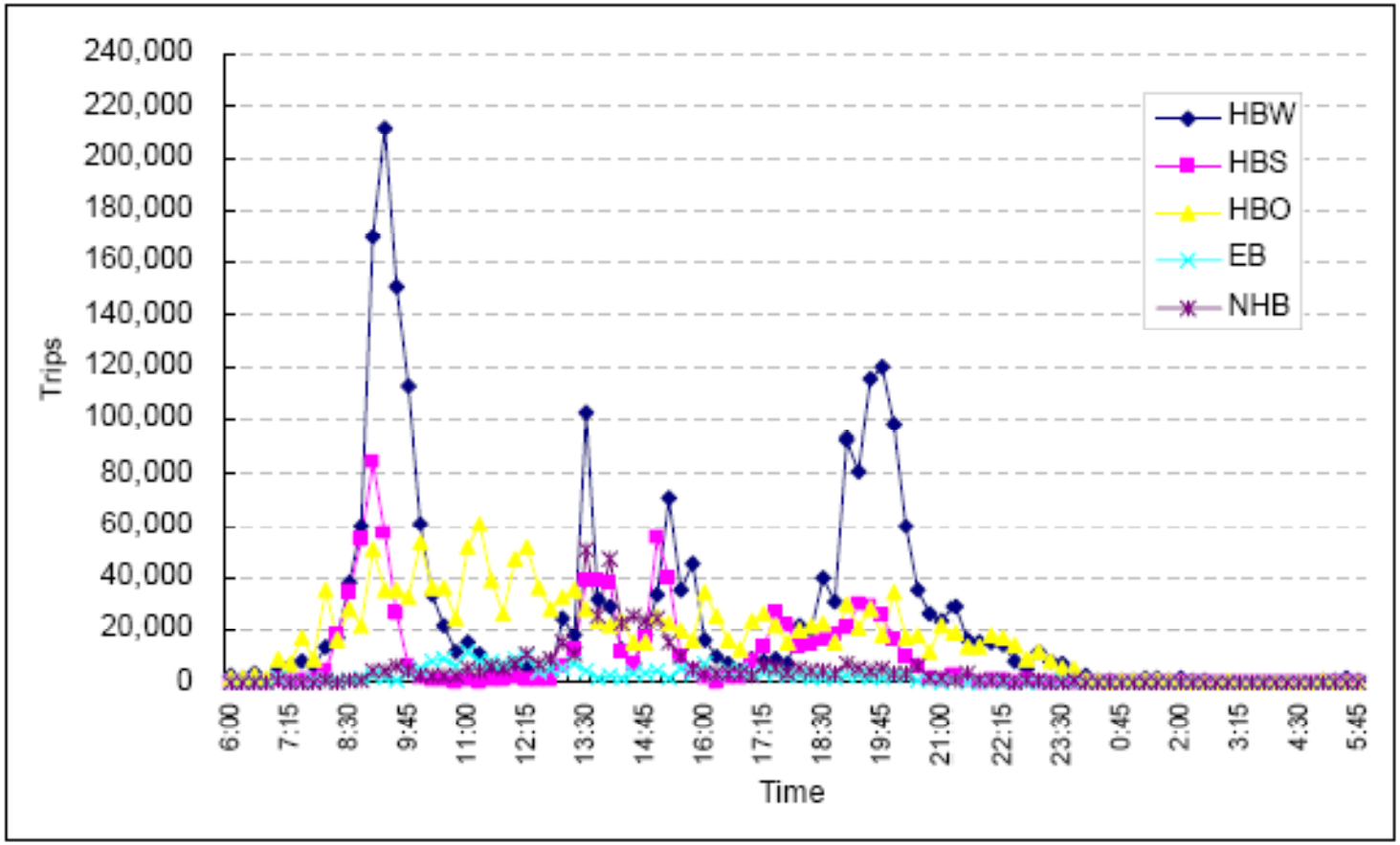


Figure 2.9 Trip Time Distribution by Purpose

Origin/Destination Volumes

- **PT works best where there are large, concentrated travel volumes between high intensity areas**
  - **To/from large, dense housing estates**
  - **To/from large commercial centers, e.g. downtowns or central business districts (CBD's)**
- **PT works best when concentrations of origins and destinations are arranged linearly**

