Capital Needs Inventory (CNI)

FTA 2017 Transit Asset Management Roundtable

August 29, 2017
What is the CNI?

- A ten-year prioritized list of capital investment needs (2017 to 2026)
- Renew, replace existing assets to achieve a State of Good Repair (SGR)
- New capital investments needed to:
  - Match capacity to near-term demand
  - Address compliance needs (e.g., NTSB, FTA, etc.)
- Provides critical input to Capital Funding Agreement (CFA)
What did the CNI Achieve?

- Established a **data-driven, risk-based asset evaluation framework**, with simple and transparent prioritization criteria
- Built an **asset inventory** to quantify investment needs utilizing previous and ongoing work
- Advanced critical **safety or compliance needs** and allowed decision makers to understand the **magnitude of investment needs**
- Delivered **defensible, high-level investment needs**, provided critical input to subsequent CFA
CNI Evolution and Improvements

Quality of Data, Level of Detail

2008-2010
- Professional Judgement
- Call for Projects
- Voting Methodology

2016
- State of Good Repair (SGR)
  - Asset Inventory
  - Age-based Conditions Assessment
  - TERM Lite Prioritization Routine
  - Call for New Needs

2018 +
- Asset & Component Inventory
- Physical Conditions Assessment
- Scoring Methodology (TERM Lite)
- Investment Scenarios

Call for New Needs
Overview of CNI Methodology

- Inventory of existing capital assets was updated from previous TERM Lite work at WMATA
- SGR Needs forecast and prioritized in customized version of TERM Lite (the ‘engine’ for the CNI Database)
- New Investment needs gathered through call for projects and prioritized separately within CNI Database
Choosing Prioritization Criteria

- Quantifiable and data-driven
- Kept to fewer than 5 for transparency and simplicity
- Cross functional leadership (the Capital Program Advisory Committee, CPAC) guided selection of criteria and measures
- Align to strategic goals
### Measuring CNI Prioritization Criteria

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Scoring Guidelines</th>
<th>Scoring Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety &amp; Security</td>
<td>• Static Scoring: Asset type&lt;br&gt;• 1 is low risk of a safety or security incident; 5 is high risk of an incident Based on industry standard (MIL-STD-882E)&lt;br&gt;• Data: Input from safety &amp; security experts, asset owners and CAPS</td>
<td></td>
</tr>
<tr>
<td>Asset Condition</td>
<td>• Dynamic Scoring: Asset condition&lt;br&gt;• Based on FTA 5-point condition rating scale: 1 is Poor; 5 is Excellent&lt;br&gt;• For priority, condition ratings inverted: asset in Excellent condition (5) scored 1 as low priority and an asset in Poor condition (1) scored 5 as high priority&lt;br&gt;• Data: Some TAICA ratings &amp; Metro modified decay curves</td>
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<tr>
<td>Service Delivery</td>
<td>• Dynamic Scoring: Asset type and condition&lt;br&gt;• 1 is 0-5% impact on customer satisfaction; 5 is over 20% impact on customer satisfaction (i.e., service reliability)&lt;br&gt;• Data: Customer Survey data, Modal data and critical/support asset data</td>
<td></td>
</tr>
<tr>
<td>Ridership Impacts</td>
<td>Static Scoring: Remains fixed throughout years of analysis&lt;br&gt;1 is little impact (less than 700 riders); 5 is extreme impact (more than 700,000 riders)&lt;br&gt;Logarithmic scale based on riders served by asset (location-driven)&lt;br&gt;Data: Ridership by mode</td>
<td></td>
</tr>
</tbody>
</table>
## Service Delivery Example

### Metrobus, Metrorail, & MetroAccess Scores:

<table>
<thead>
<tr>
<th>Percent impact on customer satisfaction</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 20%</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>20-15%</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-10%</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-5%</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-0%</td>
<td>1</td>
<td></td>
<td></td>
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</table>

### Examples from CY15 aggregate results

- Reliability for bus and rail
- On-time Performance (OTP)
- Rail signage & graphics, faregates, bus climate control
- Train climate control, train cleanliness, station climate control, bus fareboxes, bus stop signage
- Vertical transport (ELES), station lighting, paper signage, station/train & bus announcements

### Distribute by: Minutes of Delay (Metrorail), Missed Trips (Metrobus), and Fleet Failures (MetroAccess)

### Metrorail Asset Types

<table>
<thead>
<tr>
<th>Asset Types</th>
<th>Total Minutes Delay</th>
<th>Priority Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles: Rail Cars</td>
<td>8,917</td>
<td>5</td>
</tr>
<tr>
<td>Systems: Electrification</td>
<td>3,245</td>
<td>5</td>
</tr>
<tr>
<td>Systems: Train Control</td>
<td>2,488</td>
<td>5</td>
</tr>
<tr>
<td>Guideway: Trackwork</td>
<td>2,329</td>
<td>5</td>
</tr>
<tr>
<td>Systems: Communications</td>
<td>186</td>
<td>4</td>
</tr>
<tr>
<td>Systems: Utilities</td>
<td>15</td>
<td>4</td>
</tr>
</tbody>
</table>

