New York Best Practice Model
2012 Base Year Update

Executive Session

Presented to - NYBPM Partners & Modeling Community

Presented by -
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Cambridge Systematics - Thomas Rossi & Nikhil Puri
Overview of Training Sessions

• Executive Session
  • Part 1
  • Part 2

• Technical Sessions
  • 4 three-hour sessions
    • Model structure, parameters and input
    • Model setup, highway & transit route coding
    • Building scenarios, model output, and special model uses cases
Presentation Outline

• Part 1
  • What is a travel demand model?
  • How do travel demand models work?
  • NYBPM 2012- enhancements and efficiencies
  • What can the NYBPM be used for?
  • Q&A

• Part 2
  • Model Validation/Calibration
    • What is model validation and why do we do it?
    • Activity-based demand component validation
    • Aggregate results
  • Q&A
A Travel Demand Model ...

• ... takes a set of available *input data* ...
• ... and converts it to a set of *output data*, needed for planning analyses ...
• ... using a set of *mathematical formulations*...
• ... which use *parameters* to perform the conversions
Model Input and Output Data

• Input data
  • Highway and transit networks
    • Highway time and distance, tolls
    • Transit in-vehicle/walk/wait time, cost, transfers
  • Socioeconomic/land use data (population, employment, etc.)
  • Non-residential travel demand
  • Other (e.g., auto operating costs)

• Output data
  • Trip rosters
  • Roadway volumes
  • Transit line volumes and station boardings
The Model Development Process

1. **Estimation**
2. **Calibration**
3. **Validation and Reasonableness Checks**
4. **Validation**
5. **Application**
What a Model Is...and Is Not

• A model is...
  • An analytical tool to provide important information to planners
  • A means to quantitatively estimate the effects of transportation planning, policy, or investment decisions—or external factors—on transportation demand

• A model is not...
  • A crystal ball—it does not predict the future
  • A way to get “the answer” on a planning decision
How an Activity-Based Model Works

• A *synthetic population* representing everyone in the model region is created
  • Includes age, gender, household structure
• Each person’s *activities* (work, school, shopping, recreation, etc.) are simulated, along with the *associated travel* needed to achieve the activities
• *Travel choices* (destination, mode, time of day, etc.) are simulated
• All travel is aggregated and assigned to highway and transit networks
NYMTC Has Had an ABM for Years

- One of the first major metropolitan areas to develop one
- Nearly all large U.S. metro areas have one now (or are close to finishing)
- Activity-based approach allows for better analysis of emerging demographics, mobility, and technology
Improvement Goals for 2012 NYBPM

• Transparency/accessibility
• Robust, modern modeling procedures
• Improve network representation using newly available data sourced and procedures
• Systematic, comprehensive validation
• Reporting features
Transparency/Accessibility

- Not a “black box”
- All code and TransCAD scripts are open source or owned by NYMTC (and therefore can be made available)
- Model results stored in databases for easy access
- Customized reporting
Model Design, Implementation, Validation Plans
Data Updates

• Updated and improved accuracy of highway data
  • Revised traffic screenlines
  • Added vehicle classification counts
  • Reduced synthesized data
  • NJ + CT counts added

• Improved validation and reporting
Transit Data

• A more comprehensive transit validation dataset with improved reporting
  • Disparate data from a variety of sources
  • Stop-to-stop
  • District-to-district
  • Station boardings

• 2010/2011 Regional Household Travel Survey (RHTS) for mode share

• Emphasis on simplifying transit reporting
  • Hub-bound travel, station groupings, origin-destination tables
  • Will be available with the final model deliverable
Networks

• Significant amount of roadway detail added
• Conflated and integrated Transit + Highway network
  • More accurate General Transit Feed Specification (GTFS) transit travel times-positive impact on all core model components
  • Improved transit times for all time periods
  • Easier and more efficient transit project updates where GTFS available
• Incorporated familiar project coding procedures
• Automated select transit coding functionalities
Core Model Components (about 70 components total)
Robust, Modern Modeling Procedures

• Overall structure based on modern research and tested in previous settings
• Specifically adapted and revised for the unique New York area environment
• Made optimal use of local survey data (RHTS/RES) for model estimation and validation
Systematic, Comprehensive Validation

