

Estimation of Telecommuting Impact with the Atlanta Activity-Based Model

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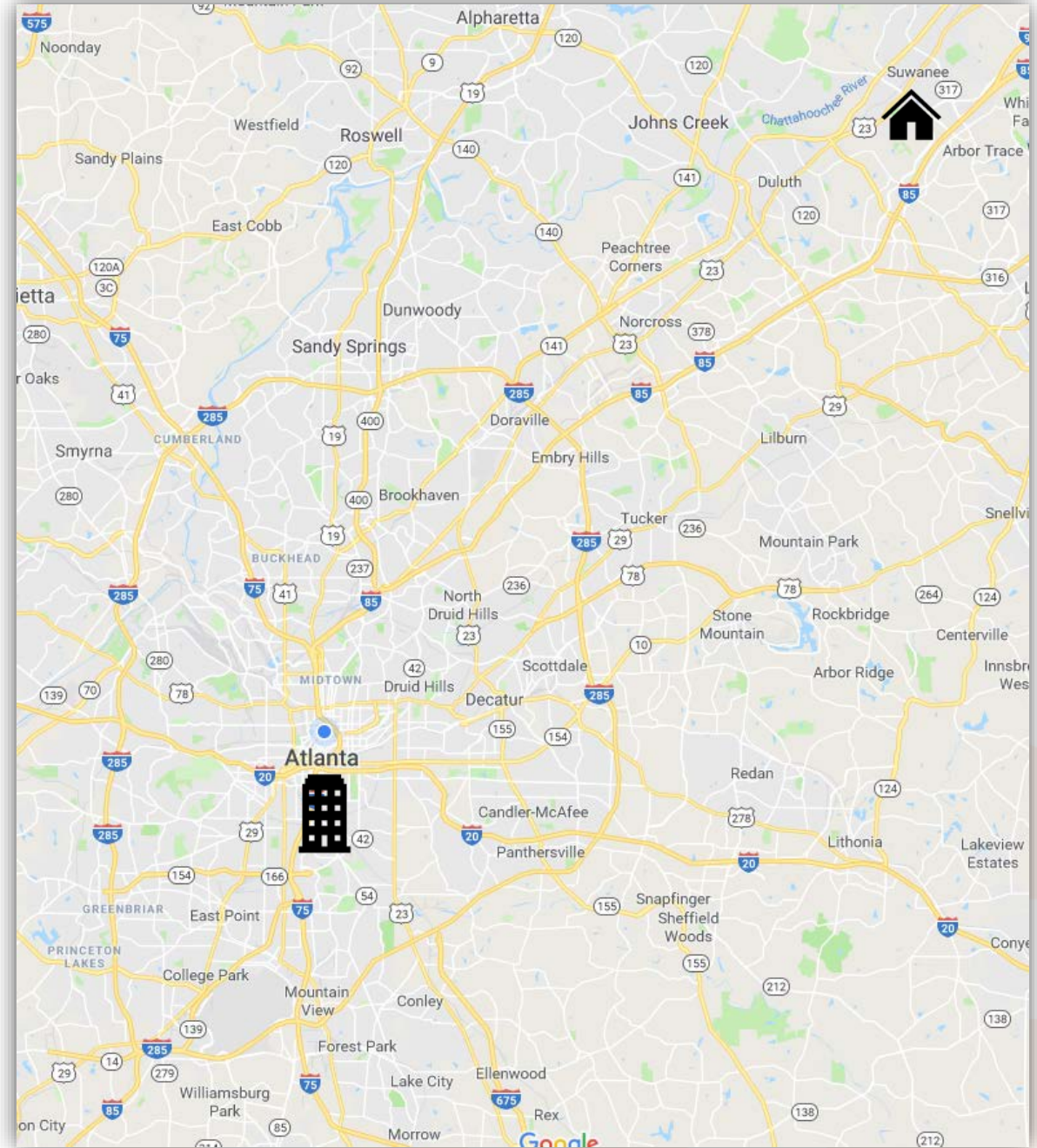
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Commuting in Atlanta - Example

