Network Analysis
Transit Objectives

• Design and implement cross-corridor bus transit that serves demand over the short, mid, and long-term
• Deliver fast, reliable, comfortable service
• Create simple route structure
• Provide improved transit access to destinations
• Increase ridership in a financially sustainable manner
• Ease congestion on I-287 by moving people from cars to buses
• Provide transit capable of serving traditional and reverse commuters
New Data

Data Inputs
• Detailed TZx ridership data
  – Provides better transit performance metrics
• Regional Household Travel Survey (RHTS)
  – Provides a more complete picture of travel behavior and markets
• NYSDOT travel time/speed data from EZ-Pass transponders
  – Provides more robust estimates of I-287 travel times
• Downtown White Plains Traffic Analyses
  – Provides better estimates of travel times and access to MNR

Ongoing Analyses
• Traffic Counts on Route 59 from Suffern to Nyack
  – Provides a complete AM and PM picture of local conditions on 59
System Performance
Performance Metric #1: Ridership

TZx ridership crossing the bridge (May 2013)
Available capacity (extra seats) in the peak periods

<table>
<thead>
<tr>
<th>AM PEAK (6-10 AM)</th>
<th>Eastbound</th>
<th>Westbound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Trips</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Available Seats</td>
<td>1,310</td>
<td>630</td>
</tr>
<tr>
<td>Ridership</td>
<td>520</td>
<td>140</td>
</tr>
<tr>
<td>Extra Seats</td>
<td>+790</td>
<td>+490</td>
</tr>
<tr>
<td>Bus equiv.</td>
<td>14 buses</td>
<td>9 buses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PM PEAK (3-7 PM)</th>
<th>Eastbound</th>
<th>Westbound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Trips</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Available Seats</td>
<td>570</td>
<td>970</td>
</tr>
<tr>
<td>Ridership</td>
<td>180</td>
<td>480</td>
</tr>
<tr>
<td>Extra Seats</td>
<td>+390</td>
<td>+490</td>
</tr>
<tr>
<td>Bus equiv.</td>
<td>7 buses</td>
<td>9 buses</td>
</tr>
</tbody>
</table>

Source: Transport of Rockland May 2013 ridership data
Performance Metric #1: Ridership

<table>
<thead>
<tr>
<th></th>
<th>Existing AM</th>
<th>Proposed AM</th>
<th>Existing PM</th>
<th>Proposed PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Riders</td>
<td>23</td>
<td>28</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Avg Available Seats</td>
<td>34</td>
<td>29</td>
<td>32</td>
<td>27</td>
</tr>
</tbody>
</table>

Capacity: 57
Performance Metric #2: Load Factor

**What does it measure?**

Percentage of seats filled by passengers on all bus trips (passenger miles/seat miles)

Accounts for occupancy across various trip lengths

**Performance Standard**

85% (not to exceed) at the maximum load point during the peak
Performance Metric #2: Load Factor

Eastbound AM 4-hr morning peak, TZx Routes (May 2013)

Peak Load Factor Target = 85% (Occupancy at the peak location)
Performance Metric #2: Load Factor

Peak Load Factor Target = 85% (Occupancy at the peak location)

- Proposed Service - AM Peak: 40%
- TZx - AM Peak: 27%
- TOR - All (Daily): 19%
- TOR - 59 (Daily): 23%
- Bee-Line - All (Daily): 35%
- Sound Transit (Seattle): 38%
- Community Transit (suburban WA): 60%

Sound Transit and Community Transit presented as case studies previously.
Performance Metric #3: Farebox Recovery

What does it measure?
The percentage of operating costs recovered through fares

Performance Standard
The higher the ratio the less public subsidy is required
Performance Metric #3: Farebox Recovery

- Proposed Service: 40%
- TZx: 20%
- TOR - All: 30%
- Rockland Private Coaches: 73%
- Bee-Line: 36%
- Sound Transit (Seattle): 27%
- Community Transit (suburban WA): 46%

Sound Transit and Community Transit presented as case studies previously
Performance Metric #4: Subsidy per Passenger

What does it measure?
The amount of government subsidy paid per passenger

Performance Standard
No standard, but a subsidy in the $2 to $4 range is preferable
Performance Metric #4: Subsidy per Passenger

<table>
<thead>
<tr>
<th>Service</th>
<th>Subsidy per Passenger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Service</td>
<td>$4.00</td>
</tr>
<tr>
<td>TZx</td>
<td>$5.15</td>
</tr>
<tr>
<td>TOR - All</td>
<td>$2.81</td>
</tr>
<tr>
<td>Rockland Private Coaches</td>
<td>$4.42</td>
</tr>
<tr>
<td>Bee-Line</td>
<td>$2.09</td>
</tr>
<tr>
<td>Sound Transit (Seattle)</td>
<td>$4.76</td>
</tr>
<tr>
<td>Community Transit (suburban WA)</td>
<td>$3.96</td>
</tr>
</tbody>
</table>

Sound Transit and Community Transit presented as case studies previously.
System Performance: Summary

- Low ridership and a high number of available seats on TZx
- Simply adding more service will not increase ridership
- High subsidy costs
- Low profile
- Poor quality of passenger waiting areas
Proposed Improvements

- Short-term infrastructure improvements
  - New buses
  - Improved waiting areas
  - Transit priority measures
- Branded service
- Simple routing
- Integrated fare structure
- Connections to key destinations
Travel Demand
Why is Rockland Ridership So Low?