• Based on industry standard procedures
• Validation plan followed closely
• Every component validated and reviewed by NYMTC staff and Steering Committee members
• Aggregate results examined intensely
• When something didn’t work, we explored and made adjustments as appropriate
Model Validation and Calibration

• Currently finishing up
• Validation plan
  • Check results of all components
  • Revise parameters/models as needed
  • Examine aggregate results (e.g., highway volumes, transit demand)
  • Sensitivity testing

<table>
<thead>
<tr>
<th>Vehicles per Household</th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
<th>Percentage Point Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>23.5%</td>
<td>23.8%</td>
<td>0.2%</td>
</tr>
<tr>
<td>1</td>
<td>31.8%</td>
<td>32.0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>2</td>
<td>29.9%</td>
<td>29.6%</td>
<td>-0.3%</td>
</tr>
<tr>
<td>3</td>
<td>10.0%</td>
<td>9.8%</td>
<td>-0.3%</td>
</tr>
<tr>
<td>4+</td>
<td>4.8%</td>
<td>4.9%</td>
<td>0.1%</td>
</tr>
<tr>
<td>veh/hh</td>
<td>1.22</td>
<td>1.20</td>
<td>-0.9%</td>
</tr>
</tbody>
</table>
Aggregate Model Validation

• Compare volumes to counts
  • % vehicle miles traveled difference by facility type
  • Screenline crossing comparisons
  • Major route/crossing comparisons
  • Comparing volumes on individual links

• Transit comparisons
  • Comparisons at station group, geography, service type levels
  • Not straightforward due to variety of services, transfers, data inconsistencies

<table>
<thead>
<tr>
<th></th>
<th>Modeled VMT</th>
<th>Count VMT</th>
<th>Total</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate/Freeway/Tollway</td>
<td>13,898,937</td>
<td>13,413,130</td>
<td>3.6%</td>
<td>7%</td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>6,914,402</td>
<td>7,264,617</td>
<td>-4.8%</td>
<td>10%</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>3,507,136</td>
<td>3,645,011</td>
<td>-3.8%</td>
<td>10%</td>
</tr>
<tr>
<td>Major Collector</td>
<td>804,773</td>
<td>743,297</td>
<td>8.3%</td>
<td>15%</td>
</tr>
<tr>
<td>Minor Collector</td>
<td>181,201</td>
<td>198,792</td>
<td>-8.8%</td>
<td>15%</td>
</tr>
<tr>
<td>Local Street</td>
<td>31,861</td>
<td>56,185</td>
<td>-43.3%</td>
<td>15%</td>
</tr>
<tr>
<td>Ramp</td>
<td>93,171</td>
<td>126,702</td>
<td>-26.5%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25,431,481</strong></td>
<td><strong>25,447,734</strong></td>
<td><strong>-0.1%</strong></td>
<td><strong>1%</strong></td>
</tr>
</tbody>
</table>
Overall Folder Structure

- Intuitive folder structure, maintaining familiarity
  - Name and path are flexible
  - Some simplification and re-organization
  - Removes or deprecates outdated/unused files

- Consistent Concepts
  - Many functions and locations are consistent with the 2010 model
Reporting Features

• Take advantage of latest TransCAD capabilities
• Customized to NYMTC’s needs and desires
• Database of all model results
TransCAD Graphical User Interface & Reporting

- Customized to NYMTC’s requirements
- More intuitive flowchart interface and reporting
- Improved model parameter management
- Streamlined utilities
- Multi-threading capabilities
What does this all mean?

• Transparent, easy-to-use user interface
  • Does require a basic understanding of modeling

• Simulates regional travel well
  • Ideal for air quality conformity
  • Existing and future conditions
  • Geographic coverage
  • Auto+ taxi+ truck+ subway+ commuter rail + bus
    • Distinguishes between commuter and local buses;
    • Select Bus Service

• Ability to model corridors and subareas
What can I use the NYBPM for?

- Regional planning
  - Long range transportation plans (land use, network, pricing)
  - Air quality conformity (VMT, VHT, Speed)
  - Subarea/corridor analysis (VMT, VHT, Speed)
  - Truck volumes
- Policy analysis
  - Pricing/tolling (mode shifts, diversions)
  - Peak spreading
- Project analysis
  - Scenario and long-range planning
  - Equity analysis (impacts on low-income populations)
What can I use the NYBPM for? (continued)

• Transit planning
  • Mode shifts as a result of improved service
  • Impact of Transit Signal Priority
  • Demand for a new ferry service?