- My home to work: 30 miles
- My commute: Drive-to-P&R (10 minutes), Express Bus (50 minutes), and Walk-to-destination (10 minutes)
- Time lost on the road: 140 minutes



Background and Objectives

➤ Reasons for telecommuting

- Heavy traffic congestion
 - ◆ An effective travel demand management option
 - ◆ More efficient use of workers' time
- Advancements in communication technology
 - ◆ High-speed internet
 - ◆ Increased opportunity for teleconferencing

➤ Objectives of this paper

- Present a methodology to address telecommuting in ARC activity-based model
- Measure the impact of increased telecommuting in metro Atlanta

Methodology

➤ Challenges:

- Telecommuting is not exclusively modeled in ARC ABM
- “Home” activities in the daily activity pattern (DAP) model, not distinguishable
- How to separate telecommuting from other home activities without changing the model structure

➤ General guideline

- Modify the ABM with a change in daily activity patterns that reflect telecommuting impact
- Expected outcome in activity patterns?



Methodology

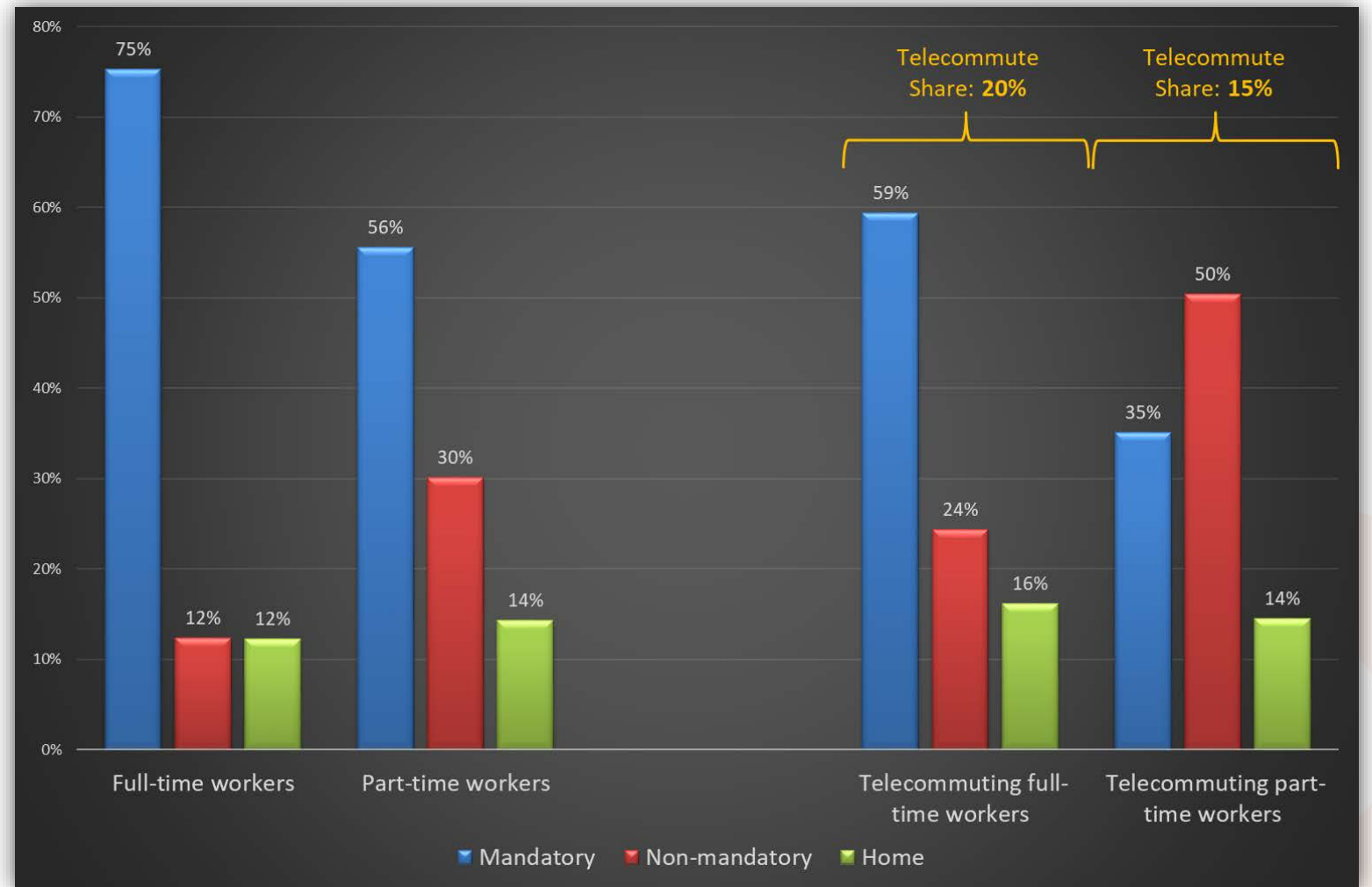
➤ First phase

- Identify the share of daily activity patterns from the RTP 2040 model
→ “Baseline”
- Investigate observed telecommuting patterns from the household survey
 - ◆ Frequencies and shares of telecommuting by occupation and by work type (full-time and part-time workers)



Survey Says ...

