SERVICE DELIVERY POLICY WORKSHOP

October 20, 2016
Office of Performance Management and Innovation, Planning and Scheduling Department, Office of Transportation Planning
Agenda

• Context
  • Framework for service planning, the bus network

• Process
  • Current process, proposed process

• Measures
  • Proposed Service Delivery Policy

• Trade-Offs
  • Examples of trade-offs

• Next Steps
  • FMCB approval of proposed process, Service Delivery Policy, and trade-offs
Overview

• The goal of the service delivery process is to produce measurable improvements for MBTA customers in a timely manner

• Today’s presentation/discussion outlines staff recommendations for moving forward to improve service delivery

• The recommended process focuses on the bus network
  • Service planning for rapid transit will be based on the line-by-line capacity planning work already underway
1. Define and prioritize **the problems and tradeoffs**
2. Set **measures** to evaluate key attributes
3. Do baseline **analysis** of how current service performs
4. Set **targets** (short-term and aspirational)
5. Determine **tactical tools** to use to improve service
6. **Implement** service and other changes
7. **Evaluate** progress toward achieving targets
Tactical toolbox for bus service improvements

Operational Changes
• All door boarding and faster fare collection
• Improved dispatching tools and procedures

Partnerships with municipalities
• Bus lanes
• Signal priority and queue jumps

Private sector partnerships

Capital Projects
• Fleet facilities
• Additional buses

Service Changes
• Routes alignment and stop spacing
• Frequency and span changes

Pilots are one method to test different tactics
Data

• We have a lot of data:
  • Surveys, ridership statistics, reliability performance, crowding models, demographics, etc.

• Our proposed measures are based on the best available data

• Our data is limited by availability and data quality

• We use models to measure passenger experience

• We shouldn’t limit our problem definition by where we have data
The Bus Network

• 175 directly-operated routes, 5 contracted-bus routes
• 446,700 daily riders
• Approximately half of all bus trips include a transfer

Types of bus routes
• Local bus routes with full weekday service
• Key bus routes with longer span and higher frequency (19 routes)
• Commuter bus route with limited peak-direction trips, includes express bus routes with limited stops

<table>
<thead>
<tr>
<th>Type</th>
<th>Percent of Routes</th>
<th>Total Weekly Ridership</th>
<th>Percent of Bus Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Bus</td>
<td>73%</td>
<td>1,362,756</td>
<td>55%</td>
</tr>
<tr>
<td>Key Bus</td>
<td>11%</td>
<td>1,029,512</td>
<td>42%</td>
</tr>
<tr>
<td>Commuter Bus</td>
<td>24%</td>
<td>68,014</td>
<td>3%</td>
</tr>
</tbody>
</table>

Service organized into 7 bus districts
Bus Districts

MBTA Bus Routes by District
- Albany / Cabot
- Arbonway
- Charlestown / Fellsway
- Lynn
- Somerville / N. Cambridge
- Southampton
- Quincy
- Private Carriers
Bus Districts: Albany / Cabot
Bus Districts: Arborway
Bus Districts: Southampton

MBTA Bus Routes by District
- Albany / Cabot
- Arborway
- Charlestown / Fellsway
- Lynn
- Somerville / N. Cambridge
- Southampton
- Quincy
- Private Carriers

1. **Context**
1. The Problem

Bus Districts: Quincy
Survey Results

Factors that “frequently” prevent bus riders from using the MBTA

Source: Service Standards Survey, July 2015; Total responses 6027
PROCESS
Current Service Planning Process

- Quarterly changes
  - Focus on bus, heavy rail, and light rail
  - Scope: Schedule updates; individual stop adjustments
  - No “major service changes”
  - Within existing budget and fleet

- Biennial Service Plan
  - Focus on bus
  - Scope: Reallocation of resources between routes; re-routing; corridor- or route-level stop consolidation
  - Individual or collective changes may be defined as “major service changes”
  - Historically has assumed the existing operating budget and fleet
  - The last Service Plan was conducted in 2008
Proposed Service Planning Process

“Rolling” District-Level Bus Service Planning

• Replace static biennial process with a constant process that addresses bus districts on a rolling basis
• First district process would take approximately 1 year
• Afterward complete 2-3 districts annually so all service revisited every 3 years
• Process includes a Schedule Rebuild and Service Plan for each district
  • Schedule rebuild updates all running times, matches frequency and span to demand, and addresses crowding
  • Service Plan modifies routes and coverage to reflect travel patterns and improves service using all the tactics in the toolkit
Proposed Service Planning Process

“Rolling” District-Level Process

Start with one district...