• Changing travel behavior
  • Testing work-from-home impacts
  • Active transportation
  • Technology-driven changes (open road tolling, Uber/Lyft, etc.)
Questions?
Part 2 Model Validation/Calibration & Model Structure
Systematic, Comprehensive Validation

• Based on industry standard procedures
• Validation plan followed closely
• Every component validated, and reviewed by NYMTC staff and Steering Committee members
• Aggregate results examined intensely
• When something didn’t work, we explored and made adjustments as appropriate
Purpose of Model Validation

• Confirm that model accurately reflects travel behavior in the region, under existing and potential future conditions
  • Run model for base year, compare to observed data for 2012
  • Examine sensitivity of model results to key variables (e.g., travel time, cost, demographic changes)
  • Ensure that results are reasonable for required types of planning analyses
Dealing with Limitations

• Data limitations
  • Observed data does not cover everything modeled
  • Errors and uncertainties in observed data
  • Inconsistencies among observed data sources

• Model limitations
  • Limitations in data used for model development
  • Simplifications (even in a complex model)
  • Aggregation errors (even in a mostly disaggregate model)
Summary of Validation Plan

• Tests for major component segments
  • Input data/synthetic population
  • Activity patterns
  • Location choices
  • Mode choices
  • Time of day
  • Highway assignment
  • Transit assignment
Summary of Validation Plan (continued)

• Guidelines for validation tests
  • Numeric where appropriate
• Single pass validation
• Full feedback validation
• Sensitivity testing/temporal validation
Summary of Model Validation

• The remaining slides present selected validation results
• These results represent the “conformity ready” model version dated 6/15
  • Focus on highway related results for conformity analysis
  • Validation continues with improving results
• Highlighted cells indicate results we are paying particular attention to during remaining validation work
Component Validation Templates

• Compare model results by segment to observed data
• Segments defined by:
  • Relevance to travel choice
  • Geographic subarea
  • Observed data sufficiency

### RHTS data shares by HHSize

<table>
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<tr>
<th></th>
<th>Autos</th>
<th>Total</th>
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<th>2</th>
<th>3</th>
<th>4+</th>
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<td>100%</td>
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<tr>
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<td>26%</td>
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<td></td>
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<tr>
<td>2</td>
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<td>7%</td>
<td>41%</td>
<td>34%</td>
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<tr>
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<td>2%</td>
<td>11%</td>
<td>25%</td>
<td>27%</td>
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</tbody>
</table>

### Model shares by HHSize

<table>
<thead>
<tr>
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<th>Autos</th>
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<th>2</th>
<th>3</th>
<th>4+</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>0</td>
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<td>15%</td>
<td>12%</td>
<td></td>
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<tr>
<td>1</td>
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<td>47%</td>
<td>31%</td>
<td>26%</td>
<td>20%</td>
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<td>30%</td>
<td>7%</td>
<td>40%</td>
<td>39%</td>
<td>38%</td>
<td></td>
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<tr>
<td>3+</td>
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<td>2%</td>
<td>11%</td>
<td>20%</td>
<td>30%</td>
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### Socioeconomic Data Checks

Results as of 6/15/2020

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>22,025,103</td>
<td>22,029,241</td>
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<tr>
<td>Households</td>
<td>8,086,279</td>
<td>8,086,275</td>
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<tr>
<td>Persons per Household</td>
<td>2.72</td>
<td>2.72</td>
</tr>
<tr>
<td>Autos per Household</td>
<td>1.42</td>
<td>1.41</td>
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</table>
Socioeconomic Data Checks (continued)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Labor Force</td>
<td>10,335,483</td>
<td>10,327,697</td>
</tr>
<tr>
<td>Total Employment</td>
<td>10,208,383</td>
<td>n/a</td>
</tr>
<tr>
<td>Workers per Household</td>
<td>1.28</td>
<td>1.28</td>
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</tbody>
</table>