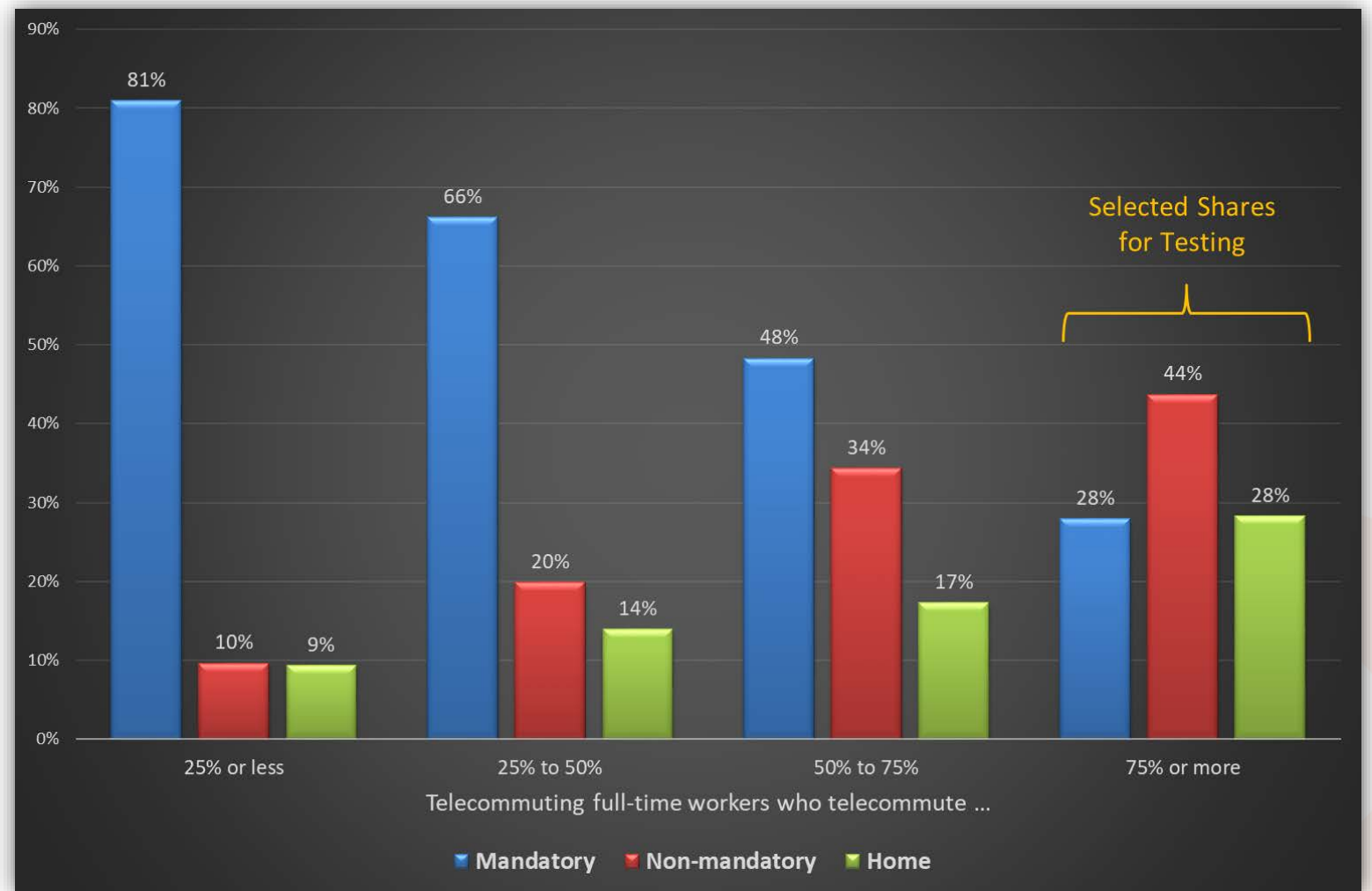
➤ Observed DAPs by worker type



* 2011 Atlanta Household Travel Survey

