• **Metrorail**
  – Size -106.3 miles and 86 stations
  – Annual Ridership – 217 million trips
  – Average Weekday Ridership – 744 thousand
  – Fleet Size – 1,142 rail cars

• **Metrobus**
  – Size – 323 routes on 169 lines
  – Annual Ridership - 125 million trips
  – Average Weekday Ridership – 436 thousand
  – Fleet Size – 1,536 buses
**MetroAccess**
- Size – provides trips that begin and end less than 3/4 of a mile from a Metrorail station or bus route within the Washington Metropolitan Area Transit Zone
- Annual Ridership - 2.3 million trips
- Average Weekday Ridership - 7 thousand
- Fleet Size – 600

**FY2013 Budget**
- Capital Budget - $905 million
- Operating Budget - $1.576 billion
Asset Life Cycle Cost
Complete View of Asset Life Cycle Cost

Acquisition
Operation, Maintenance, Renewal and Disposition

Federal Transit Administration
State of Good Repair Roundtable
July 16-18, 2012 ▪ Philadelphia, PA
Capturing Asset Life Cycle Cost

Operation and Maintenance Cost (Maximo and other systems)
- Routine Cost
- Maintenance Cost
- Service Disruption

Age and Reliability (Capital Budget Request – Decision Lens)

Asset Replacement/Renewal/Disposition (PeopleSoft)
Life Cycle Management Process

Policies, Procedures, and Management

Inventory of Assets

Data Collection and Condition Assessment

Third Party Condition (TGV, Holland, Sperry, Etc.)

Work (Corrective and Preventive)

Inspection (Track Walker)

Method to Store and Analyze

Maximo
PeopleSoft
Fleet Watch
Rail Performance Monitoring
Optram

4th Federal Transit Administration
State of Good Repair Roundtable
July 16-18, 2012 ■ Philadelphia, PA
## Example of Cost Collection

### Tasks for Work Order 8626538

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Task</th>
<th>Description</th>
<th>Component</th>
<th>Work Acc</th>
<th>Reason</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>Found multiple PRR drop outs and a couple of line voltage out</td>
<td>000-300-004-003-016</td>
<td>40</td>
<td>100</td>
<td>COMP</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>Reviewed logs, performed visual inspection of pcc, no discreet</td>
<td>000-300-004-003-013</td>
<td>20</td>
<td>82</td>
<td>COMP</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>DURING A TRUNKETED PTU MONITORED TT, FOUND FRONT SI</td>
<td>000-300-004-003-012</td>
<td>45</td>
<td>84</td>
<td>COMP</td>
</tr>
</tbody>
</table>

### Labor

<table>
<thead>
<tr>
<th>Labor ID</th>
<th>Labor Code</th>
<th>Name</th>
<th>Start Time</th>
<th>Finish Time</th>
<th>Hours</th>
<th>Approved?</th>
<th>Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>E01027</td>
<td>Knight, Arthur B</td>
<td>12:30</td>
<td>14:00</td>
<td>1:30</td>
<td>B</td>
<td>7/3/12</td>
</tr>
<tr>
<td>10</td>
<td>E013788</td>
<td>Koeko, Leroy William</td>
<td>12:30</td>
<td>14:00</td>
<td>1:30</td>
<td>B</td>
<td>7/3/12</td>
</tr>
<tr>
<td>10</td>
<td>E001697</td>
<td>Dudley, Wayne</td>
<td>12:30</td>
<td>14:00</td>
<td>1:30</td>
<td>B</td>
<td>7/3/12</td>
</tr>
<tr>
<td>20</td>
<td>E001420</td>
<td>Wright, Yorin L</td>
<td>16:00</td>
<td>22:00</td>
<td>6:00</td>
<td>B</td>
<td>7/3/12</td>
</tr>
<tr>
<td>30</td>
<td>E003223</td>
<td>Oksodu, Cyprian I</td>
<td>0:00</td>
<td>4:00</td>
<td>4:00</td>
<td>B</td>
<td>7/3/12</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th>Task Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Storeroom</th>
<th>Issue Type</th>
<th>Bin</th>
<th>Line Cost</th>
<th>Warranty?</th>
</tr>
</thead>
<tbody>
<tr>
<td>C13460866</td>
<td>BOARD, PRINTED CIRCUIT:5K, CAF</td>
<td>4.00</td>
<td>400</td>
<td>ISSUE</td>
<td>XXXXXX</td>
<td>1,988.9184</td>
<td>N</td>
</tr>
</tbody>
</table>