Results as of 6/15/2020
## Selected Model Results
### Household Income

<table>
<thead>
<tr>
<th>Income Level</th>
<th>RHTS</th>
<th>Model</th>
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</thead>
<tbody>
<tr>
<td>Less than $15,000</td>
<td>9.8%</td>
<td>9.7%</td>
</tr>
<tr>
<td>$15,000 to $29,999</td>
<td>15.8%</td>
<td>15.8%</td>
</tr>
<tr>
<td>$30,000 to $49,999</td>
<td>15.3%</td>
<td>14.7%</td>
</tr>
<tr>
<td>$50,000 to $74,999</td>
<td>16.3%</td>
<td>15.9%</td>
</tr>
<tr>
<td>$75,000 to $99,999</td>
<td>12.3%</td>
<td>14.1%</td>
</tr>
<tr>
<td>$100,000 to $149,999</td>
<td>15.3%</td>
<td>20.4%</td>
</tr>
<tr>
<td>$150,000 to $199,999</td>
<td>7.7%</td>
<td>3.1%</td>
</tr>
<tr>
<td>$200,000 or more</td>
<td>7.6%</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

### Subregion Results

<table>
<thead>
<tr>
<th>Subregion</th>
<th>Less than $15,000</th>
<th>$15,000 to $29,999</th>
<th>$30,000 to $49,999</th>
<th>$50,000 to $74,999</th>
<th>$75,000 to $99,999</th>
<th>$100,000 to $149,999</th>
<th>$150,000 to $199,999</th>
<th>$200,000 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0%</td>
<td>0%</td>
<td>-1%</td>
<td>0%</td>
<td>2%</td>
<td>5%</td>
<td>-5%</td>
<td>-1%</td>
</tr>
<tr>
<td>Manhattan</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
<td>-5%</td>
<td>-10%</td>
</tr>
<tr>
<td>Other NYC</td>
<td>-4%</td>
<td>-5%</td>
<td>-4%</td>
<td>-1%</td>
<td>3%</td>
<td>8%</td>
<td>-1%</td>
<td>3%</td>
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<tr>
<td>Long Island</td>
<td>4%</td>
<td>3%</td>
<td>2%</td>
<td>-1%</td>
<td>0%</td>
<td>2%</td>
<td>-8%</td>
<td>-3%</td>
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<tr>
<td>Westchester-Putnam-Dutchess</td>
<td>3%</td>
<td>4%</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>-9%</td>
<td>-5%</td>
</tr>
<tr>
<td>Rockland-Orange</td>
<td>2%</td>
<td>2%</td>
<td>-3%</td>
<td>-2%</td>
<td>-2%</td>
<td>4%</td>
<td>-4%</td>
<td>3%</td>
</tr>
<tr>
<td>Bergen-Passaic</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
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<td>2%</td>
<td>5%</td>
<td>-6%</td>
<td>-3%</td>
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<tr>
<td>Essex-Hudson-Union</td>
<td>-2%</td>
<td>-1%</td>
<td>-2%</td>
<td>-1%</td>
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<td>6%</td>
<td>-4%</td>
<td>1%</td>
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<tr>
<td>Middlesex-Morris-Somerset-Mercer</td>
<td>5%</td>
<td>3%</td>
<td>1%</td>
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<td>-1%</td>
<td>2%</td>
<td>-8%</td>
<td>-2%</td>
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<tr>
<td>Monmouth-Ocean</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>-1%</td>
<td>1%</td>
<td>4%</td>
<td>-4%</td>
<td>-2%</td>
</tr>
<tr>
<td>Hunterdon-Sussex-Warren</td>
<td>4%</td>
<td>4%</td>
<td>0%</td>
<td>-2%</td>
<td>1%</td>
<td>1%</td>
<td>-8%</td>
<td>0%</td>
</tr>
<tr>
<td>Connecticut</td>
<td>0%</td>
<td>2%</td>
<td>-1%</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
<td>-3%</td>
<td>-4%</td>
</tr>
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Results as of 6/15/2020
## Selected Model Results