Survey Says ...

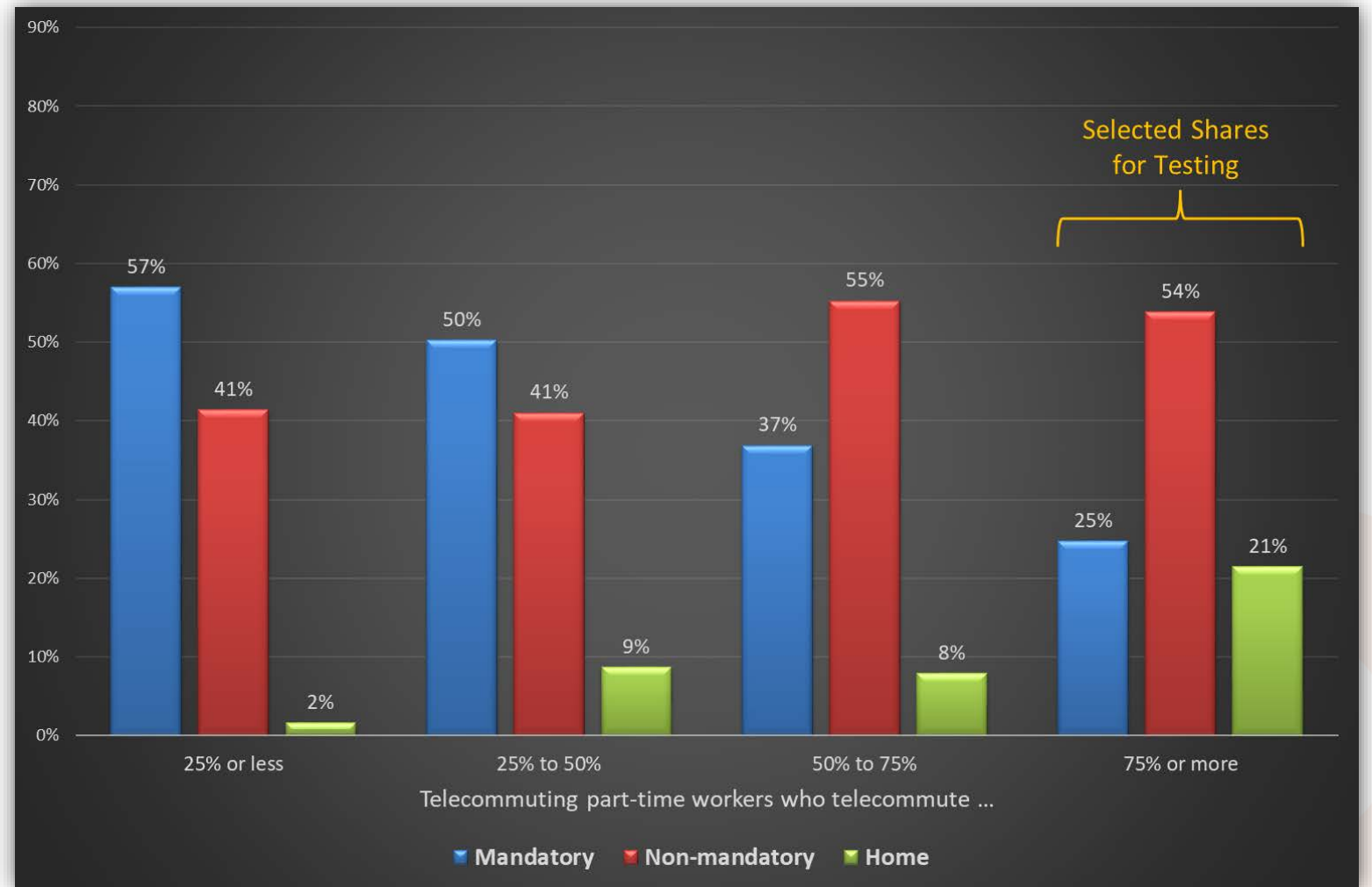
- Observed DAPs for telecommuting full-time workers