Select Labor | Select Planned Labor | New R
Select Materials | Select Reserved Items | Select Asset Spare Parts | New R
Example of Cost Collection

<table>
<thead>
<tr>
<th>Asset Name:</th>
<th>B2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Belong To:</td>
<td>B2000</td>
</tr>
<tr>
<td>Domicile Location:</td>
<td>6046</td>
</tr>
<tr>
<td>Operational Status:</td>
<td>REM FR SER</td>
</tr>
<tr>
<td>Status Reason:</td>
<td>STORAGE</td>
</tr>
<tr>
<td>Facility Location:</td>
<td></td>
</tr>
<tr>
<td>Tag/Alias:</td>
<td></td>
</tr>
<tr>
<td>Barcode:</td>
<td></td>
</tr>
</tbody>
</table>

Maintenance Office: BMNT-BMNT-ADMIN
Owning Office: BMNT-BMNT-BMT

Maintenance Cost

- Total Cost: 137,811.1200
- YTD Cost: 76,586.5000

Rail Car Restriction

- Position: |
- Line: |
- Yard: |
- RPM Restriction: |
- Restriction Date: |

Chain Marker Location

- Chain Marker: |
- Offset(ft): |
- Y-Offset(ft): |

Start Location

- Year: 2000
- Make: ORION VI
## Example of Data Analysis of Cost

<table>
<thead>
<tr>
<th>Fleet Age</th>
<th>SUBFLEET</th>
<th>Miles</th>
<th>Fuel Gallons</th>
<th>Fuel $ Cost</th>
<th>Fuel Cost</th>
<th>Total $ Cost</th>
<th>Avg MPG</th>
<th>Cost Per Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 4</td>
<td>CLEAN DIESEL</td>
<td>4,310,560</td>
<td>1,217,383</td>
<td>2,678,243</td>
<td>2.20</td>
<td>6,228,167.35</td>
<td>3.56</td>
<td>$ 1.21</td>
</tr>
<tr>
<td>2001 9</td>
<td>CNG</td>
<td>4,871,058</td>
<td>1,391,662</td>
<td>3,345,993</td>
<td>1.68</td>
<td>6,135,726.45</td>
<td>2.48</td>
<td>$ 1.26</td>
</tr>
<tr>
<td>2002 8</td>
<td>CNG</td>
<td>110,667</td>
<td>44,950</td>
<td>75,516</td>
<td>1.68</td>
<td>120,068.96</td>
<td>2.48</td>
<td>$ 1.09</td>
</tr>
<tr>
<td>2003 5</td>
<td>CNG</td>
<td>3,824,621</td>
<td>1,180,451</td>
<td>1,983,157</td>
<td>1.68</td>
<td>4,225,234.08</td>
<td>3.24</td>
<td>$ 1.10</td>
</tr>
<tr>
<td>2005 8</td>
<td>Orion VII (2003) 2500 CNG 40ft, Cummins</td>
<td>938,326</td>
<td>314,872</td>
<td>528,985</td>
<td>1.68</td>
<td>1,078,279.84</td>
<td>2.96</td>
<td>$ 1.15</td>
</tr>
<tr>
<td>2007 3</td>
<td>Orion VII (2003) 2700 40ft</td>
<td>1,175,675</td>
<td>280,598</td>
<td>471,405</td>
<td>1.68</td>
<td>1,039,564.11</td>
<td>4.15</td>
<td>$ 0.88</td>
</tr>
<tr>
<td>2008 2</td>
<td>Orion VII (2003) 2800 CNG</td>
<td>384,527</td>
<td>178,735</td>
<td>300,274</td>
<td>1.68</td>
<td>807,872.52</td>
<td>2.15</td>
<td>$ 2.10</td>
</tr>
<tr>
<td>1997 13</td>
<td>NABI 5400 60 FT BRT</td>
<td>347,363</td>
<td>200,932</td>
<td>337,565</td>
<td>1.68</td>
<td>773,291.41</td>
<td>1.75</td>
<td>$ 2.33</td>
</tr>
<tr>
<td>1997 13</td>
<td>Orion V (1997) 42, 43, 44/40ft</td>
<td>4,203,661</td>
<td>1,095,606</td>
<td>2,410,332</td>
<td>2.20</td>
<td>5,642,466.22</td>
<td>3.84</td>
<td>$ 1.32</td>
</tr>
<tr>
<td>2000 10</td>
<td>Orion VI (2000) Low Floor</td>