Urumqi, China

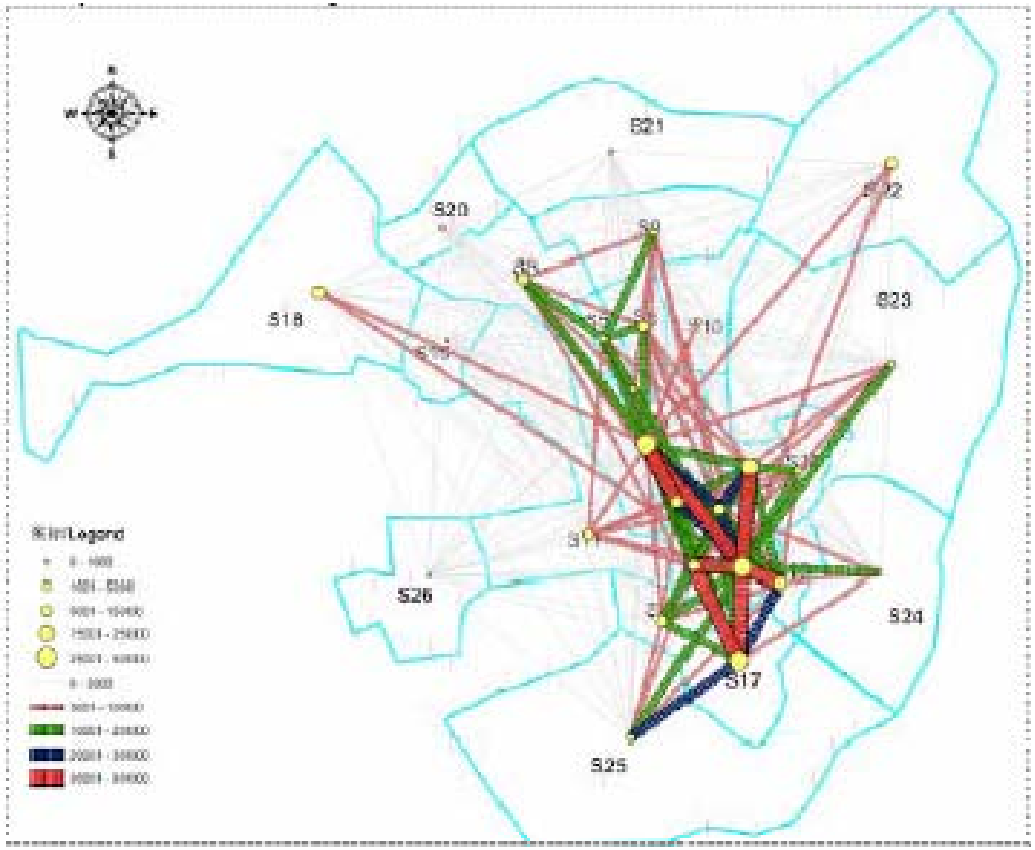
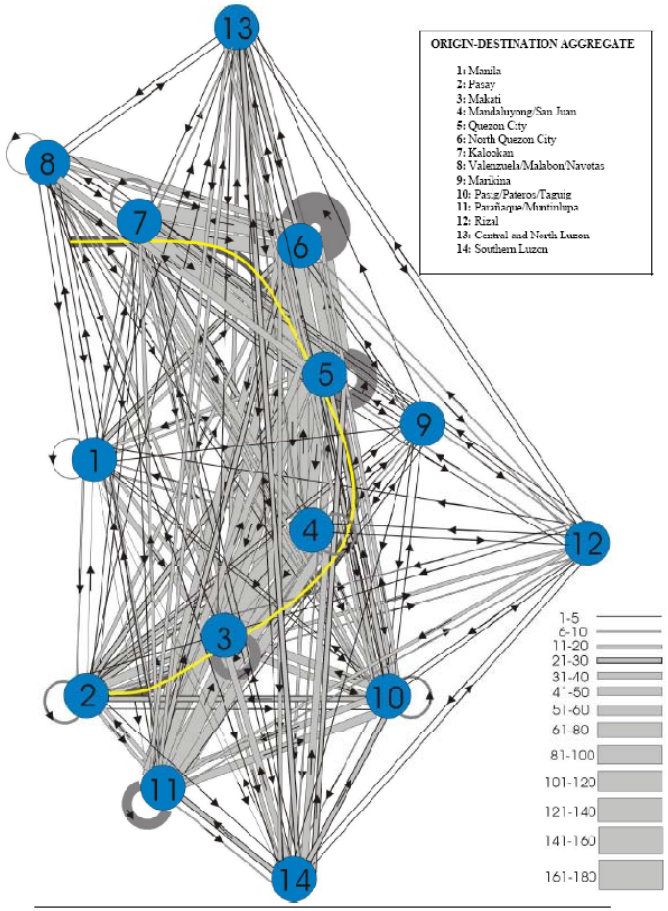


Figure 3.1 Desire lines of public transport in Urumqi (2006)

Manila
EDSA Bus Users



Distance from Origin to Destination

- **Extremely short trips (2 km) mostly made by walking**
- **Bicycles viable option up to 8-10 km**
- **Conventional bus trip lengths generally 5-10 km in developing cities**
- **Suburban rail trip length average over 10 km**