### Residential Tenure and Housing Type

<table>
<thead>
<tr>
<th>Own/Rent</th>
<th>RHTS</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own</td>
<td>45.5%</td>
<td>45.7%</td>
</tr>
<tr>
<td>Rent</td>
<td>54.5%</td>
<td>54.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Housing Type</th>
<th>RHTS</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Detached</td>
<td>45.5%</td>
<td>45.1%</td>
</tr>
<tr>
<td>Single Family Attached</td>
<td>8.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Apartment</td>
<td>46.1%</td>
<td>48.3%</td>
</tr>
<tr>
<td>Other</td>
<td>0.4%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
Selected Model Results
Work Arrival/Departure Times

Arrival Time

Departure Time

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arrival to work</td>
<td>Departure from work</td>
</tr>
<tr>
<td>AM pk (6-10)</td>
<td>74.7%</td>
<td>1.8%</td>
</tr>
<tr>
<td>PM pk (3-7)</td>
<td>5.5%</td>
<td>69.6%</td>
</tr>
</tbody>
</table>

Average Duration (hours)

<table>
<thead>
<tr>
<th></th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7.63</td>
<td>7.55</td>
</tr>
<tr>
<td>Female</td>
<td>7.40</td>
<td>7.35</td>
</tr>
<tr>
<td>All</td>
<td>7.52</td>
<td>7.45</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
### Selected Model Results

#### Worker Trip Mode Share

<table>
<thead>
<tr>
<th>Trip Mode Share</th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
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</thead>
<tbody>
<tr>
<td>SOV</td>
<td>56.4%</td>
<td>51.9%</td>
</tr>
<tr>
<td>HOV 2</td>
<td>5.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td>HOV 3</td>
<td>1.0%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Taxi</td>
<td>1.5%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Commuter rail/bus – auto access</td>
<td>4.8%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Commuter rail/bus – walk access</td>
<td>3.7%</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trip Mode Share</th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway/ferry – auto access</td>
<td>0.8%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Subway/ferry – walk access</td>
<td>15.4%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Local bus – auto access</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Local bus – walk access</td>
<td>4.5%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Walk</td>
<td>5.6%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Bike</td>
<td>0.7%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trip Mode / Auto Per Worker</th>
<th>Expanded RHTS data</th>
<th>Model Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero Auto</td>
<td>&lt;1</td>
</tr>
<tr>
<td>SOV</td>
<td>0.8%</td>
<td>31.4%</td>
</tr>
<tr>
<td>HOV 2</td>
<td>2.8%</td>
<td>10.9%</td>
</tr>
<tr>
<td>HOV 3</td>
<td>0.8%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Taxi</td>
<td>3.8%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Commuter rail/bus – auto access</td>
<td>0.8%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Commuter rail/bus – walk access</td>
<td>4.6%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Subway/ferry – auto access</td>
<td>0.5%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Subway/ferry – walk access</td>
<td>50.3%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Local bus – auto access</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Local bus – walk access</td>
<td>16.9%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Walk</td>
<td>15.9%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Bike</td>
<td>2.6%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>
Selected Model Results

Non-Worker Stop Location Choice

Distance (miles)

- Model
- HHSurvey

Average Distance (miles) by Subregion

<table>
<thead>
<tr>
<th>Region</th>
<th>Expanded RHTS data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manhattan</td>
<td>2.58</td>
<td>2.29</td>
</tr>
<tr>
<td>Other NYC</td>
<td>3.94</td>
<td>3.74</td>
</tr>
<tr>
<td>Long Island</td>
<td>7.05</td>
<td>7.29</td>
</tr>
<tr>
<td>Westchester-Putnam-Dutchess</td>
<td>5.44</td>
<td>4.88</td>
</tr>
<tr>
<td>Rockland-Orange</td>
<td>8.49</td>
<td>8.00</td>
</tr>
<tr>
<td>Bergen-Passaic</td>
<td>5.61</td>
<td>5.65</td>
</tr>
<tr>
<td>Essex-Hudson-Union</td>
<td>4.65</td>
<td>4.72</td>
</tr>
<tr>
<td>Middlesex-Morris-Somerset-Mercer</td>
<td>6.47</td>
<td>6.27</td>
</tr>
<tr>
<td>Monmouth-Ocean</td>
<td>7.41</td>
<td>7.26</td>
</tr>
<tr>
<td>Hunterdon-Sussex-Warren</td>
<td>11.26</td>
<td>10.77</td>
</tr>
<tr>
<td>Connecticut</td>
<td>5.06</td>
<td>4.73</td>
</tr>
<tr>
<td>Region</td>
<td>5.41</td>
<td>5.07</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
### VMT by Functional Class (on links with counts)