• Rockland market is relatively small, low-density, and dispersed around I-287
• Rockland-Manhattan job market mostly served by west-of-Hudson transit: buses and Pascack Valley and Port Jervis Lines
• Rockland-Manhattan via Hudson/Harlem Lines has low demand
• Rockland-Westchester is underserved
Rockland Travel Market Is Small

Transit capital and operating investment decisions made based on work trips

Source: RHTS, 2011
Rockland Work Trip Destinations

122,100 Daily Work Trips

- Intra-Rockland: 67,600
- To Westchester: 28,000
- To Manhattan: 13,700
- To Everywhere Else: 12,900

Source: RHTS, 2011
Rockland to Manhattan Work Mode Share

- **Bus (Private Coach) = 36%**
  - 4,660 commuters

- **Train = 28%**
  - 450 commuters use TZx and transfer to Hudson or Harlem Lines
  - 530 commuters drive into Tarrytown and transfer to the Hudson Line
  - 100 commuters take the ferry from Haverstraw to Ossining and transfer to the Hudson Line
  - 1,000 commuters take the Port Jervis or Pascack Valley Lines
  - 1,500 commuters drive to New Jersey and transfer to train or ferry

- **Auto = 36%**
  - 4,440 commuters

Source: RHTS, 2011
Limited Catchment

Source: RHTS, 2011
## Residential Density

### Density Benchmark: ~7 – 12 DUA for BRT

#### Rockland – I-287 and Route 59 Corridor (3-mile catchment)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Sub-Area</th>
<th>Area (ac)</th>
<th>Dwelling Units (DU)</th>
<th>Population</th>
<th>DU/acre (DUA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nyack</td>
<td>2,424</td>
<td>6,880</td>
<td>15,113</td>
<td>2.84</td>
</tr>
<tr>
<td>2</td>
<td>W. Nyack</td>
<td>3,376</td>
<td>3,274</td>
<td>8,163</td>
<td>0.97</td>
</tr>
<tr>
<td>3</td>
<td>Nanuet/Spring Valley</td>
<td>3,646</td>
<td>11,765</td>
<td>40,838</td>
<td>3.23</td>
</tr>
<tr>
<td>4</td>
<td>Suffern/Airmont</td>
<td>3,536</td>
<td>6,224</td>
<td>13,627</td>
<td>1.76</td>
</tr>
<tr>
<td>5</td>
<td>Palisades PnR</td>
<td>14,834</td>
<td>12,968</td>
<td>38,534</td>
<td>0.87</td>
</tr>
<tr>
<td>6</td>
<td>Nanuet PnR</td>
<td>10,356</td>
<td>19,593</td>
<td>70,204</td>
<td>1.89</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>38,171</strong></td>
<td><strong>60,704</strong></td>
<td><strong>186,479</strong></td>
<td><strong>1.59</strong></td>
</tr>
</tbody>
</table>

#### Westchester – I-287 and Route 119 Corridor (3-mile catchment)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Sub-Area</th>
<th>Area (ac)</th>
<th>Dwelling Units (DU)</th>
<th>Population</th>
<th>DU/acre (DUA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Tarrytown/Elmsford</td>
<td>5,615</td>
<td>12,686</td>
<td>31,668</td>
<td>2.26</td>
</tr>
<tr>
<td>12</td>
<td>Platinum Mile/Port Chester</td>
<td>6,041</td>
<td>16,653</td>
<td>42,911</td>
<td>2.76</td>
</tr>
<tr>
<td>13</td>
<td>Route 100</td>
<td>4,456</td>
<td>18,899</td>
<td>45,150</td>
<td>4.24</td>
</tr>
<tr>
<td>14</td>
<td>Downtown White Plains</td>
<td>567</td>
<td>6,047</td>
<td>12,205</td>
<td>10.66</td>
</tr>
<tr>
<td>10</td>
<td>North White Plains</td>
<td>11,848</td>
<td>23,652</td>
<td>59,991</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>28,528</strong></td>
<td><strong>77,937</strong></td>
<td><strong>191,925</strong></td>
<td><strong>2.73</strong></td>
</tr>
</tbody>
</table>
Residential Density