- Schedule Rebuild – 6 months to implement
  - Analyze data to update run times for every route-variant-direction combination
  - Build garage-level vehicle schedule for all routes
  - Develop a garage-level operator schedule for all routes
  - Operator pick process
  - Prepare rating for operations
  - Day of service delivery

- Service Plan – 6 months to implement
  - Analyze data to change routing, frequencies, or span
  - Public process to collect input
  - Build garage-level vehicle schedule for all routes
  - Develop a garage-level operator schedule for all routes
  - Operator pick process
  - Public process to present the plan
  - Prepare rating for operations
  - Day of service delivery
Proposed Service Planning Process

Network Optimization

• Priorities and key measures for optimizing network determined as part of the Strategic Plan
  • How to measure future demand
  • Where we need to add capacity
  • How should we measure connectivity
• Modify network and coverage to reflect travel patterns
  • Analyze regional origins and destinations and future development
• Planning for all modes in the network
  • Improve reliability and capacity through infrastructure investments on subway and light rail
  • Evaluate commuter rail schedules and coverage and pros/cons of “commuter” vs “regional” rail
MEASURES
Service Delivery Policy addresses service availability, service quality, and service planning measures.

**Service availability measures**
1. Coverage
2. Minimum Frequency
3. Minimum Span of Service
4. Accessible

**Service quality measures**
5. Reliable
6. Comfortable
7. Safety
8. Communication

**Service planning measures**
9. Cost-efficiency
10. Capacity
11. Connectivity

*Should we have an equity measure?*

Proposal is to focus on the **six route level measures** for rolling service planning.
Policy Development Process

Collaborative process between MBTA, MassDOT, CTPS and stakeholders since early 2015

• Policy Advisory Committee of internal and external stakeholders met 4 times to draft objectives and review measures
• Technical Advisory Committee met 7 times to determine measures based on best available data
• Online survey with over 6000 responses
• 10 workshops with community organizations
Proposed Service Availability Measures

1. Coverage
   - **Base**: Percent of the population that lives no more than 0.5 miles from a transit stop
   - **Frequent Service**: Percent of the population that lives no more than 0.5 miles from high-frequency service (defined as a minimum 15-minute headway on weekdays and 20-minute headway on weekends) and in census block groups with densities greater than 7,000 people/sq. mile.
   - **Low-Income**: Percent of low-income households that are no more than 0.5 miles from a transit stop

No proposed target for coverage
Coverage

85% of population live with ½ mile of service

Transit Service Areas

- High Frequency Service
- All Transit Service
- No RTA or MTA Service

3 Measures
Proposed Service Availability Measures

2. Minimum Frequency
   • Measures are established by mode and time of day to set the minimum number of trips that the MBTA should run.

3. Minimum Span of Service
   • Measures are established by mode and day of the week to set the minimum hours during which service should be available.
   • Minimums set the floor of service that the MBTA should be providing, service can go above to meet demand
   • Constraints often prevent the MBTA from meeting these minimum thresholds
   • The RIDE availability is based on the span of service and coverage of the fixed route service
# Minimum Span of Service

Proposed in draft Service Delivery Policy

<table>
<thead>
<tr>
<th>Mode</th>
<th>Day</th>
<th>Minimum Span of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekday</td>
<td>7:00 AM – 7:00 PM</td>
</tr>
<tr>
<td>Local</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>8:00 AM – 6:30 PM</td>
</tr>
<tr>
<td></td>
<td>Sunday</td>
<td>10:00 AM – 6:30 PM</td>
</tr>
<tr>
<td>Community</td>
<td>Weekday</td>
<td>10:00 AM – 4:00 PM</td>
</tr>
<tr>
<td>Commuter</td>
<td>Weekday</td>
<td>7:00 – 9:00 AM (and 4:00 – 6:30 PM)</td>
</tr>
<tr>
<td>Supplemental</td>
<td>Weekday</td>
<td>No minimum span</td>
</tr>
<tr>
<td><strong>Key Bus Routes</strong></td>
<td>Weekday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Sunday</td>
<td>7:00 AM – midnight</td>
</tr>
<tr>
<td><strong>Heavy Rail</strong></td>
<td>Weekday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Sunday</td>
<td>7:00 AM – midnight</td>
</tr>
<tr>
<td><strong>Light Rail</strong></td>
<td>Weekday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>6:00 AM – midnight</td>
</tr>
<tr>
<td></td>
<td>Sunday</td>
<td>7:00 AM – midnight</td>
</tr>
<tr>
<td><strong>Commuter Rail</strong></td>
<td>Weekday</td>
<td>7:00 AM – 10:00 PM</td>
</tr>
<tr>
<td><strong>Boat</strong></td>
<td>Weekday</td>
<td>7:00 AM – 10:00 PM</td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>8:00 AM – 6:30 PM</td>
</tr>
</tbody>
</table>

