The City Carrier Street Time Study

A Presentation to the Postal Rate Commission

December 3, 2003
Why A New City Carrier Street Time Study?

• The data used to support cost attribution in the CRA were dated.

• Old special studies lead to high CVs.

• PRC criticized the city carrier special studies for limited sample sizes, study design problems, and econometric deficiencies.
  – The PRC pointed out they are not a system-wide approach.
  – The PRC has criticized some of the special studies for using simulated instead of actual carrier behavior.
  – The old method required linking together the results of different special studies, which could be inconsistent.
Goals of the New Study

- Tailor the analysis to PRC methods and requirements.
- Focus on a system-wide approach.
- Increase accuracy: Avoid bias and reduce variance.
- Draw data in accordance with good statistical practice.
- Collect data from live carrier operations. Reflect current operations.
- Avoid prohibitive cost so as to promote updates.
- Construct a study architecture consistent with regular updates.
- Be consistent with ongoing USPS city carrier data collection efforts.
Overview of the Study

Measure volume variable street time by class and subclass

Step 1: Form time / cost pools representing street time activities.

Step 2: Measure volumes, by shape, that are collected and delivered.

Step 3: Measure the relationship between activity time and volume by shape.

Step 4: Distribute volume variable cost by class and subclass.
Research Work Plan

- Design the Study.
- Determine Sample Size And Method Of Data Collection
- Initial Training
- Beta Test
- Review Beta and Refine Study
- Final Training
- Data Collection
- Compile and Prepare Data
- Specify Econometric Models
- Calculate Cost Pools
- Estimate Variabilities
- Distribute Volume Variable Costs
Step 1:

Form time / cost pools representing street time activities.
Defining Street Time Activities

Goal: Define a set of activities consistent with carrier operations that are measurable and complete.

Discussions with operations experts revealed:

1. Street time delivery is done in “sections.”
   - Curbline
   - Park & Loop/Foot
   - Dismount
   - NDCBU
   - VIM
   - Central/Apartment

2. Parcels and Accountables cause retraces and customer contact.

3. “Access” and “Load” are not separable activities.

4. Carriers have a set of non-delivery activities that occur at specific locations:
   - Relay boxes
   - Preparation
   - Collection at SLB
Scanning the Carrier’s Day

- Cost pools are defined by sets of successive scans.
- All carrier street time is included.
- Carriers “self scan” using DC scanners.
- All sets of scan pairs were analyzed and activity pools defined.
  - 36 individual scans -- 1296 pairs were analyzed & defined.
- Most sets of scan pairs are “illegal.”
- Scans pairs must be “complete.”
  - All “Begin Delivery” scans must have a “Finish Delivery” scan
  - All “Start Activity” scans must have an “End Activity” scan
- Appropriate “nesting” is allowed.
  - Parcel/accountable delivery can occur within a section.
  - Lunch or break can occur in any activity.
Scanning the Carrier's Day
Measuring “Travel to and From the Route” Time

- Leave Office
- Arrive Dev. Park Pt.
- Start Route Activity
- End Route Activity
- Leave Dev. Park Pt.
- Arrive Office

Clock to Non Street Action
Clock off Non Street Action
Clock to Non Street Action
Clock off Non Street Action
Defining Time Pools

- Prep
- Travel to & from Route
- Delivery Within CurblineSections
- Delivery Within P&L/FootSections
- Delivery Within DismountSections
- Delivery at NDCBU Sections
- Delivery at VIM Sections
- Delivery in Central/ApartmentSections
- Travel Between Sections orActivities
- Parcel / Accountable Delivery
- Travel for Deviation Delivery
- Relay Boxes
- Collection at SLB (Express &Regular)
- Other (Break, etc.)
- Off Clock (Lunch, etc.)
Data Collection Effort

- National random sample.
- Data were collected at over 150 ZIP Codes.
- All routes in each ZIP Code were sampled.
- Over 3,400 routes were tested.
- Data collected for 2-week period, May-June 2002
- Over 35,000 route-day observations.
- Data were collected on carrier activities and volumes on each route.
# Street Time Proportions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop/Foot Delivery</td>
<td>30.71 %</td>
</tr>
<tr>
<td>Curbline Delivery</td>
<td>13.20%</td>
</tr>
<tr>
<td>NDCBU Delivery</td>
<td>5.15%</td>
</tr>
<tr>
<td>VIM Delivery</td>
<td>0.21%</td>
</tr>
<tr>
<td>Central Delivery</td>
<td>6.09%</td>
</tr>
<tr>
<td>Dismount Delivery</td>
<td>10.68%</td>
</tr>
<tr>
<td>Prep</td>
<td>4.79%</td>
</tr>
<tr>
<td>Travel To/From Route</td>
<td>8.32%</td>
</tr>
<tr>
<td>Network Travel</td>
<td>10.41%</td>
</tr>
<tr>
<td>Deviation Delivery Travel</td>
<td>0.47%</td>
</tr>
<tr>
<td>Parcel/Accountable Delivery</td>
<td>4.68%</td>
</tr>
<tr>
<td>Relay</td>
<td>1.25%</td>
</tr>
<tr>
<td>General Collection (SLB)</td>
<td>0.22%</td>
</tr>
<tr>
<td>Express Collection (SLB)</td>
<td>0.02%</td>
</tr>
<tr>
<td>Other (Break, etc.)</td>
<td>3.78%</td>
</tr>
</tbody>
</table>