Urumqi, China Trip Times
2006 O/D Survey

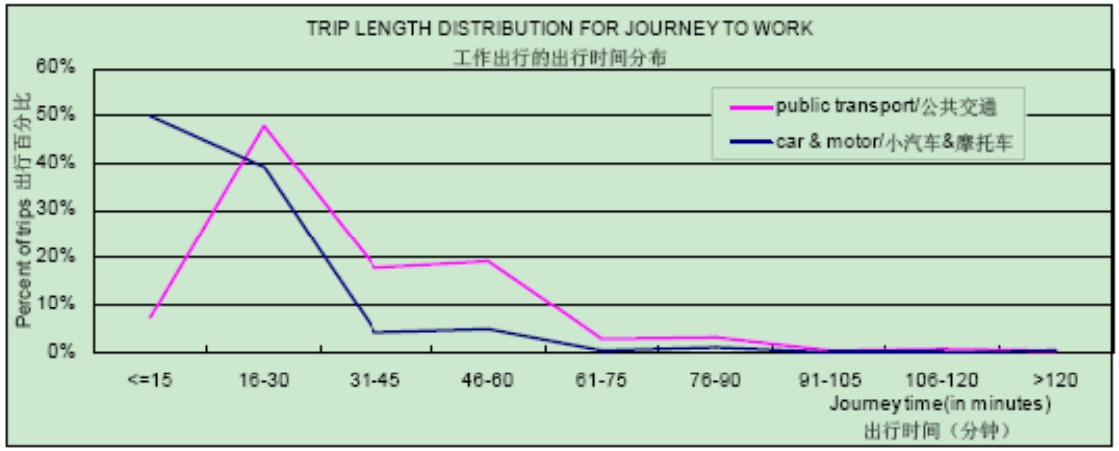


Figure 2.11 Trip length distribution for journey to work

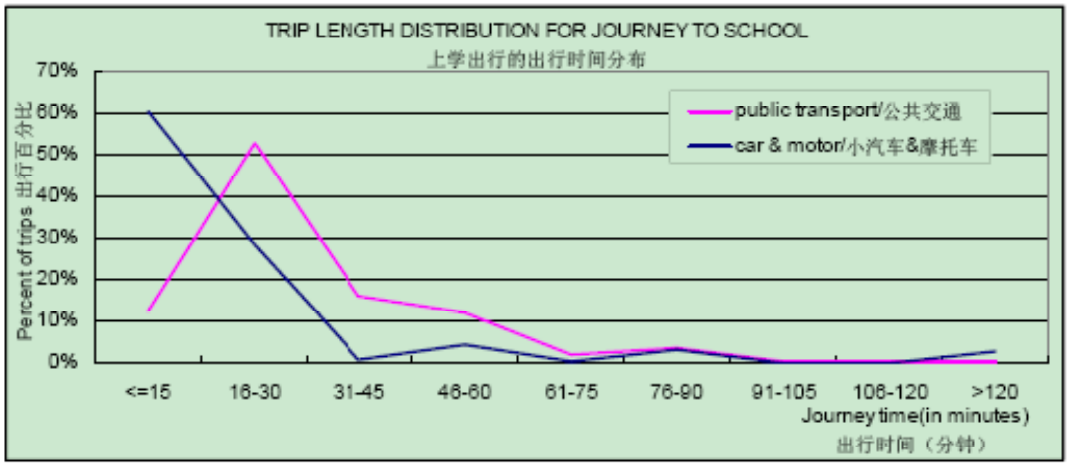
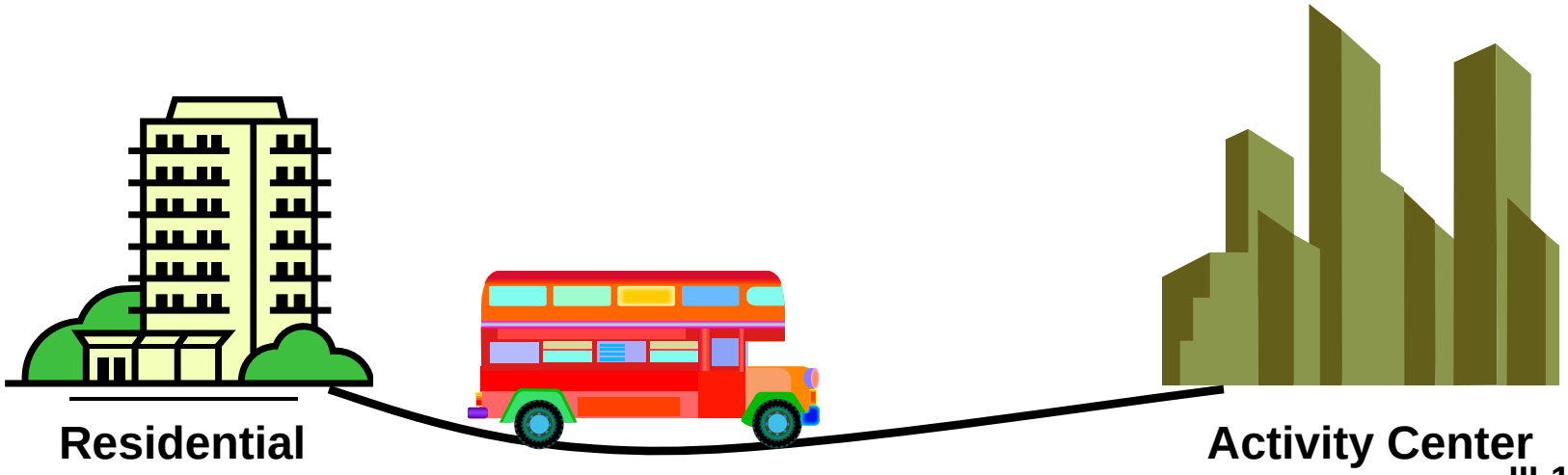