1 This is a guideline for high-density areas. There is no minimum span for low-density areas on weekends.
Span of Service

MBTA Bus Route Standards: Span
Route Grade (standard: meets minimum span)
- Clearly Failing: > 15 minutes under minimum span
- Barely Failing: 0-15 minutes under minimum span
- Barely Passing: 0-15 minutes over minimum span
- Clearly Passing: > 15 minutes over minimum span

100 routes clearly passing
30 routes barely passing
23 routes clearly failing
14 routes barely failing
## Minimum Frequency

### Proposed in draft Service Delivery Policy

<table>
<thead>
<tr>
<th>Mode</th>
<th>Weekday Time Periods</th>
<th>Minimum Frequency or Maximum Headway</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus</strong></td>
<td><strong>Local Community</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AM and PM Peak</td>
<td>Every 30 minutes</td>
</tr>
<tr>
<td></td>
<td>All other periods</td>
<td>Every 60 minutes</td>
</tr>
<tr>
<td></td>
<td>Saturday and Sunday</td>
<td>Every 60 minutes</td>
</tr>
<tr>
<td><strong>Bus</strong></td>
<td><strong>Commuter</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AM Peak</td>
<td>3 trips in the peak direction</td>
</tr>
<tr>
<td></td>
<td>PM Peak</td>
<td>3 trips in the peak direction</td>
</tr>
<tr>
<td><strong>Key Bus Routes</strong></td>
<td>AM and PM Peak</td>
<td>Every 10 minutes</td>
</tr>
<tr>
<td></td>
<td>Early AM and Midday</td>
<td>Every 15 minutes</td>
</tr>
<tr>
<td></td>
<td>Base/School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evening and Late Evening</td>
<td>Every 20 minutes</td>
</tr>
<tr>
<td></td>
<td>Saturday and Sunday</td>
<td>Every 20 minutes</td>
</tr>
<tr>
<td><strong>Rapid Transit</strong></td>
<td>AM and PM Peak</td>
<td>Every 10 minutes</td>
</tr>
<tr>
<td></td>
<td>All other periods*</td>
<td>Every 15 minutes</td>
</tr>
<tr>
<td></td>
<td>Saturday and Sunday</td>
<td>Every 15 minutes</td>
</tr>
<tr>
<td><strong>Commuter Rail</strong></td>
<td>AM Peak</td>
<td>3 trips in the peak direction</td>
</tr>
<tr>
<td></td>
<td>PM Peak</td>
<td>4 trips in peak direction</td>
</tr>
<tr>
<td></td>
<td>All other periods</td>
<td>Every 3 hours in each direction</td>
</tr>
<tr>
<td></td>
<td>Saturday</td>
<td>Every 3 hours in each direction</td>
</tr>
<tr>
<td><strong>Boat</strong></td>
<td>AM and PM Peak</td>
<td>3 trips in the peak direction</td>
</tr>
<tr>
<td></td>
<td>Off-Peak periods</td>
<td>Every 3 hours</td>
</tr>
</tbody>
</table>
Minimum Frequency

MBTA Bus Route Standards: Frequency
Route Grade (standard: meets minimum frequency)
- Clearly Failing: < 75% of standard
- Barely Failing: 75 – 99%
- Barely Passing: 100 – 125%
- Clearly Passing: > 125% of standard

105 routes clearly passing
31 routes barely failing
22 routes barely passing
14 routes clearly failing

3 Measures
Survey: local/commuter headways

Level of Convenience at Frequency Intervals (Local (Non-Key) Bus Route or Express Bus)

- Convenient
- Inconvenient, but would use
- Would not use the service

Source: Service Standards Survey, July 2015
Survey: key bus headways

Level of Convenience at Frequency Intervals
(Key Bus Routes or Silver Line)

Source: Service Standards Survey, July 2015
4. Reliability

• Measures are established by mode and frequency of service

• Bus Reliability:
  
  • Scheduled-Departure Service: Service that operates with a headway longer than 15 minutes.
    • Origin timepoint: The trip must leave between 0 minutes before and 3 minutes after its scheduled departure time.
    • Mid-route timepoints: The trip must leave between 1 minute before and 6 minutes after its scheduled departure time.
    • Destination timepoint: The trip must arrive no later than 5 minutes after its scheduled arrival time.
  
