VII. Service Monitoring

Public Transport Planning and Regulation: An Introduction
### Planning and Analysis Building Blocks

<table>
<thead>
<tr>
<th>Schedule Building</th>
<th>Cost Analysis and Financial Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Analysis</td>
<td>Service Monitoring and Data Collection</td>
</tr>
<tr>
<td>Measures &amp; Standards</td>
<td>Fares and Revenue: Policy, Analysis, and Collection</td>
</tr>
<tr>
<td>Network and Route Design</td>
<td>Terminology and Basic Relationships</td>
</tr>
<tr>
<td>Market Factors and Demand Analysis</td>
<td></td>
</tr>
</tbody>
</table>

**Focus of Discussion**
Measures/Standards & Service Monitoring: A Two-Way Relationship

- **Obvious Relationship**
  - Service monitoring program should support evaluation and planning needs (measures and standards)

- **Feedback Relationship**:
  - Measures and standards should be consistent with service monitoring capabilities and available resources
What Route Data Are Needed for Monitoring?

• Scheduling
  – Passenger load onboard (maximum load point and other important locations)
  – Bus arrival/departure times at selected time points

• Service Planning
  – Fare revenue
  – Passenger trips
    • By time-of-day
    • Boardings and alightings by stop
  – Transferring among routes
  – Passenger characteristics, travel patterns, and attitudes
Typical Route Monitoring Techniques

- Driver/Conductor Counts
- Point Counts
- On/Off Counts
- Station Entry/Exit Counts
- Travel Time Surveys
- Passenger Surveys
Driver/Conductor Counts

Method
Drivers or conductors count passengers as part of the fare collection process. Turnstile counts may be used.

Limitation
Drivers (conductors) on interlined routes must be careful to separate and record counts.

Megabus Pereira
Bangalore
Driver/Conductor Counts and Interlining

- **Interlining**
  - Bus starts on Route A
  - It continues on Route B at the terminal

- **Counting Implications**
  - Counts should be taken separately on each route
**Example of a Driver/Conductor Count Form**

<table>
<thead>
<tr>
<th>Route</th>
<th>56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Number</td>
<td>3213</td>
</tr>
<tr>
<td>Schedule Number</td>
<td>56-01</td>
</tr>
<tr>
<td>Date</td>
<td>20/12/2006</td>
</tr>
<tr>
<td>Weather</td>
<td>Fair/28°</td>
</tr>
<tr>
<td>Operator</td>
<td>Zidane</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trip Number</th>
<th>Adult</th>
<th>Student</th>
<th>Senior</th>
<th>Passes</th>
<th>Disabled</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>4</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>1</td>
<td>15</td>
<td>8</td>
<td>9</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>21</td>
<td>50</td>
</tr>
</tbody>
</table>

(Some Systems Record Running Totals)
Key Data and Uses
Driver/Conductor Counts

• Total Boardings by Trip (sometimes by fare category)
  – Assess productivity
  – Revise the service design

• Revenue by Trip
  – Assess productivity
Point Counts

Method
Data collector stands at a bus stop and records passenger load and arrival (or departure) time.

Procedure
Light Loads
Count Passengers
Heavy Loads
Count Empty Seats
Standing Loads
Count Standing Passengers and Empty Seats

Problems
Tinted windows or full bus advertising may require data collector to board bus
Example of a Point Check Form

<table>
<thead>
<tr>
<th>Route(s)</th>
<th>Weather</th>
<th>Route Number</th>
<th>Bus Number</th>
<th>Scheduled Time</th>
<th>Actual Time</th>
<th>Passengers On Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>36,47</td>
<td>Rain/31°</td>
<td>36</td>
<td>9926</td>
<td>7:03</td>
<td>7:05</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>47</td>
<td>0101</td>
<td>7:05</td>
<td>7:06</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>47</td>
<td>9709</td>
<td>7:10</td>
<td>7:12</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>0511</td>
<td>7:15</td>
<td>7:18</td>
<td>38</td>
</tr>
</tbody>
</table>
Many Routes Can Be Covered At Once in a Radial System

Route 1

Route 2

Route 3

Central City

Maximum load point
Key Data and Uses

Point Checks

• Load count
  – **Scheduling:** Calculate *demand intervals*
    • When count taken at the maximum load point

• Arrival (departure) times
  – **Assess schedule adherence**
  – **Revise scheduled running times**
On/Off Counts

Method A data collector rides the bus and, at each stop, records:
- Passenger ons and offs
- Bus arrival (departure) times at time points.