<td>2,229,177</td>
<td>571,638</td>
<td>1,267,383</td>
<td>2.20</td>
<td>2,977,243.38</td>
<td>3.90</td>
<td>$ 1.34</td>
</tr>
<tr>
<td>2003 7</td>
<td>Neoplan (2003) 8300 60ft</td>
<td>326,428</td>
<td>158,628</td>
<td>349,422</td>
<td>2.20</td>
<td>714,051.81</td>
<td>2.06</td>
<td>$ 2.19</td>
</tr>
<tr>
<td>2006 4</td>
<td>New Flyer (2006) 6000 Hybrid</td>
<td>1,887,460</td>
<td>421,346</td>
<td>926,962</td>
<td>2.20</td>
<td>1,923,000.66</td>
<td>4.46</td>
<td>$ 1.02</td>
</tr>
<tr>
<td>2009 1</td>
<td>New Flyer 37ft Hybrid</td>
<td>639,881</td>
<td>132,652</td>
<td>291,615</td>
<td>2.20</td>
<td>644,160.15</td>
<td>4.07</td>
<td>$ 1.01</td>
</tr>
<tr>
<td>2009 1</td>
<td>New Flyer BRT (6301-641)</td>
<td>4,545,866</td>
<td>1,137,171</td>
<td>2,021,776</td>
<td>2.20</td>
<td>4,716,552.39</td>
<td>4.36</td>
<td>$ 0.95</td>
</tr>
<tr>
<td>2009 1</td>
<td>New Flyer BRT 62ft (5431-5452)</td>
<td>618,085</td>
<td>157,977</td>
<td>347,849</td>
<td>2.20</td>
<td>694,248.70</td>
<td>3.90</td>
<td>$ 1.12</td>
</tr>
<tr>
<td>2010 0</td>
<td>New Flyer BRT (6462-6609)</td>
<td>5,620,133</td>
<td>1,336,303</td>
<td>2,939,866</td>
<td>2.20</td>
<td>4,925,327.25</td>
<td>4.23</td>
<td>$ 0.88</td>
</tr>
</tbody>
</table>
Management of Life Cycle Cost – Key Component

1. Ability to identify the lowest maintainable element

2. Investigation of Service Disruptions to determine causes
   – Reliability Analysis
   – Engineering Modifications to improve reliability
Benefits and Challenges

• Benefits
  – Ability to track rising operating and maintenance cost
  – Ensures that prescribed maintenance is done
  – Ability to direct resources to priority needs
  – Have a database of the asset life expectancy based on age

• Challenges
  – Ability to identify the lowest maintainable asset element, similar to rolling stock
  – Refine asset life expectancy based on performance
  – Determining the optimal schedule to perform the optimal work
Capturing asset life-cycle cost - Future
Capturing Asset Life Cycle Cost - Future

Operation and Maintenance Cost (Maximo)
- Routine Cost
- Maintenance Cost
- Service Disruption

More Monitoring and Reliability Analysis on Asset Components (influence projects submitted during Budget Call)

Asset Replacement/Renewal/Disposition (PeopleSoft)
• Benefits
  – Able to identify rising operating and maintenance cost by lowest maintainable element of the asset
  – Historical data
    • Based on performance instead of age and service disruption

• Changes
  – Establish enterprise wide policies and procedures
  – Set performance standards and operational goals for the lowest maintainable element of the asset
    • Including infrastructure assets
  – Monitor performance
  – Predict preventive maintenance needs
  – Determine the optimal schedule to perform the optimal work