  • Frequent Service: Service that operates with a headway less than or equal to 15 minutes.
    • Origin or mid-route timepoints: The trip must leave no later than the scheduled headway plus 3 minutes.
    • Destination timepoint: The actual run time must be no more than 120 percent of the scheduled run time.
Proposed Service Quality Measures

Reliability (continued)

• Rapid Transit Reliability:
  • Light Rail and Heavy Rail: Passengers should wait the scheduled headway, or less, at each station; passengers in-vehicle travel times should be no more than 3 minutes longer than the scheduled travel time.
  • Mattapan Line: The trip must leave no later than the scheduled headway plus 3 minutes; the actual run time must be no more than 120 percent of the scheduled run time.

• Commuter Rail and Boat Reliability:
  • Depart the passengers’ origin stations/docks no earlier than 0 minutes and no later than 5 minutes after the time published in the schedule; arrive at the passengers’ destination stations/docks no later than 5 minutes after the time published in the schedule.

• Service Operated
  • Percent of scheduled service that is actually provided for each bus route, light rail line, heavy rail line, commuter rail line, and boat route.
Reliability

Passing is over 75%, overall bus network at 65% for the past 30 days
Survey: satisfaction with reliability

- Satisfaction with reliability is the biggest driver of overall customer satisfaction in our panel survey.
- Travel time, wait time, and crowding (in that order) are the biggest drivers of recent trip satisfaction.


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Source: Service Standards Survey, July 2015

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Extremely Inconvenienced Threshold (cumulative percentages, bus riders)

<table>
<thead>
<tr>
<th>Lateness Level</th>
<th>Percent of Riders Extremely Inconvenienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute late</td>
<td>1%</td>
</tr>
<tr>
<td>2 minutes late</td>
<td>2%</td>
</tr>
<tr>
<td>5 minutes late</td>
<td>7%</td>
</tr>
<tr>
<td>10 minutes late</td>
<td>46%</td>
</tr>
<tr>
<td>15 minutes late</td>
<td>80%</td>
</tr>
<tr>
<td>20 minutes late</td>
<td>95%</td>
</tr>
<tr>
<td>More than 20 minutes late</td>
<td>99%</td>
</tr>
</tbody>
</table>
Proposed Quality Measures

5. Comfortable

• Measures are established by mode.

• Bus Crowding:
  • High-volume time periods: The maximum comfortable passenger-to-seat ratio for high-volume travel periods is 140%. At loads less than 140% of seated capacity, all passengers are considered comfortable. No passengers are considered comfortable when the vehicle load exceeds 140% of seated capacity.
  • Low-volume time periods: The maximum comfortable passenger-to-seat ratio for low-volume travel periods is 125%. At loads less than 125% of seated capacity, all passengers are considered comfortable; between 125% and 140% of seated capacity, seated passengers are considered comfortable; and no passengers are considered comfortable when the vehicle load exceeds 140% of seated capacity.
Proposed Service Quality Measures

Comfortable - continued

• Rapid Transit Crowding:
  • Light rail vehicles: Passengers occupying space in the aisle should have no less than 3.75 square feet of personal space in peak hours and 10.00 square feet of personal space in off-peak hours
  • Heavy rail vehicles: Passengers occupying space in the aisle should have no less than 3.00 square feet of personal space in peak hours and 10.00 square feet of personal space in off-peak hours.

• Commuter Rail Crowding:
  • For early AM, AM peak, midday school, and PM peak time periods, the maximum passenger-to-seat ratio is 110%.
  • For sunrise, midday base, evening, late evening, night, and weekend time periods, the maximum passenger-to-seat ratio is 100%.

• There is no crowding measure for the ferry mode.
What does crowded look like?

Above 140% of seated capacity, all passengers are considered uncomfortable.