Figure 2.12 Trip length distribution for journey to school

Land Use

- **Intensity/Density**
  - **Residential (Origin)**
  - **Activity Center (Destination)**
- **Availability of safe, secure walking environment**

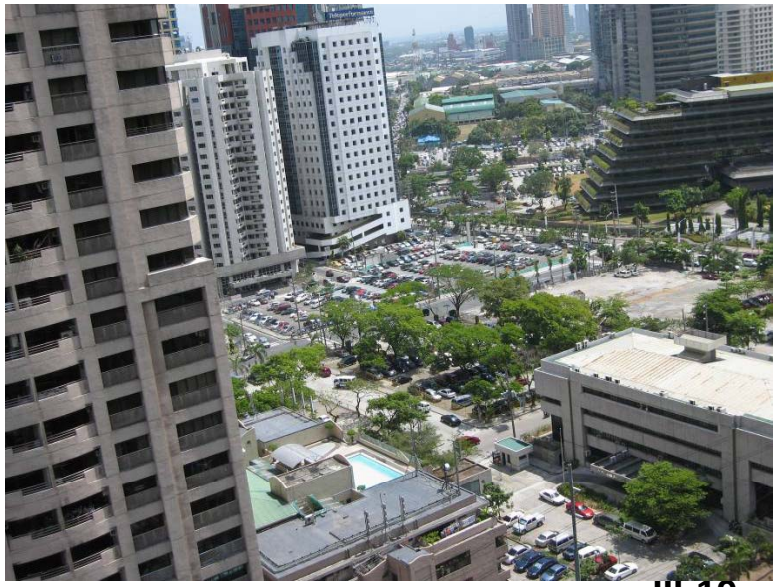


Origin/Destination

- **Public transport works best for trips between:**
  - ***High density, "walkable"* residential and**
  - ***High density "walkable"* non-residential areas (e.g., traditional central business districts)**

- **Traditional public transport does not serve well trips between:**
  - ***Low density* residential areas and**
  - ***Low density* employment areas**