Dwelling Units per Acre

Density Benchmark for efficient BRT performance

Rockland
Westchester

Westchester average density 2.7 Du/acre
Rockland average density 1.6 Du/acre

Rail Catchment Zones
Travel Demand: Summary

- Small transit market (all markets, all trips) in relation to Westchester
- Smaller cross-county transit market focused around I-287 and White Plains
- Major origin in the Spring Valley/Monsey/Nanuet area has other, faster transit options serving Manhattan than eastern Rockland County
- Cross-corridor Manhattan demand has relatively small Rockland origins (i.e., Nyack, residential areas around the Palisades Center)
Travel Time Estimates

- Transit schedules
- Drive-time surveys
- Traffic analyses
- Travel speed data
Traffic Performance – AM

Eastbound I-287: Exit 9 (Tarrytown) to Exit 5 (White Plains)

• 12 Observation Days

TRAVEL TIME (6:00 – 7:45) = 6 MIN

TRAVEL TIME (8:00 – 9:15) = 18 MIN

TRAVEL TIME (9:15 – 10:00) = 9 MIN
Traffic Performance – PM

Westbound I-287: Exit 5 (White Plains) to Exit 9 (Tarrytown)

- 12 Observation Days

TRAVEL TIME (3:00 – 7:00) = 4 MIN
Travel Times

Trip: Palisades Center to Tarrytown / White Plains
Travel Times – Summary

Palisades Center to Tarrytown / White Plains – 7 AM

Tarrytown

Existing Travel Time: 23
Projected Travel Time: 19

White Plains

Existing Travel Time: 27
Projected Travel Time: 19
Travel Times – Summary

Palisades Center to Tarrytown / White Plains – 8 AM

Tarrytown

<table>
<thead>
<tr>
<th>Existing Travel Time</th>
<th>Projected Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>19</td>
</tr>
</tbody>
</table>

White Plains

<table>
<thead>
<tr>
<th>Existing Travel Time</th>
<th>Projected Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>29</td>
</tr>
</tbody>
</table>
Travel Times – Summary

Tarrytown / White Plains to Palisades Center – 5 PM

**Tarrytown**

- Existing Travel Time: 24
- Projected Travel Time: 21

**White Plains**

- Existing Travel Time: 26
- Projected Travel Time: 19
Travel Times

Trip: Suffern to Tarrytown / White Plains
# Travel Times – Summary

## Suffern to Tarrytown / White Plains – 7 AM

### Tarrytown

<table>
<thead>
<tr>
<th></th>
<th>Existing Travel Time</th>
<th>Projected Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72</td>
<td>57</td>
</tr>
</tbody>
</table>

### White Plains

<table>
<thead>
<tr>
<th></th>
<th>Existing Travel Time</th>
<th>Projected Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>76</td>
<td>57</td>
</tr>
</tbody>
</table>

---

A map showing the travel routes from Suffern to Tarrytown and from Tarrytown to White Plains.
Travel Times – Summary

Suffern to Tarrytown / White Plains – 8 AM

**Tarrytown**
- Existing Travel Time: 72
- Projected Travel Time: 57

**White Plains**
- Existing Travel Time: 87
- Projected Travel Time: 67
Travel Times – Summary

Tarrytown / White Plains to Suffern – 5 PM

<table>
<thead>
<tr>
<th>Tarrytown</th>
<th>White Plains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Travel Time</td>
<td>77</td>
</tr>
<tr>
<td>Projected Travel Time</td>
<td>58</td>
</tr>
</tbody>
</table>

The map shows the travel routes from Tarrytown to Suffern and from White Plains to Suffern at 5 PM.
Travel Times – Summary

- Interventions will reduce travel times
- AM Peak
  - 7 am – Travel times from Rockland to Tarrytown / White Plains are comparable
    - Conditions along 287 EB in Westchester are stable
  - 8 am – Travel time to White Plains increases
    - Conditions along 287 EB in Westchester deteriorate post-7:45 am
    - Longer-term investment needed to address this
- PM Peak
  - Travel times from Tarrytown / White Plains to Rockland are comparable
    - Conditions along 287 WB in Westchester are stable
Travel time is only part of the story…
Transit Connections

Number of intermodal transit connections available at:

• **White Plains**  29
  – MNR Harlem Line
  – Bee Line 1W, 3, 5, 6, 11, 12, 13, 14, 15, 17, 20, 21, 27, 40, 41, 60, 62, 63, 77
  – Shuttles to Platinum Mile (6)
  – OWL
  – TLC
  – I-Bus

• **Tarrytown**  3
  – MNR Hudson Line
  – Bee-Line 1T, 13
# Train Frequencies

AM Metro-North Departures, 6:00 – 8:15 am

<table>
<thead>
<tr>
<th>Departure Type</th>
<th>From Tarrytown</th>
<th>From White Plains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Express</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Local</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>21</td>
</tr>
</tbody>
</table>
Travel Times to GCT

Times shown are average of inbound trip times between 6:00 and 8:15 am (anticipating pre-9:00 am arrival to GCT)
Monthly Train Fares

- Tarrytown to GCT: $289
- White Plains to GCT: $249
Discussion