150% of seated capacity
154% of seated capacity

Measures
Crowding

Data reflects an average weekday in Fall 2015. Routes SL1, SL2, SLW, 71, and some Limited Service routes are excluded due to insufficient data.
Patterns of bus crowding

Peaks

Inbound

9

66

111

Outbound

3 Measures

Peaks

Constant

Peaks and constant

Uncomfortable Passenger Hours

60

40

20

0

6a 8a 10a 12p 2p 4p 6p 8p 10p 12a

6a 8a 10a 12p 2p 4p 6p 8p 10p 12a

6a 8a 10a 12p 2p 4p 6p 8p 10p 12a
Proposed Service Planning Measure

6. Cost-Efficiency

Existing Bus Cost-Effectiveness Standard in the 2010 Service Delivery Policy

\[
Net \text{ cost/passenger} = \frac{Operating \ Costs - Service \ Revenue}{Boarding \ Customers}
\]

Deficient Route: greater than 3 times the system average

Considerations
- Relative measure
- Service revenue means routes with higher seniors/students/TAP passengers have higher costs
- Doesn’t measure all benefits
- Only for bus

Should we measure both the benefits and the costs?

<table>
<thead>
<tr>
<th>Measures</th>
<th>Weekday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average net cost per passenger</td>
<td>$2.14</td>
<td>$2.02</td>
<td>$1.94</td>
</tr>
<tr>
<td>Clearly Passing (&lt;2.75x average cost)</td>
<td>151</td>
<td>112</td>
<td>90</td>
</tr>
<tr>
<td>Barely Passing (2.75x to 2.99x average cost)</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Barely Failing (3x to 3.24x average cost)</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Clearly Failing (&gt;3.25x average cost)</td>
<td>8</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>
Cost-Efficiency: Proposed Measure

The benefits are provided by three metrics scored on a scale:

- Ridership per Revenue Vehicle Hour
- Equity ridership proportion
- Network value, itself composed of three metrics:
  - Hours of added coverage
  - Service to major destinations
  - Number of transferring riders

\[
\text{Cost Efficiency} = \frac{\text{Benefit of Operated Service}}{\text{Cost to Operate}}
\]

Where Cost to Operate=

- Standard cost per service hour for each mode
- Additional service hours represent additional cost; a route that provides the same value in fewer service hours is more “cost-efficient”
Example Route: 73

Ridership:
- Total Weekly boardings: 38,000 (top 10%)
- Boardings / RVH: 68 (above-average)

Equity Measures:
- 15% low-income (bottom 20%)
- 8.6% Senior / TAP card use (below average)

Network Value:
- Number of transfers (high)
- Major destinations: Mt. Auburn Hospital, Harvard Sq, ~45,000 jobs along route
- Coverage hours
Example Route: 112

Ridership:
- Total Weekly boardings: 9,000 (below-average)
- Boardings / RVH: 46 (below-average)

Network Value:
- Number of transfers (medium – major nodes on both ends)
- Major destinations: downtown Chelsea, and Everett
- Coverage hours

Equity Measures:
- 69% low-income (top 10%)
- 19.8% Senior / TAP card use (top 10%)
Implications

• Separates benefits from cost
• Different services can combine to create the same benefit score
• Identifies routes’ strengths and weaknesses; suggests more specific/targeted interventions to raise cost-efficiency
• Can apply to other modes

Discussion questions

• Should scores be relative or absolute?
• Are some components more important than others? How should they be weighted?
Proposed Network Measures

4. Accessibility
   • Platform hours accessible (elevator uptime and accessible stations)
   • Percent of trips with accessible vehicles

7. Safety
   • Set in coordination with state and federal regulatory partners

8. Communication
   • Real-time prediction accuracy measure
   • System status measure
     • The MBTA will provide its users with elevator status alerts within 10 minutes of identified change in operability status.
   • Announcements according to ADA and Language Access Plan

10. Capacity
    No proposed measures, to be discussed as part of Strategic Plan

11. Connectivity
Should there be an equity measure?

• Is equity ensuring access for people who cannot afford other means of transportation?
  • Then include in cost-efficiency and measure changes to low-income coverage when making service changes

• Is equity ensuring people all over the region have access to the system?
  • Then measure changes to overall coverage when making service changes

• Is equity ensuring that our service quality and service changes aren’t disproportionate when considering race/ethnicity or income?
  • Addressed by Title VI

• How else should we measure equity?
What requires Disparate Impact/Disproportionate Burden analysis under Title VI

• Major service changes or fare changes
  • A service change that is defined as a “major service change” or any fare change requires an equity analysis using the thresholds described the DI/DB policy.