Land Use Variations in Manila



Land Use Variations Beijing

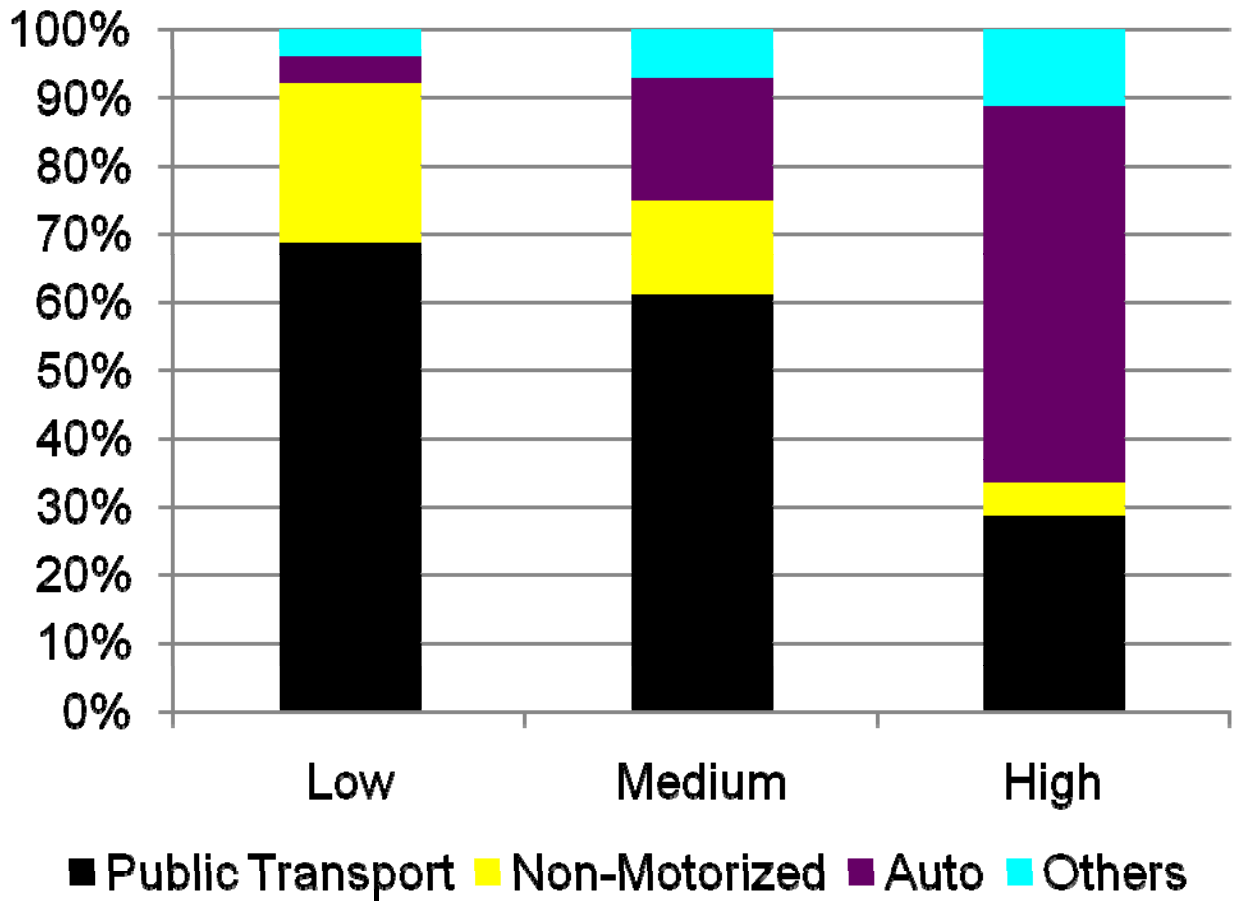
Important Demographic Characteristics

- **Income**
- **Gender**
- **Age**
- **Labor force/student population**

Income Is Most Important Demographic Factor

- **Low Income**
  - **Affordability**
    - **A problem when fares > 10% to 20% of income**
    - **Concessionary fares sometimes help**
  - **Alternatives are walking, bicycling**
- **Medium Income**
  - **Affordability is 3% to 5% of income**
  - **Taxis, two-wheelers and sometimes autos are alternatives**
- **High Income**
  - **Autos are an alternative**

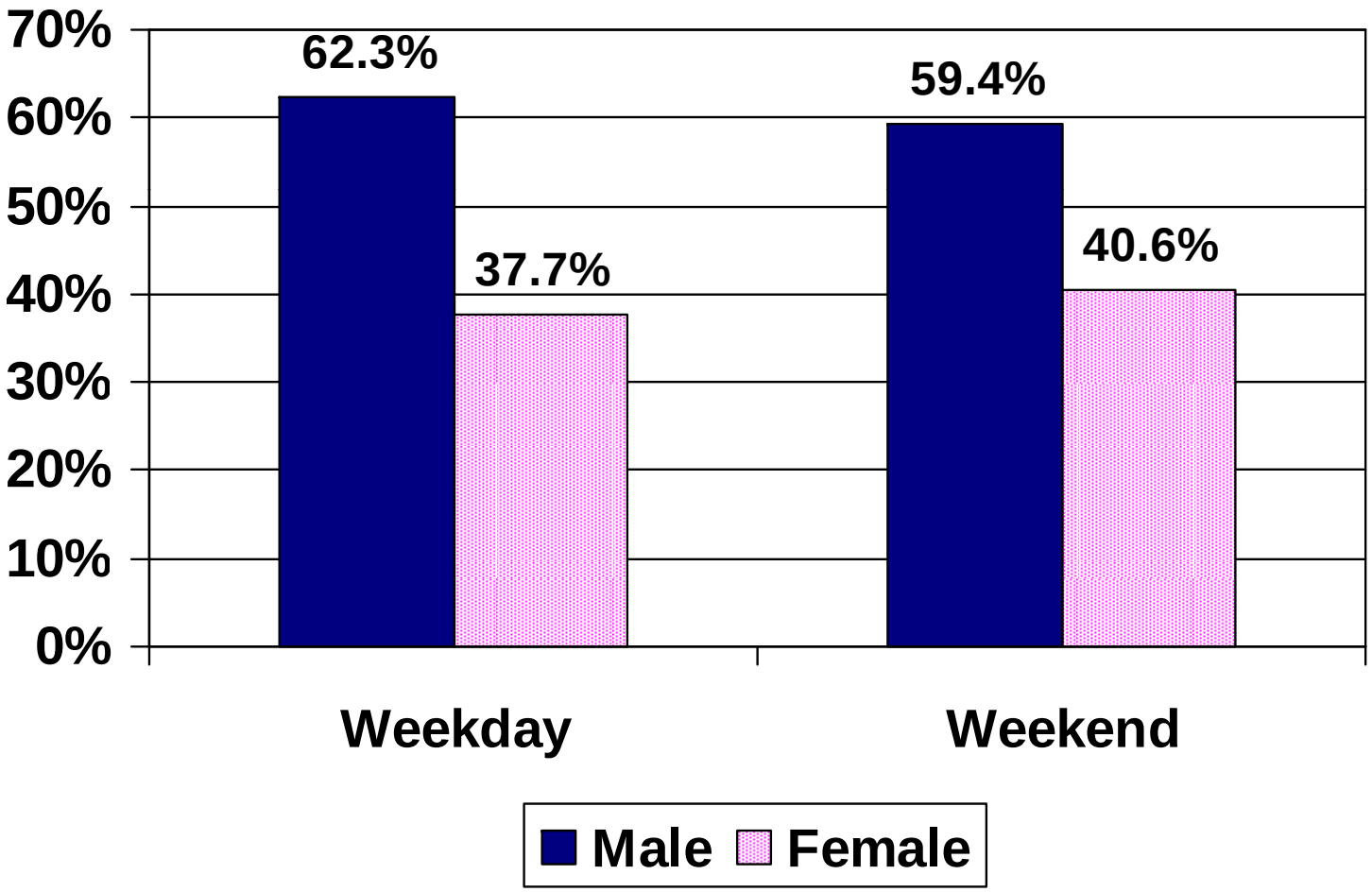
Bogota Travel by Income Group



Gender

- **Men are a larger proportion of PT riders in developing (not developed) cities**
  - **Lower proportion of women working**
  - **Higher proportion of women on weekends when non-work trips increase**
  - **Religious rules**
- **Women's safety/security concerns**
  - **Lighting at stops**
  - **To stop/from stop**

