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

### Focus of Discussion

- Market Factors and Demand Analysis
- Network and Route Design
- Measures & Standards
- Performance Analysis
- Cost Analysis and Financial Planning
- Schedule Building

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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.
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>
<th>Date</th>
<th>20/12/2006</th>
<th>Driver/Conductor Name</th>
<th>Zidane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Number</td>
<td>3213</td>
<td>Weather</td>
<td>Fair/28°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule Number</td>
<td>56-01</td>
<td>Operator</td>
<td>Zidane</td>
<td></td>
<td></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>36, 47</th>
<th>Weather</th>
<th>Rain/31°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Monday</td>
<td>Collector</td>
<td>Bagui</td>
</tr>
<tr>
<td>Date</td>
<td>14/02/2006</td>
<td>Maximum Load</td>
<td>☑</td>
</tr>
<tr>
<td>Location</td>
<td>7th Ave/26th St</td>
<td>Arrival Time</td>
<td>☐</td>
</tr>
<tr>
<td>Direction</td>
<td>Inbound</td>
<td>Departure Time</td>
<td>☑</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<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</td>
<td>9926</td>
<td>7:03</td>
<td>7:05</td>
<td>40</td>
</tr>
<tr>
<td>47</td>
<td>0101</td>
<td>7:05</td>
<td>7:06</td>
<td>43</td>
</tr>
<tr>
<td>47</td>
<td>9709</td>
<td>7:10</td>
<td>7:12</td>
<td>50</td>
</tr>
<tr>
<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
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>Bus Number</th>
<th>Schedule Number</th>
<th>Date</th>
<th>Weather</th>
<th>Observer</th>
<th>On</th>
<th>Off</th>
<th>Total</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2456</td>
<td>53-11</td>
<td>30/06/2006</td>
<td>Sun/33°</td>
<td>Chahiri</td>
<td>16</td>
<td>2</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marche</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>2</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6th/Main</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>2</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12th/Main</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28</td>
<td>3</td>
<td>32</td>
<td>No sign</td>
</tr>
<tr>
<td></td>
<td>15th/Main</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>25</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>City Terminal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32</td>
<td>2</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>62</td>
<td>62</td>
<td>124</td>
<td></td>
</tr>
</tbody>
</table>

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WORLD BANK
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
Load Profile Diagram
Grid or Crosstown Bus Route

![Bar Chart]

- Market: 0
- Offices: 30
- Bus Route: 20
- Shops: 30
- Bus Route: 0

Passengers Leaving Stop

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Load Profile Diagram
Express Bus Route

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

Passengers Leaving Stop

0 10 20 30 40 50 60
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/Smartcards.

**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
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
Example of Survey Card

REGISTER HERE TO WIN A FREE MONTHLY PASS!

Name: ___________________________ Ph: (_________)

Home address: ________________________________

City, State: __________________________ Zip: __________

ABOUT THIS TRIP

1. Where did you come from before you got on this bus/rapid service?
   - Work
   - College
   - Home
   - Other school
   - Shopping
   - Medical services
   - Social, church, or personal business
   - Other

2. How did you get to this bus/rapid service?
   - Walked
   - Driven my car
   - Rode my bicycle
   - Rode an RTA bus (Route: _________)
   - Rode another bus (Route: _________)
   - RTA Rapid / Red, Blue, or Green Line / Waterfront
   - Rode with someone who parked

3. Where are you going now?
   - Work
   - College
   - Home
   - Other school
   - Shopping
   - Medical services
   - Social, church, or personal business
   - Other

4. When you get off this vehicle, how will you get to your final destination?
   - Walk
   - Drive my car
   - Get picked up by someone
   - Rode my bicycle
   - Rode an RTA bus (Route: _________)
   - Rode another bus (Route: _________)
   - RTA Rapid / Red, Blue, or Green Line / Waterfront
   - Rode with someone who parked

5. How many days a week do you usually make this trip?
   - 7 days a week
   - 6 days a week
   - 5 days a week
   - 4 days a week
   - 3 days a week
   - 2 days a week
   - 1 day a week
   - Half a month
   - More than a month

6. How long have you been using the bus to make this trip?
   - Less than a month
   - 1 - 6 months
   - 7 - 11 months
   - 1 - 2 years
   - 3 - 4 years
   - More than 4 years

7. Do you have a car or other personal vehicle that you could have used to make this trip?
   - Yes
   - No

8. How many vehicles are in your household?
   - None
   - One
   - Two
   - Three
   - Four or more

9. If this bus/rapid service was not available, how would you make this trip?
   - Use my car
   - Use a taxi
   - Walk
   - Bicycle
   - Ride with a friend
   - I would not make this trip

ABOUT YOURSELF

10. I am...  [ ] Male  [ ] Female

11. I am
    [ ] African-American  [ ] Asian
    [ ] Hispanic  [ ] White
    [ ] Other

12. My age is...
    - Under 18
    - 18 to 24
    - 25 to 34
    - 35 to 44
    - 45 to 49
    - 50 to 64
    - 65 or more

13. Do you have an ADA card issued by RTA?
    - Yes
    - No

14. Do you have a Handicapped Parking Permit?
    - Yes
    - No

15. What is your total household income?
    - Under $10,000
    - $10,000 - $19,999
    - $20,000 - $29,999
    - $30,000 - $39,999
    - $40,000 - $49,999
    - $50,000 - $59,999
    - $60,000 - $79,999
    - $80,000 or greater

WHAT DO YOU THINK?

16. Please rank your satisfaction with RTA’s performance in the following areas. (5 is very satisfied and 1 is very dissatisfied)
   - Courteous drivers
   - Bus/rapid on-time
   - Clean RTA stopped
   - Dependable service
   - Adequate shelters
   - Convenient routes
   - Overall performance
   - Clean shelters
   - Crime level at RTA stops
   - Crime level on RTA vehicles

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></td>
<td></td>
<td>Fare Revenue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boardings by</td>
</tr>
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<td></td>
<td></td>
<td>Fare Category</td>
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<td></td>
<td>Boardings by</td>
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<td></td>
<td>Stop</td>
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<td>Attitudes</td>
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<tr>
<td>Driver/Conductor Count</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Point Count</td>
<td>XS</td>
<td></td>
</tr>
<tr>
<td>Ride Count</td>
<td>XS XS X X X X X X</td>
<td></td>
</tr>
<tr>
<td>Station Entry/Exit Counts</td>
<td>X</td>
<td>X X X X X X 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
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