• Periodic monitoring
  • Measures the systemwide distribution of transit amenities, vehicle assignment, and all standards in the Service Delivery Policy
  • Where a disparity is identified, the MBTA should identify steps to address the disparity
  • The threshold for the service monitoring is proposed to be the same as the threshold for major service changes in the DI/DB policy
TRADE-OFFS
Service planning is a balancing act of trade-offs between the various measures.

Assuming the same level of resources, which components should we prioritize?
# Key tradeoffs

<table>
<thead>
<tr>
<th>Metric</th>
<th>Trade-Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>• Less frequent service to more areas</td>
</tr>
<tr>
<td></td>
<td>• More frequent service to fewer areas</td>
</tr>
<tr>
<td>Frequency and Span</td>
<td>• More frequent service for a shorter time</td>
</tr>
<tr>
<td></td>
<td>• Less frequent service for a longer time</td>
</tr>
<tr>
<td>Transfers</td>
<td>• More routes/fewer transfers with less frequent service</td>
</tr>
<tr>
<td></td>
<td>• Fewer routes/more transfers with more frequent service</td>
</tr>
<tr>
<td>Directness</td>
<td>• Shorter walks to stops with slower, less direct service</td>
</tr>
<tr>
<td></td>
<td>• Longer walks to stops with faster, more direct service</td>
</tr>
<tr>
<td>Reliability</td>
<td>• Fewer trips with more reliability</td>
</tr>
<tr>
<td></td>
<td>• More trips with less reliability</td>
</tr>
</tbody>
</table>
Trade-Offs

Should we prioritize:

- High frequency coverage in high density areas?
- Coverage of low-income households?
- Or overall coverage with less frequency?
Coverage: High frequency and high density

85% of the population in high density areas live within ½ mile of weekday frequent service.
Coverage: Low income households

89% of low-income households are within ½ mile of service.
Coverage vs. Frequency

Survey respondents have a preference for high frequency service

Are you willing to walk farther to a bus stop or surface Green Line stop for faster service?

<table>
<thead>
<tr>
<th>Option</th>
<th>Percent of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>56.8</td>
</tr>
<tr>
<td>No</td>
<td>13.7</td>
</tr>
<tr>
<td>Does not apply</td>
<td>29.5</td>
</tr>
</tbody>
</table>

Source: Service Standards Survey, July 2015
If the coverage remains the same, should we prioritize one seat rides with lower frequency or higher frequency service that might require a transfer?
Directness of Travel vs. Frequency

- Existing routes provide service from Marblehead to Wonderland (441/442) and Downtown (448/449).
- Current service level:
  - 441/442 (local bus): AM Peak headway of 16 minutes for the corridor, service throughout the day
  - 448/449 (commuter bus): headway of 30 minutes for the corridor, 5 trips total during AM peak only
  - Ridership approximately similar
  - Combined headway of 10.5 minutes
- If 448/449 service were reassigned to 441/442, headways on the 441/442 would decrease from 16 mins to 8.3 mins at 7:00 AM.
Directness of Travel vs. Frequency

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Directness of Travel vs. Frequency

- Overall coverage does not change very much (448/449 riders can still get downtown by transferring at the Blue Line)
- Upside: The 441/442 becomes effectively a key bus route at peaks.
  - The riders experience time savings with increased frequency.
  - High-frequency coverage is expanded in an area with little high-frequency service
- Downside: The riders on the 448/449 will have their travel time to downtown increase with the required transfer to the Blue Line.
Trade-Offs

Should we schedule reliable, but less frequent service, or less reliable, but more frequent service?

- Reliability
- Service with capacity vs. Minimum Frequency
- Service without capacity
- Crowding
Reliability vs Frequency

- Variability exists in the time it takes to run the route
- Example Route 111 (Haymarket – Woodlawn), outbound, weekday 4:00-6:00 PM

Distribution of Run Times

Current Scheduled Run Time: 33 minutes
Reliability vs Frequency

- When we increase the run + layover time, if the number of buses does not increase, the headway needs to increase.