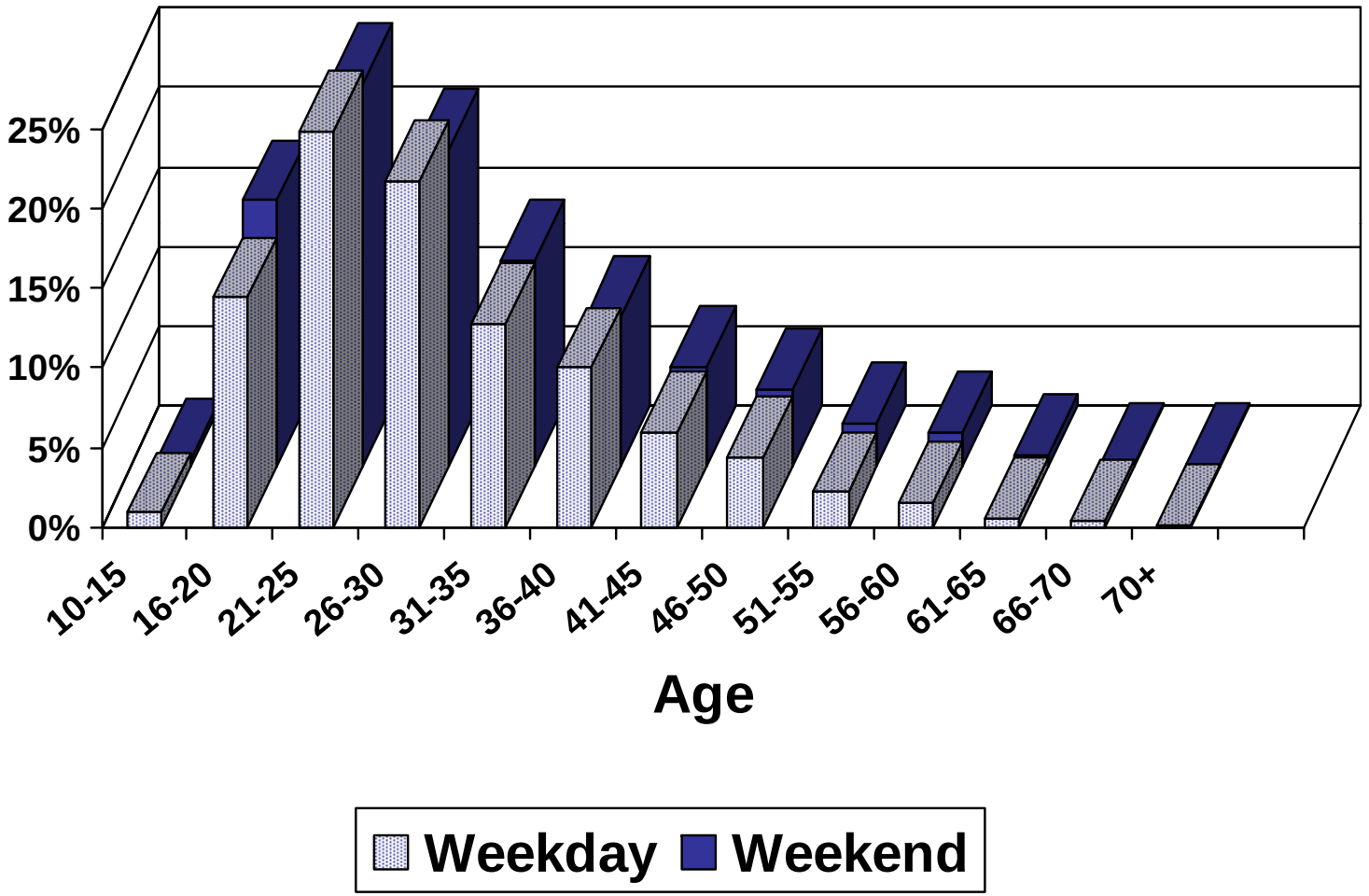
Gender
Manila Edsa Bus Users



Age

- Majority of PT users between 16-40
  - Workers
  - Students
- Fewer older workers, students
  - They may have money for taxis and other forms of private transport
- More younger travelers on weekends

Age Profile
Manila Edsa Bus Users



Public Transport System Factors

- **Levels and quality of PT service**
  - **Travel times, reliability**
  - **Comfort, amenities**
- **PT Fares**
- **Availability of safe, secure non-motorized access**
- **If affordable, availability of other options**
  - **Shared ride taxis**
  - **Conventional 2-, 3- and 4-wheeled taxis**
  - **Private motor vehicles two and four wheelers**