* 2011 Atlanta Household Travel Survey

Survey Says ...

- Observed DAPs for telecommuting part-time workers



* 2011 Atlanta Household Travel Survey

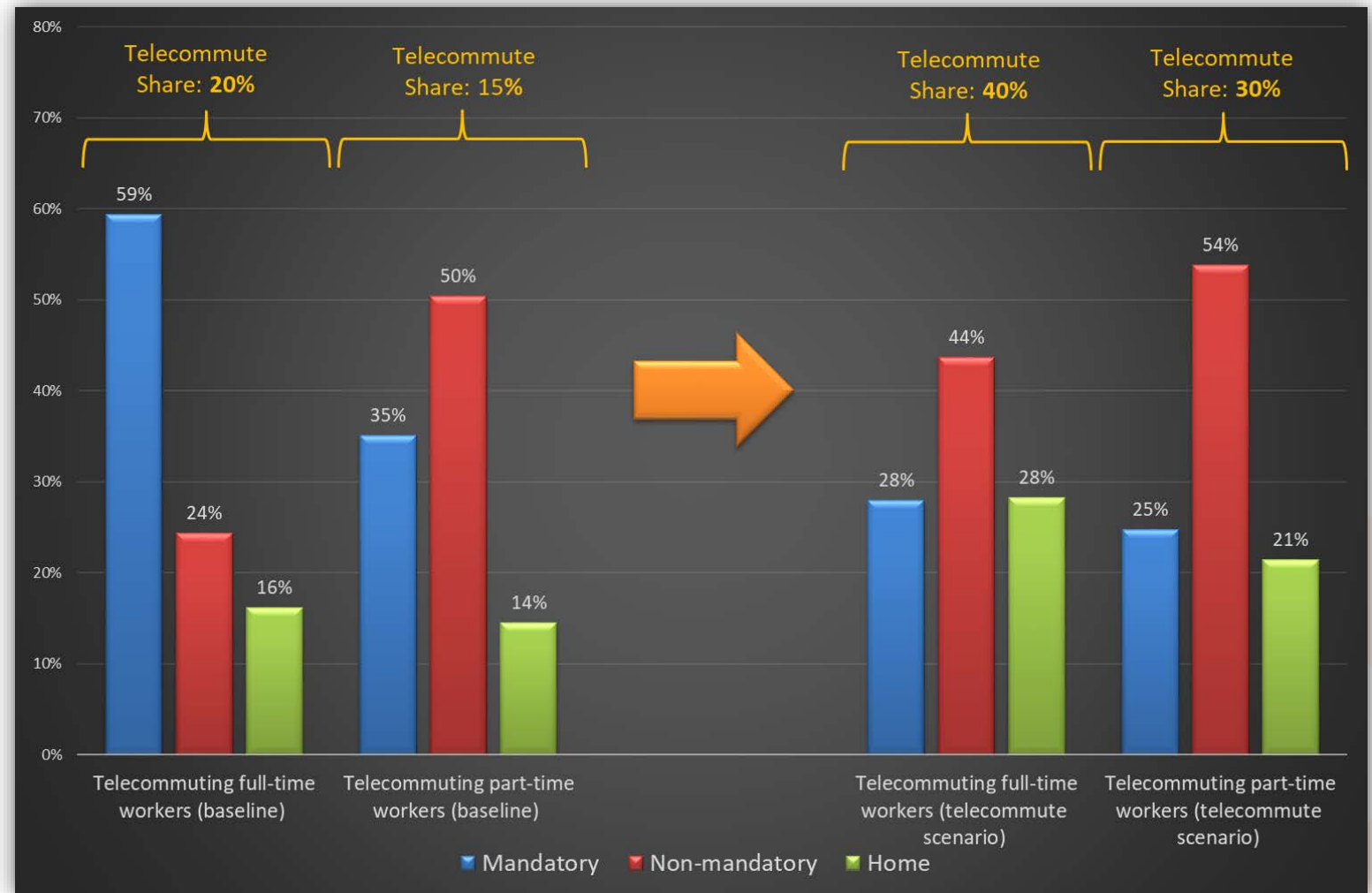
Methodology

➤ First phase

- Identify the share of daily activity patterns from the RTP 2040 model
→ Baseline
- Observed telecommuting patterns from the household survey
 - ◆ Frequencies/shares of telecommuting by occupation and by work type
- Assume the percent increase in telecommuting in the horizon year, 2040
- Derive the target shares of daily activity patterns reflecting telecommuting
- Estimate the target number of full-time and part-time workers by daily activity pattern

Methodology - Assumptions

- Target shares of telecommuting and DAPs



Methodology

- Second phase
 - Modify DAP utility function

$$U_i = ASC_{ij} + \beta_{ik} \cdot SE_k + \beta_{il} \cdot ACC_l + \beta_{im} \cdot INTRA_m + TC_n$$

where,

U_i = Utility for daily activity pattern i (i = mandatory, non-mandatory or home),

ASC_{ij} = alternative specific constant for i and person type j ,

SE_k = socioeconomic variable k ,

ACC_l = accessibility term l ,

$INTRA_m$ = household interaction term m ,

TC_n = telecommute constant for worker type n , and

β = coefficients.

Methodology

➤ Third phase

- Trial and error: A series of 100% sample runs for the horizon year
- Optimize the telecommuting constants to match the target frequencies of daily activity patterns reflecting telecommuting

$$TC_{an} = TC_{an_1} + \ln(Freq_target_{an}/Freq_revised_{an}) \cdot AF_n$$

where,

TC_{an} = telecommute constant for daily activity *a* and worker type *n*,

Freq_target_{an} = target frequencies of daily activities by activity *a* and worker type *n*,