<table>
<thead>
<tr>
<th>Run Time Percentile</th>
<th>4:00-6:00 PM Outbound Run + Layover Time</th>
<th>4:00-6:00 PM # Buses</th>
<th>4:00-6:00PM Outbound Headway</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
<td>48 minutes</td>
<td>8</td>
<td>11 minutes</td>
</tr>
<tr>
<td>85%</td>
<td>50 minutes</td>
<td>8</td>
<td>11 minutes</td>
</tr>
<tr>
<td>90%</td>
<td>52 minutes</td>
<td>8</td>
<td>12 minutes</td>
</tr>
<tr>
<td>95%</td>
<td>56 minutes</td>
<td>8</td>
<td>13 minutes</td>
</tr>
</tbody>
</table>

*Current headway is 8 minutes, corresponding to a 33-minute run + layover time*
Reliability vs Crowding

- When we increase the headway, crowding increases.

<table>
<thead>
<tr>
<th>Run Time Percentile</th>
<th>4:00-6:00 PM Outbound Headway</th>
<th>4:00-6:00 PM Outbound Average Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
<td>11 minutes</td>
<td>52</td>
</tr>
<tr>
<td>85%</td>
<td>11 minutes</td>
<td>52</td>
</tr>
<tr>
<td>90%</td>
<td>12 minutes</td>
<td>57</td>
</tr>
<tr>
<td>95%</td>
<td>13 minutes</td>
<td>62</td>
</tr>
</tbody>
</table>

Current average maximum load is 38 passengers, corresponding to a 8-minute average headway. A bus is considered crowded at loads greater than 55 passengers. Note that maximum load is a different way to measure crowding from the passenger comfort metric.
Reliability vs Crowding

• Route 111 is an extreme example
• Other routes will have smaller run-time adjustments or crowding impacts
  • Route 93: PM peak run times increased by only 7.2%; headway increase from 8 to 9 minutes; average maximum loads increase from 34 to 37
• Buses can be reallocated between routes
  • Shifting a bus from Route 93 to Route 111 would result in a Route 93 headway of 9.5 minutes and an average PM peak maximum load of 40
  • Shifting a bus to Route 111 would improve the headway from 12 to 10 minutes, and reduce the average PM peak maximum load from 57 to 47
Survey respondents express varying and conflicted views regarding the choice between reliability and frequency.

Source: Service Standards Survey, July 2015

Survey: Reliability vs Frequency
Reliability Frequency Toolbox

Tools to address this problem

- Speed up buses and reduce variability of run times
  - Service and operating changes:
    - Reduce coverage by scheduling shorter routes
    - Reduce the number of stops
    - Reduce dwell times at stops by changing the way that passengers board
    - Decrease bus bunching with better dispatching tools and procedures
  - Municipal partnerships:
    - Bus signal priority
    - Dedicated bus lanes and queue jumping
- Reallocate buses from routes with capacity to routes without capacity
- Increase the number of buses operating
Summary of tradeoffs

• What should be the main priorities in the rolling service planning process?
  • Improving reliability, even if it requires reductions in scheduled frequency and increases in crowding
  • Reducing crowding, even if it requires reductions in frequency in other routes, reductions in coverage, or worse reliability
  • Improving frequency in areas with high-population density, but possibly increasing transfers
  • Improving/maintaining coverage for areas with large low-income populations
  • Increasing/maintaining overall coverage, but reducing frequency
  • Meeting minimum frequency and span
Next Steps

1. Finalize the Service Delivery Policy
   • Adding today’s feedback on priorities and tradeoffs
   • Provide revised draft to FMCB by November 7
   • Get public input
   • Service Delivery Policy adopted by FMCB

2. Initiate Service Planning process, starting with a pilot district as a pilot
   • Once pilot is complete, conduct rolling service planning for all 7 districts every 3 years

3. Incorporate additional measures and targets for the network in the Strategic Plan
   • Use measures to do network-wide service planning
APPENDICES
Network Standards

- **Accessibility**
  - Percent of total platform hours that are accessible
  - Percent of trips with at least one ADA-compliant vehicle

- **Communication**
  - Real-time prediction accuracy standards
    - At 0.0-to-5.0 minutes away from a stop, the difference between the prediction and the actual arrival should be between -1 and +1 minutes.
    - At 5.1-to-10.0 minutes away from a stop, the difference between the prediction and the actual arrival should be between -2 and +3 minutes.
  - Elevator status available within 10 minutes of identified change in operability status
  - 100% of stops announced according to ADA policies
  - 100% of announcements made in languages as specified by the Language Access Plan

Next steps
Appendix: Survey Results

How long does your most frequent trip on the MBTA take?