Levels and Quality of PT Service

- **All travel time not the same**
  - **Waiting, transferring and walking time much more onerous**
- **Reliability may be more important than average travel time**
- **Crowding a key quality factor, particularly for:**
  - **Women**
  - **Older people**
  - **Higher income travelers with choices**

Availability of Safe, Secure Non-Motorized Access

- **Pedestrian access conditions**
  - **Sidewalk coverage and repair**
  - **Crossings**
- **Bicycle facilities**
  - **Bikeways**
  - **Bicycle parking**

Beijing

Safety and Traffic Management

- **Availability *and management* of safe, secure access and waiting facilities are important determinant of PT use**
- **Why?**
  - **Pedestrians and bicycle users**
    - **Large % of traffic injuries and deaths**
  - **People going to/from or waiting for PT**
    - **Large % of non-motorized travel deaths**

Passenger Information a Key Service Quality Parameter

- People need to be aware of options
  - Routing
  - Schedules
  - Fares
- Many trips are non-recurring, making PT use difficult
  - Non work
  - Visitors
  - Tourists
- A big issue in developing cities

Why is Demand Estimation Needed?

- **Ridership critical planning and design parameter**
  - **Assess the passenger and revenue impacts of new services and facilities**
  - **Assess the passenger and revenue impacts of service changes**

Demand Estimation Techniques for Short-Medium Term Service Changes

- **Similar routes method**
  - Apply existing service experience to a service change
- **Statistical models**
  - Develop formula relating existing demand to existing service parameters
- **Elasticity models**
  - Apply percent change to current ridership based on change in a fare or service parameter

≈ Similar Routes

Method Ridership on proposed service will reflect ridership on an existing service

Estimation

1. Select similar service based on (typical):
   - Population density
   - Generators served
   - Service design (e.g., intervals, span)
2. Adjust ridership for differences
   - Service levels
   - Rider potential

≈ Example of Similar Routes

Problem **Estimate ridership for a new route that will provide bus service between La Source (an edge town) and Orleans.**

Solution

1. Collect data for a similar route

	New Route	Route 12
Population/Square Kilometer	15000	17000
Daily Kilometers	1600	1800
Daily Passengers	?	3125

2. **Calculate ridership rate for Route 12**

Ridership rate = Daily passengers / Daily kilometers

= 3125 / 1800

= 1.74 passengers/KM

3. **Calculate potential users for new route as a percent of Route 12 population density**

Potential (%) = Population density (New route)/ Population density (Route 12)

= 15000/17000

= 88.2%

4. Estimate ridership rate for the new route

Ridership rate = Route 12 ridership rate x Potential %

= 1.74 passengers/KM x 88.2%

= 1.53 passengers/KM

5. Estimate daily ridership rate for the new route

Ridership rate = New route ridership rate x daily kilometers

= 1.53 passengers/KM x 1600 KM

= 2448 passengers *(or 2400)*

≈

Key Issues
Similar Routes Method

1. **Identification of key differences between existing and new route**

2. **Approach used to adjust for differences**

Statistical Models

$r^2 = 0.74$

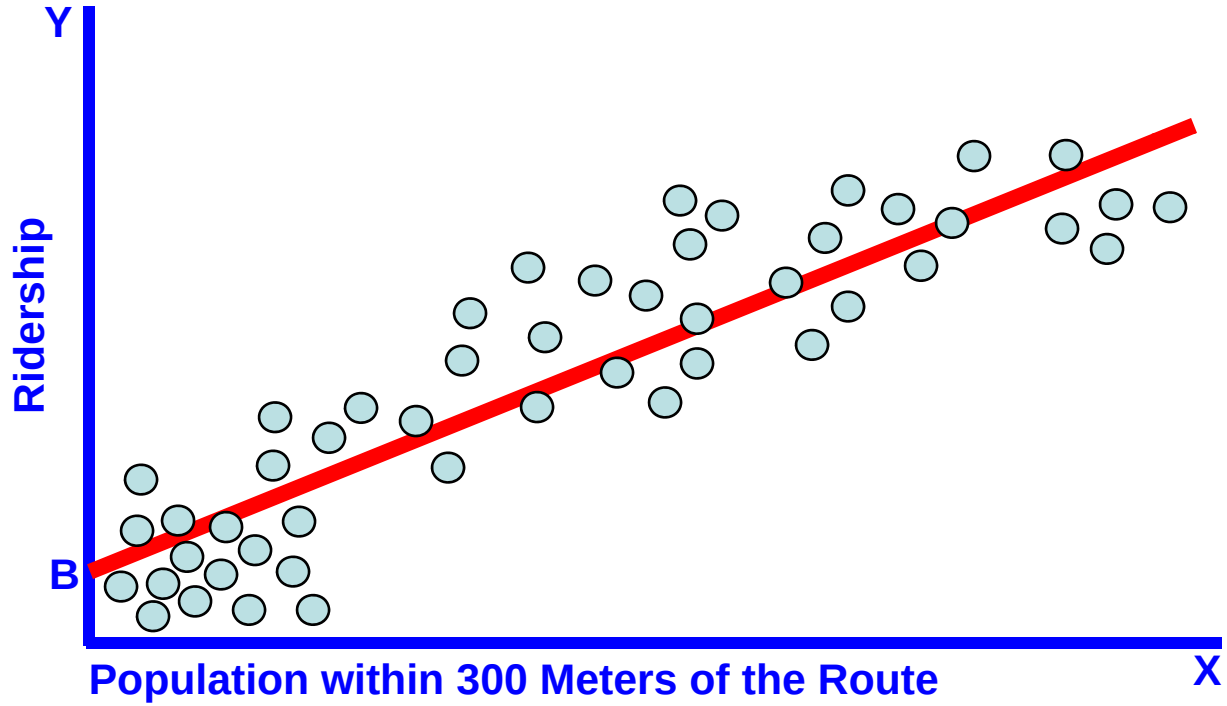
Method Based on ridership on existing routes and key service and demographic variables