Washington Metropolitan Area Transit Authority
Weighting Methodology

- Risk-based priority scoring chosen based on FTA’s guidance and collaborative risk management (CRM) work
- WMATA’s version of TERM Lite was modified to support this approach
- Uses criteria to represent either the likelihood or consequence of asset failure
  - Asset condition as likelihood
  - Weighted average of other criteria as consequence

<table>
<thead>
<tr>
<th>Asset Condition</th>
<th>Probability of Failure Score</th>
<th>Weighted Avg. Consequence of Failure Score</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>X%</td>
<td>X% + Y% + Z% =100%</td>
<td>X%</td>
</tr>
<tr>
<td>Service Delivery</td>
<td>X%</td>
<td>X% + Y% + Z% =100%</td>
<td>Y%</td>
</tr>
<tr>
<td>Safety &amp; Security</td>
<td>Y%</td>
<td>X% + Y% + Z% =100%</td>
<td>Z%</td>
</tr>
<tr>
<td>Number of Impacted Riders</td>
<td>Z%</td>
<td>X% + Y% + Z% =100%</td>
<td>X% + Y% + Z% =100%</td>
</tr>
</tbody>
</table>
Priority Status Assignment

“Compliance” status identified by

- Compliance issues (change in regulation or code)
- Accidents or safety concerns (damaged, requires replacement in audit, investigation)
- Technological obsolescence (no longer fit for service)

Complete review of existing inventory assigned “Compliance” to individual assets for SGR scoring

Project managers submitted New Investment Needs and designated projects by “Compliance” definitions above

“Compliance” scoring forces maximum conditions score
Developing WMATA’s Risk-based Weights: Facilitated Discussion

How WMATA developed unique criteria weights:

- Worst case risk outcomes defined for “consequence” criteria through the measurement process

- Real world experience with these outcomes discussed with CPAC to baseline risks to the agency:
  - Financial impacts
  - Stakeholder credibility

- Scenario weights for criteria were developed from both facilitated team rankings of outcomes and individual CPAC surveys
Four Weighting Scenarios Tested

- Throughout the CNI ‘testing’ period both SGR and New Investment Needs were tested against four scenarios.
- Each scenario focused on a different consequence over others.
- CPAC members reviewed results and chose Safety & Security Focus for CNI.

<table>
<thead>
<tr>
<th>Proposed Test Scenarios</th>
<th>Focus of Consequence Weights</th>
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<tbody>
<tr>
<td>Scenario 1</td>
<td>Service Delivery</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>Safety &amp; Service Focus</td>
</tr>
<tr>
<td>Option 1</td>
<td>Safety &amp; Security Driven</td>
</tr>
<tr>
<td>Option 2</td>
<td>Riders Impacted</td>
</tr>
</tbody>
</table>
State of Good Repair Needs
Unconstrained 10-Year Estimate

- SGR needs over the 10-year period total to $17.4 billion
  - Needs unconstrained by budget, time and execution capacity
- Current backlog estimated to be about $6.5 billion
SGR Priority Results

- All SGR needs score above 25 with most scoring above 50 (out of 100 possible points)
- Guideway elements and rail Systems score the highest
- Railcars are the highest scoring Vehicles (due to ridership impacts)
- All Stations and Facilities needs score in bottom half of SGR needs
Profile illustrates the relationship between likelihood and consequence of failure.

- Tunnels have the worst condition (overall) and highest likelihood of failure due to water intrusion.
- Rail revenue vehicles have the highest consequence of failure.
Priority Tiers: For Comparison to CIP Funding

- **Methodology**
  - Create tiers for easier interpretation/communication of needs and comparison to current CIP funding
  - More evenly distributed investment packages in terms of priority (i.e., three tiers versus 300+ “projects”)

- **Tier 1** are the highest priority assets (scoring greater than 70 out of 100)
  - Tier 1 is only SGR-related needs

- **Tier 2** includes assets scoring from 40 to 69

- **Tier 3** includes assets or projects scoring less than 40
  - Tier 3 is a mix of SGR and New needs
**Ten-Year Combined Needs**

<table>
<thead>
<tr>
<th>Cost</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| - Total Capital Needs: $25.2 billion  
  - SGR, $17.4B  
  - New needs, $7.0B  
  - Unallocated capital expenses, $800M  
    - Minor repairs and maintenance  
    - IT, engineering, environmental services | - Needs are not projects – yet. They inform decisions about project development resources.  
- Once project development and evaluation are complete, *projects* may advance into construction, acquisition  
- Needs estimate will be refined as Transit Asset Inventory & Condition Assessment matures |