Source: Service Standards Survey, July 2015
7 STEPS CASE STUDY
BUS CROWDING

What do these 7 steps look like in practice?
"I normally take the 111 bus seven days a week and it is usually very full. Sometimes it is so full that I have to wait for two or three buses to pass, and will have to wait up to 10-20 minutes for another bus.

-Edwin, 111 Rider

"Yo uso este bus normalmente todos los días, siete días a la semana. Si me vengo en el bus de las 5 PM o por la mañana, a veces tengo que esperar 2-3 buses que pasen e esperar unos 10-12 minutos para poder entrar a otro bus. Durante la mañana normalmente hay mucha gente, en un bus con capacidad de 40 personas, esto se llena entre 60-90 personas.

-Rosa Maria, 111 Rider
Customer Experience Interviews

OPMI interviewed riders on the 7, 111, 66 and 57, the most critical crowding bus routes, this is what they said...

I ride the 57 every day to go to work. If I am here a lot earlier I can usually get a seat. If it is a lot later it is completely packed, especially if people don’t move down the bus. (As he was speaking he was being left behind by the bus that was passing by.) - Jason, 57 Rider

I am always left behind by the buses because they are too crowded. I sometimes take the green line because this bus is not as reliable. - Kioko, 57 Rider
"I ride the 66 bus every day to get to work, my experience really depends on the time, if I get here five minutes before, either 8:25, and the next couple of buses will be really crowded. Because this is so early on the route, I can usually get a seat, but by Commonwealth Ave, we are packed on the bus. In the afternoon, I usually don't take the bus back because it is so crowded."

- Lindsay, 66 Rider

"When I go in the morning, it is usually the case that buses come right after the other every second and then the next one does not come for another half an hour. Right around 6:30 PM coming back from work, it is very crowded and the service is very infrequent, but most of the time I would rather walk than wait for the bus for 20 minutes. As you see there are 3 buses coming, this is an everyday experience for me."

- Hema Chey, 66 Rider
I usually take this bus to get to work every week day. Usually it is very crowded. Usually the buses will be back to back, and sometimes there will be a bus loading people here and around the corner you would have another bus loading more people up, when they are not already full. So earlier, at like 8:45, usually the bus would be really crowded and there would be a line around the corner."

- Sean, 7 Rider

"I usually ride the 7 bus every day to go to work. I am left behind every day because the buses are too crowded. I often take other forms of transportation, Yesterday I took Uber, because I didn’t feel like waiting for 3 buses until I could get on.  

- Kate, 7 Rider"
“I take the 66 nearly every day and it is a total nightmare. A timely, pleasant experience would be an exception. Wait time should not be more than 10 minutes during rush hour according to the schedule and most times we get passed up by several buses before one has enough room to pick people up. And even then, it is always completely packed and miserable. The 66 ruins my morning, every morning.”

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How do we define crowded?

PEAK
All passengers considered uncomfortable above 140% of seated capacity

MAGNITUDE
Measure amount of passenger time that is uncomfortable.

PROPORTION
Percent of passenger time that is comfortable

OFF-PEAK
From 125% to 140% of seated capacity standees considered uncomfortable, above 140% all passengers considered uncomfortable

A route is considering failing the measure if less than 95% of passenger hours are comfortable

2. Metrics
What does crowded look like?

150% of seated capacity  154% of seated capacity

Above 140% of seated capacity, all passengers are considered uncomfortable.
3. Baseline Analysis

Bus crowding

94% of passenger hours spent on MBTA buses are comfortable (Fall 2015, average weekday)

49 routes fall under the 95% of passengers hours are comfortable threshold

Data reflects an average weekday in Fall 2015. Routes SL1, SL2, SLW, 71, and some Limited Service routes are excluded due to insufficient data.
Patterns of bus crowding

3. Baseline Analysis
Causes of bus crowding

Preliminary analysis indicates different causes of crowding for different bus routes and at different times of day.

Crowding can be caused by:

- Bus bunching
- Not enough service in a specific time period
- Dropped trips
- Uneven passenger demand

This analysis will inform which tools to use to address the problem.
What tools can we use to solve this?

1. Increase Buses on The Street
2. Reallocate Existing Service
3. Decrease On-Street Delays
4. Decrease Bus Bunching
5. Decrease Dwell Time

5. Tools

- Capital Investment, Private Sector Partnerships
- Service Planning
- Municipal Partnerships
- Dispatching Tools
- AFC 2.0 And Proof of Payment