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Traffic Count</th>
<th>Model</th>
<th>% Diff.</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate/Freeway/Tollway</td>
<td>13,413,130</td>
<td>13,898,937</td>
<td>3.6%</td>
<td>+7%</td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>7,264,617</td>
<td>6,914,402</td>
<td>-4.8%</td>
<td>+10%</td>
</tr>
<tr>
<td>Minor Arterial and Below</td>
<td>4,618,142</td>
<td>4,769,987</td>
<td>-3.2%</td>
<td>+15%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25,447,734</strong></td>
<td><strong>25,431,481</strong></td>
<td><strong>-0.1%</strong></td>
<td><strong>+1%</strong></td>
</tr>
</tbody>
</table>

Total Model VMT (all links) = 358,654,552  
Total Model VMT/household = 44.4
# Major Crossings Summary

<table>
<thead>
<tr>
<th>Crossing</th>
<th>Traffic Count</th>
<th>Model</th>
<th>% Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthur Kill</td>
<td>144,952</td>
<td>159,212</td>
<td>10%</td>
</tr>
<tr>
<td>Hudson River</td>
<td>711,055</td>
<td>839,032</td>
<td>18%</td>
</tr>
<tr>
<td>The Narrows</td>
<td>193,100</td>
<td>242,153</td>
<td>25%</td>
</tr>
<tr>
<td>East River</td>
<td>1,013,835</td>
<td>1,191,131</td>
<td>18%</td>
</tr>
<tr>
<td>Harlem River</td>
<td>610,639</td>
<td>623,625</td>
<td>2%</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
## Major Route Summary

<table>
<thead>
<tr>
<th>Route</th>
<th>Count VMT</th>
<th>Model VMT</th>
<th>Model/Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Parkway</td>
<td>592,060</td>
<td>631,075</td>
<td>1.07</td>
</tr>
<tr>
<td>I-84</td>
<td>553,893</td>
<td>546,739</td>
<td>0.99</td>
</tr>
<tr>
<td>Long Island Expressway</td>
<td>430,696</td>
<td>417,348</td>
<td>0.97</td>
</tr>
<tr>
<td>Shore Parkway</td>
<td>313,086</td>
<td>242,221</td>
<td>0.77</td>
</tr>
<tr>
<td>Palisades Interstate Parkway</td>
<td>302,697</td>
<td>388,744</td>
<td>1.28</td>
</tr>
<tr>
<td>Brooklyn-Queens Expressway</td>
<td>275,978</td>
<td>294,539</td>
<td>1.07</td>
</tr>
<tr>
<td>I-684</td>
<td>248,069</td>
<td>288,390</td>
<td>1.16</td>
</tr>
<tr>
<td>Cross Island Parkway</td>
<td>245,932</td>
<td>194,670</td>
<td>0.79</td>
</tr>
<tr>
<td>FDR Drive</td>
<td>243,551</td>
<td>302,832</td>
<td>1.24</td>
</tr>
<tr>
<td>I-87</td>
<td>224,298</td>
<td>179,629</td>
<td>0.80</td>
</tr>
<tr>
<td>Northern State Parkway</td>
<td>209,526</td>
<td>302,654</td>
<td>1.44</td>
</tr>
<tr>
<td>Belt Parkway</td>
<td>207,923</td>
<td>205,011</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
Trip Mode Share Summary

<table>
<thead>
<tr>
<th>Mode</th>
<th>RHTS</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuter rail/bus</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Subway/ferry</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>Local bus</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>TOTAL TRANSIT</td>
<td>18%</td>
<td>20%</td>
</tr>
<tr>
<td>Auto</td>
<td>65%</td>
<td>64%</td>
</tr>
<tr>
<td>Non-motorized/other</td>
<td>17%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Results as of 6/15/2020
Remaining Validation Work

• Continuing to work with NYMTC staff and the Steering Committee to issue the final validated model

• A major focus is on transit validation, including mode choice and additional comparisons to observed data

• Improving major crossings

• Improving the first between modeled volumes and counts
  • Checking questionable counts
  • Network corrections/cleaning

• Minimal impact on the conformity results
Questions?