$$\text{Ridership} = B + A_1X_1 + A_2X_2 + \ldots + A_3X_3$$

Estimation

1. Collect data on existing routes
   - Socioeconomic variables — e.g., income
   - Land use variables — e.g., population
   - Service variables — e.g., headway
   - Daily ridership
2. Statistically "calibrate" model, develop mathematical parameters
3. Apply model

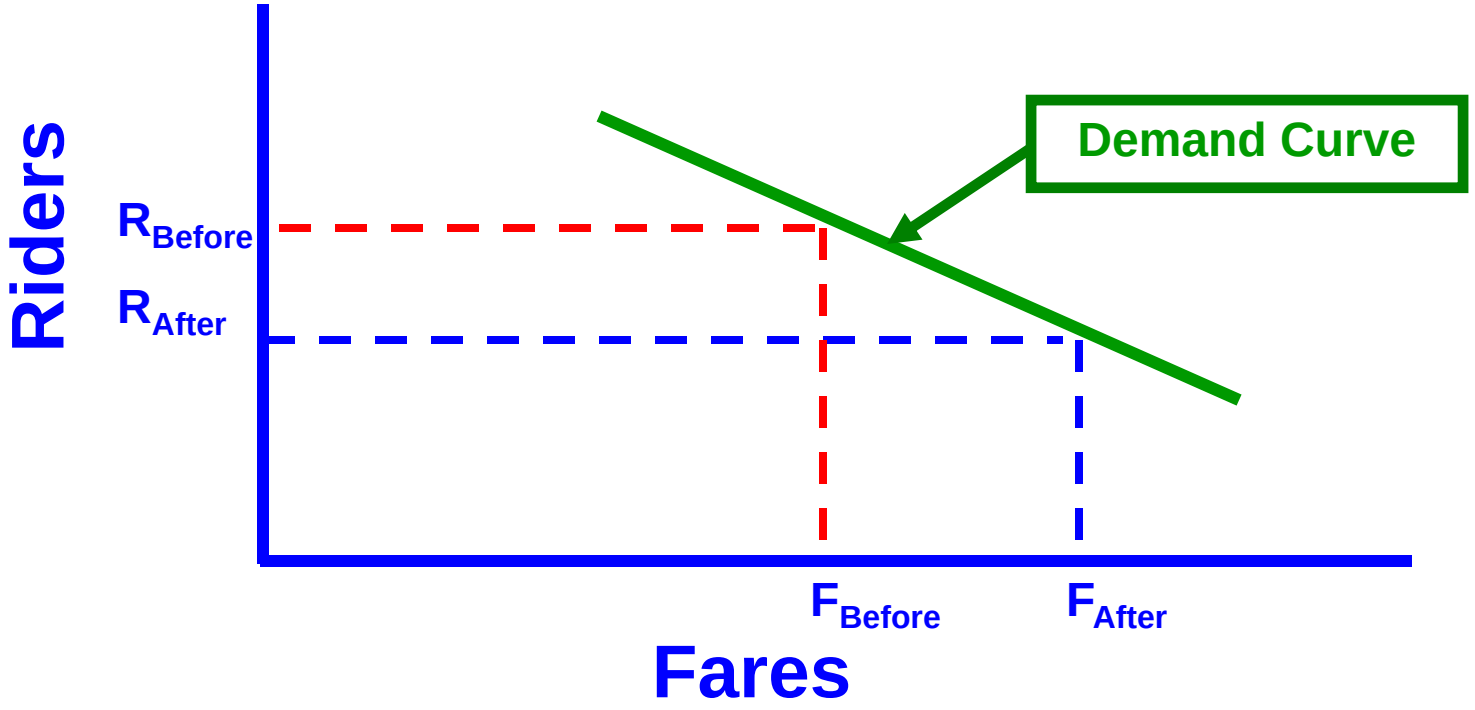
Example of Linear Regression



e Elasticity Models

Method

Elasticity is the ratio of the percent change in ridership to the percent change in a transit service parameter (e.g., fares, service levels)



Summary

- **Discussed factors that affect public transport demand**
- **Described simple demand estimation approaches.**
- ***Remember*, understanding the market factors that influence public transport use is critical to PT service planning**