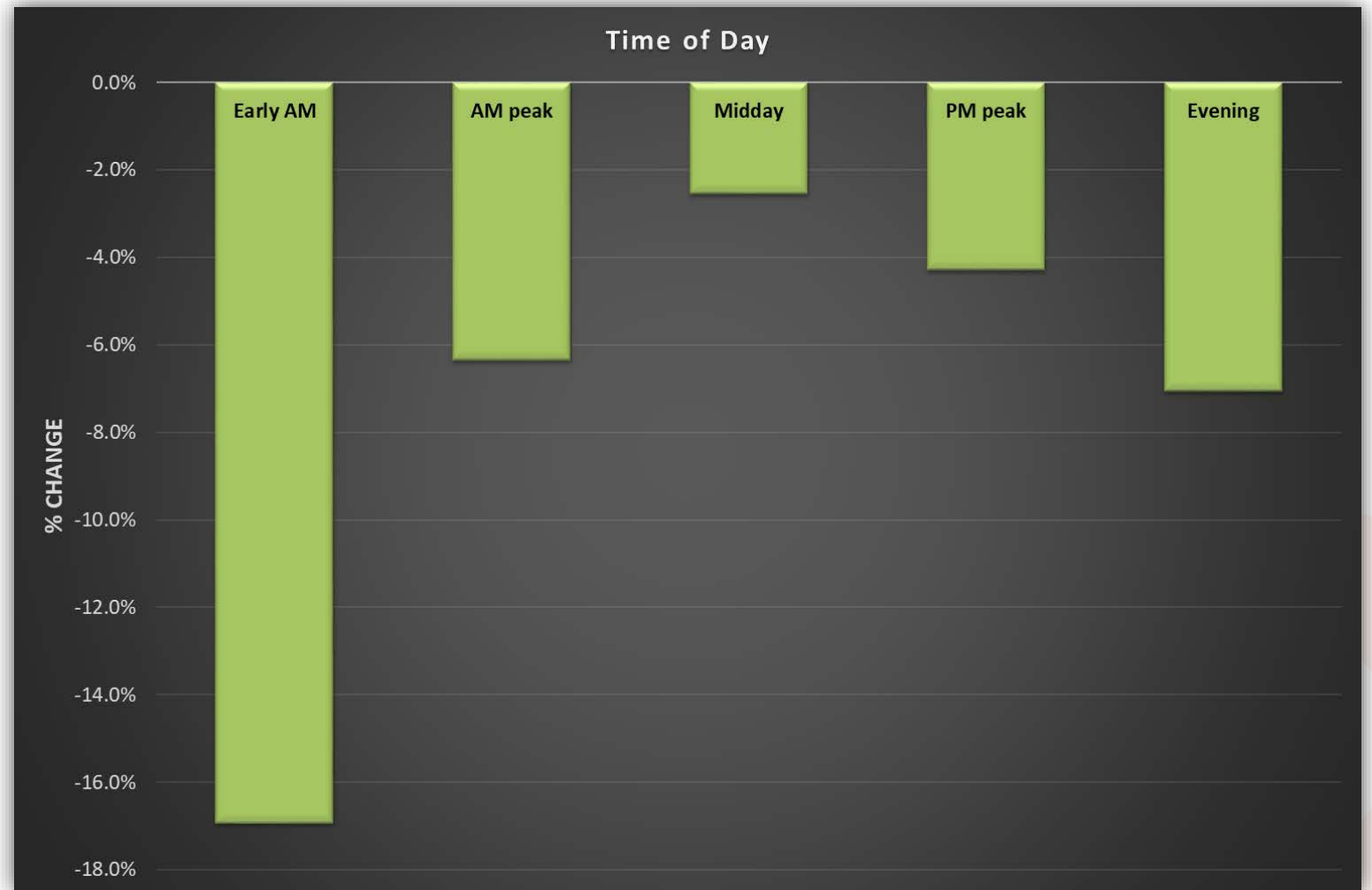
Freq_revised_{an} = revised frequencies of daily activities by activity *a* and worker type *n*,

AF_n = adjustment factor for worker type *n*.

- Full feedback runs with the optimized telecommute constants
- Compare the results (the baseline no-build vs. telecommuting scenario)