**Average Street Time Per Route:**
- 5.49 hrs. (including lunch)
- 5.17 hrs. (excluding lunch)
Step 2:

Measure volumes, by shape, that are collected and delivered.
Collecting Volume Data

Volume data were collected on the same routes and days during which scans were collected.

Letters, Flats, and Sequenced Mail data were collected from Postal Service data systems.

Parcels, Accountables, and Collection volumes data were collected through a mail count for each route on a daily basis.

All data were double punched and verified.
# Average Daily Volumes Per Route

<table>
<thead>
<tr>
<th></th>
<th>Pieces</th>
<th>Per Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letters</td>
<td>1,870.6</td>
<td>3.82</td>
</tr>
<tr>
<td>Flats</td>
<td>602.0</td>
<td>1.23</td>
</tr>
<tr>
<td>Sequenced</td>
<td>180.4</td>
<td>0.37</td>
</tr>
<tr>
<td>Parcels</td>
<td>27.4</td>
<td>0.06</td>
</tr>
<tr>
<td>Accountables</td>
<td>3.4</td>
<td>0.01</td>
</tr>
<tr>
<td>Delivery Points</td>
<td>489.7</td>
<td></td>
</tr>
</tbody>
</table>
Step 3:

Measure the relationship between activity time and volume by shape.
Econometric Methods

Estimation is done at the Zip Code (Delivery Unit) Level
-- This is where management decisions are made.
-- Allows for all responses in carrier time to volume changes.
-- Resolves the “8 hour day” problem.

Model Specification: Generalized Quadratic
-- Permits but does not impose returns to scale and scope.
-- Effective at dealing with zero volumes.
-- Consistent with the PRC Econometric Load Time specification
-- Dominant part of attributable delivery time.

Separate Equations Regular Delivery and P/A Delivery
-- Allows accurate estimation of retrace and customer contact.
-- Accounts for relatively small parcel & accountable volumes.
Route adjustment process was explained by the PRC in its Opinion in Docket No. R80-1:

"Volume changes cause the amount of carrier time devoted to certain activities to change -- thus, total carrier time changes. Because of constraints and goals, such as the desire to equalize workload and limits on the amount of carrier work time per day, volume changes can result in route adjustments."
The Econometric Models

Regular Delivery Time

\[
DT_{it} = \beta_0 + \beta_1 L_{it} + \beta_{11} L_{ij}^2 + \beta_2 F_{it} + \beta_{22} F_{ij}^2 + \beta_3 S_{it} + \beta_{33} S_{ij}^2 \\
+ \beta_4 C_{it} + \beta_{44} C_{ij}^2 + \beta_5 SP_{it} + \beta_{55} SP_{ij}^2 + \beta_6 DP_i + \beta_{66} DP_i^2 \\
+ \beta_7 DN_i + \beta_{77} DN_{ij}^2 + \beta_{12} L_{it} * F_{it} + \beta_{13} L_{it} * S_{it} + \beta_{14} L_{it} * C_{it} \\
+ \beta_{15} L_{it} * SP_{it} + \beta_{16} L_{it} * DP_i + \beta_{17} L_{it} * DN_i + \beta_{23} F_{it} * S_{it} \\
+ \beta_{24} F_{it} * C_{it} + \beta_{25} F_{it} * SP_{it} + \beta_{26} F_{it} * DP_i + \beta_{27} F_{it} * DN_i \\
+ \beta_{34} S_{it} * C_{it} + \beta_{35} S_{it} * SP_{it} + \beta_{36} S_{it} * DP_i + \beta_{37} S_{it} * DN_i \\
+ \beta_{45} C_{it} * SP_{it} + \beta_{46} C_{it} * DP_i + \beta_{47} S_{it} * DN_i + \beta_{56} SP_{it} * DP_i \\
+ \beta_{57} SP_{it} * DN_i + \beta_{67} DP_i * DN_i + \epsilon_{it}
\]