Option Automatic Passenger Counters
## Example of a On/Off Count Form

<table>
<thead>
<tr>
<th>Route</th>
<th>Schedule Number</th>
<th>Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>53-11</td>
<td>30/06/2006</td>
<td>Chahiri</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bus Number</th>
<th>2456</th>
<th>Weather</th>
<th>Sun/33°</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Scheduled</th>
<th>Actual</th>
<th>Stop Location</th>
<th>On</th>
<th>Off</th>
<th>Total</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:03</td>
<td>7:03</td>
<td>Marche</td>
<td>16</td>
<td></td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6th/Main</td>
<td>15</td>
<td>2</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>7:19</td>
<td>7:20</td>
<td>12th/Main</td>
<td>28</td>
<td>3</td>
<td>54</td>
<td>No sign</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15th/Main</td>
<td>3</td>
<td>25</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>7:30</td>
<td>7:34</td>
<td>City Terminal</td>
<td></td>
<td>32</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

| Totals    |       |               | 62 | 62  |       |          |

WORLD BANK
VII-15
Key Data and Uses
On/Off Counts

• On and off counts by stop
  – Revise the service design through analysis of the passenger loading profile
  – Identify priority sites for passenger amenities (e.g., shelters, benches)

• Arrival (departure) times
  – Assess schedule adherence
  – Revise scheduled running times
Load Profile Diagram
Radial Bus Route

Passengers Onboard/Leaving Stop

Electronic City  Kudlu Gate  Madiwala  Maharanis College  City Market

Stops

0  20  40  60  80  100  120

Passengers Onboard/Leaving Stop
Load Profile Diagram
Grid or Crosstown Bus Route

- Market
- Offices
- Bus Route
- Shops
- Bus Route

Passengers Leaving Stop

0 10 20 30 40 50 60

VII-18
Load Profile Diagram
Express Bus Route

- Collection
- Park/Ride
- Express Zone Stop
- Central City Terminal

Passengers Leaving Stop

60
50
40
30
20
10
0
Automatic Passenger Counters Can Collect On/Off Data

- Location of bus (AVL)
  - Global Positioning Systems (GPS)

- Passenger counting (APC)
  - Infra-red logic

- Time from on-board clock
## Station Entry/Exit Counts

### Method
Passengers entering and exiting stations are counted using turnstiles or IC/Smarcards.

### Information
1. Entering and exiting passengers by station
2. Can estimate travel patterns between stations (origins-destinations)
3. Can estimate passenger boardings and loads per route
4. Can estimate on/offs by station
Travel Time Surveys

Method
Data collector records arrival/departure times at stops, intersections, and points of delay.

Option: Can use automatic vehicle location (AVL)

Information
1. Running times between stops
2. Stop dwell times
3. Delay times at traffic signals
4. Delay times due to congestion

San Francisco

Route 38
33rd to Van Ness
Midday and PM

- Other Delays: 5%
- Pull-out: 11%
- Signal Delay: 20%
- Loading/Unloading: 27%
- Moving in Traffic: 31%
Passenger Surveys

Method
Passengers are surveyed on the bus. The forms are distributed by drivers, data collectors, or special survey staff.

Information
1. Passenger characteristics (e.g., car available, income, age, gender)
2. Travel patterns (e.g., purpose, origins/destinations, frequency)
3. Evaluation of service quality, amenities
Dear Passenger:

Please take a few minutes to complete this survey about the trip you are making. The results of the survey will be used for a federal government research study on the characteristics of transit riders.

As our “Thank You” for helping us, everyone who completes a survey form will be eligible to participate in a drawing where two (2) monthly passes will be awarded to the lucky winners. Only one pass to a customer.

Thank you for helping us with the survey.
Data Items Obtained By Collection Techniques

- No one technique is sufficient
- Passenger surveys are critical
- Not all X’s are “equal”

<table>
<thead>
<tr>
<th>Monitoring Technique</th>
<th>Scheduling</th>
<th>Service Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Load</td>
<td>Arrival/Departure</td>
</tr>
<tr>
<td>Driver/Conductor Count</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Point Count</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ride Count</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Station Entry/Exit Counts</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Travel Time Survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Survey</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Who Should Collect Data and Monitor Performance?

• The public authority should always monitor service and operations to assess:
  – Operator compliance with government policies and requirements (e.g., safety, operating contracts, concessions)
  – How well the public is being served
• The contractor/operator should monitor to:
  – Fine-tune services to meet changing conditions
    • Congestion and travel speeds
    • Passenger markets
Public Authority Monitoring Options

• Internal staff

• Contract to third party
Identifying New Transit Markets

**GIS is an Important Tool!**

- GIS = Geographical Information System

- Integrates Key Data into One Database
  - Socio-Economic
  - Major Generators and Land Use
  - Origin-Destination Travel Patterns
  - Street Network
GIS Techniques

- Network Analysis
- Desire lines
- Route sketch planning
Shiajzhuang Example
Network Analysis

Stops’ Boarding and Alighting
Desire Line Analysis Example

1996 Survey

Non-Toronto CBD Trips Growing Fastest

Projected 2021 Trips

The World Bank
Route Sketch Planning Example

Legend:
- Station
- 1000-metre Buffer
- 500-metre Buffer
- GO Rail

Enterprise Drive Option (4 stations)
- 2006 Population within 500 m = 5,000
- 2006 Employment within 500 m = 4,500
- 2006 Population within 1000 m = 15,400
- 2006 Employment within 1000 m = 14,100

Highway 7 Option (3 stations)
- 2006 Population within 500 m = 5,000
- 2006 Employment within 500 m = 3,400
- 2006 Population within 1000 m = 19,700
- 2006 Employment within 1000 m = 11,900
Summary

• Discussed six basic monitoring techniques pertaining to existing service and users

• *Remember*, good data is key to:
  – Understanding current markets and performance
  – Identifying new markets