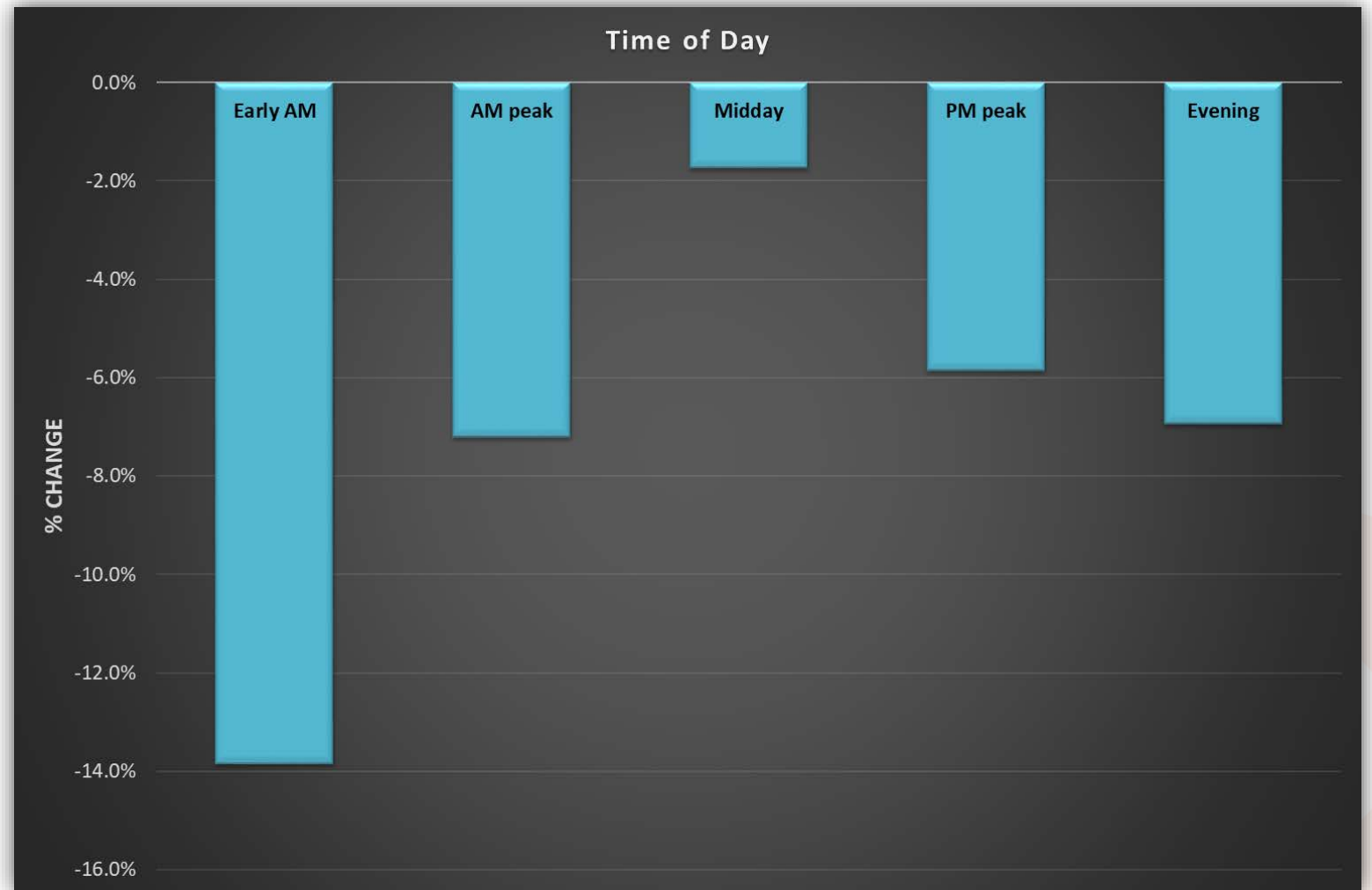
Model Results

- % Change in Person Trips, as compared to the baseline



Model Results

- % Change in Vehicle Miles Traveled, as compared to the baseline



Model Results

- % Change in Vehicle Hours Traveled, as compared to the baseline



Model Results

➤ Systemwide performance measures (20-county metro Atlanta)

Systemwide Performance Measures	Baseline (2040)	Telecommute Scenario (2040)	% Change
Person Trips	26,418,200	25,087,700	-5%
Transit Trips	441,200	393,000	-11%
Vehicle Trips	21,556,100	20,485,800	-5%
VMT	217,057,700	204,839,400	-6%
VHT	7,455,000	6,744,900	-10%
Average Congested Speed	29.1	30.4	4%

- Annual delay per person: reduced by 15 hours
- Total annual cost saving per person: \$540

Salient Findings

- Significant reduction in person/vehicle/transit trips, VMT, VHT, and delays per person
- Overall congestion relief in metro Atlanta traffic
- Implication on transportation planning decision making
 - Travel Demand Management vs. Infrastructure Investment
 - Which is more cost effective in alleviating traffic congestion and saving costs?



Implications for Modeling

- Derived DAPs reflecting an increase in telecommuting without changing the existing DAP model structure
 - Can be applied to other ABMs with similar DAP model
 - Important to make a reasonable assumption on the future telecommute pattern based on observed data
- Further enhancements
 - Implicit → Explicit
 - A separate “work-from-home” component in work location choice model or mode choice?

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