Where:
- \( L \) = Letters
- \( F \) = Flats
- \( S \) = Sequenced Mail
- \( C \) = Collection Mail
- \( SP \) = “Small” Parcels
- \( DP \) = Delivery Points
- \( DN \) = Density: Delivery Points per Square Mile
The Econometric Models

Parcel/Accountable Delivery Time

\[ \text{PADT}_{it} = \beta_0 + \beta_1 \text{LP}_{it} + \beta_{11} \text{LP}^2 + \beta_2 \text{A}_{it} + \beta_{22} \text{A}^2 \]

\[ + \beta_3 \text{DP}_i + \beta_{33} \text{DP}^2 + \beta_{12} \text{LP}_{it} \times \text{A}_{it} \]

\[ + \beta_{13} \text{LP}_{it} \times \text{DP}_i + \beta_{13} \text{A}_{it} \times \text{DP}_i + \epsilon_{it} \]

Where:

LP = “Large” Parcels
A = Accountables
DP = Delivery Points
## Econometric Results

### Regular Delivery

<table>
<thead>
<tr>
<th></th>
<th>Zip-Day Mean</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter</td>
<td>35,317.00</td>
<td>20.7%</td>
</tr>
<tr>
<td>Flat</td>
<td>11,455.43</td>
<td>8.8%</td>
</tr>
<tr>
<td>Sequence</td>
<td>3,469.21</td>
<td>2.3%</td>
</tr>
<tr>
<td>Collection</td>
<td>5,134.68</td>
<td>6.6%</td>
</tr>
<tr>
<td>Small Parcel</td>
<td>368.01</td>
<td>1.4%</td>
</tr>
<tr>
<td>Delivery Pts.</td>
<td>9,318.52</td>
<td>67.3%</td>
</tr>
<tr>
<td>Density</td>
<td>72.84</td>
<td>-8.7%</td>
</tr>
<tr>
<td>R^2</td>
<td>0.8190</td>
<td></td>
</tr>
<tr>
<td># of obs</td>
<td>1,495</td>
<td></td>
</tr>
</tbody>
</table>

Combined Variability is 39.8%
Econometric Results

Parcel/Accountable Delivery

<table>
<thead>
<tr>
<th></th>
<th>Zip-Day Mean</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Parcel</td>
<td>141.30</td>
<td>26.8%</td>
</tr>
<tr>
<td>Accountable</td>
<td>57.79</td>
<td>25.3%</td>
</tr>
<tr>
<td>Delivery Pts.</td>
<td>8,067.43</td>
<td>49.9%</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.7058</td>
<td></td>
</tr>
<tr>
<td># of obs</td>
<td>1,475</td>
<td></td>
</tr>
</tbody>
</table>

These costs explicitly account for deviation deliveries, retraces, and customer contact.
## Volume Variabilities By Cost Pool

<table>
<thead>
<tr>
<th>Activity</th>
<th>Variability</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Delivery</td>
<td>39.8%</td>
<td>Econometric Model</td>
</tr>
<tr>
<td>Prep</td>
<td>na</td>
<td>Office Time</td>
</tr>
<tr>
<td>Travel To/From Route</td>
<td>40.7%</td>
<td>Burden Method</td>
</tr>
<tr>
<td>Network Travel</td>
<td>0%</td>
<td>Fixed</td>
</tr>
<tr>
<td>Parcel/Accountable Delivery</td>
<td>52.1%</td>
<td>Econometric Model</td>
</tr>
<tr>
<td>Relay</td>
<td>40.7%</td>
<td>Burden Method</td>
</tr>
<tr>
<td>General Collections</td>
<td>36.9%</td>
<td>PRC Method R2000-1</td>
</tr>
<tr>
<td>Express Collections</td>
<td>0%</td>
<td>PRC Method R2000-1</td>
</tr>
</tbody>
</table>
Step 4:

Distribute volume variable cost by class and subclass.
Cost Pools are by shape

Use CCS to distribute to class

Regular Delivery: Letters, Flats, Sequenced Mail, Small Parcels, Collection

P/A Delivery: Large Parcels and Accountables

Letter Cost Pool:
- STD. A ECR: 20%
- STD. A Reg: 10%
- STD A Non Profit: 13%
- FCSP: 26%
- FCPSRT: 31%
Conclusion

- Operational sound, statistically reliable study.
- Consistent with PRC requirements
- Improves accuracy, reflects actual carrier activity.
- Potentially updateable, possible links to Postal Service data systems.