SCAG Model improvement-Telecommute Model

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Outline

- Overview of SCAG ABM Update - RTP 2024- current
- RTP 2024 approach for incorporating telecommute
- Limitations with the current approach
- Improvements to the telecommute model for RTP 2028
- Simulated results after model implementation
- Conclusions and next steps

SCAG ABM

- **Sub-model refinements**-revised and re-estimated coefficients of several key sub-models, using currently available data.
- **New sub-models** – several sub-models into SCAG ABM model system for future planning and policy analysis
  - Re-calibration of the models to targets developed based on a wide range spectrum of timely and local target data
- Comprehensive **research and analysis** have been conducted on work from home and AOC
- Implementing **emerging technologies** such as transportation network company (TNC, micromobility), updates to TAZ and networks
- Model choice-accommodated the changes of future transit route patterns outlines in **LA Metro's NextGen** bus plan

Improvement and Enhancement for 2024RTP/SCS

1.Population Synthesis, Accessibility, Zonal SED and LU

2.1a Usual School Location (Grade school)

2.1b Usual School Location (University)

2.1c Usual Work Location

4.1b Individual Discretionary Activities

6. Combinatorial Mode Choice

6. Combinatorial Mode Choice extension (TNC, Micromobility)

7. Trip Departure time

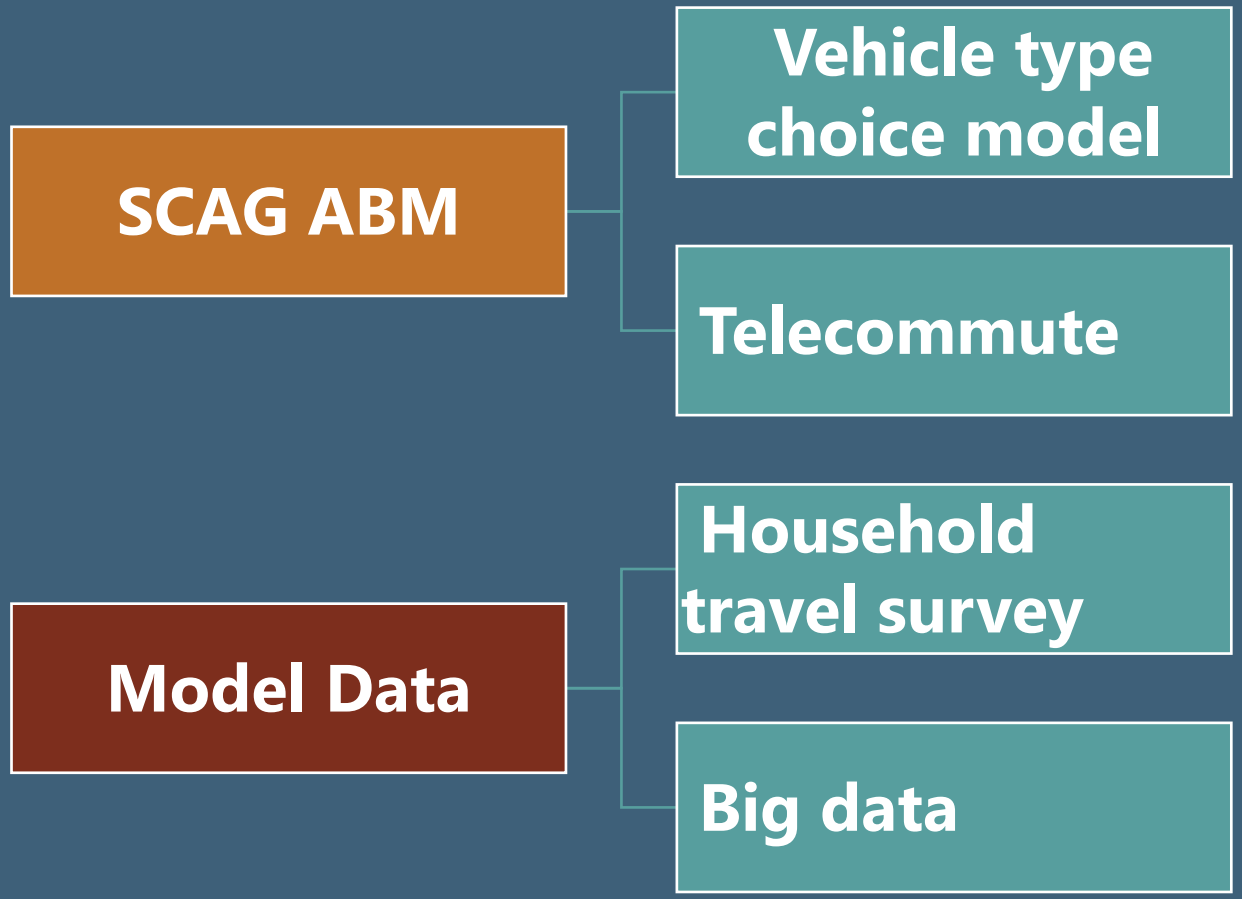
4. In home activity

Model runtime improvement

- ✓Significant improvement in run time, code optimization, upgraded version of Java (Java18), Java code update
  - A standard three feedback loop run with 100% household sampling using the SCAG RTP 2020 model - 84 hours
  - SCAG RTP 2024 model - 65 hours – 23% reduction

- ✓Implemented version control – with Azure DevOps to efficient tracking of changes made to software code and input data, ensuring versioning and history tracking for better collaboration.

Ongoing improvement



TELECOMMUTE MODEL

RTP 2024 Approach

- **Work Arrangement Model**
  - Work place type
    - Fixed out-of-home work location,
    - Variable work location and
    - Home work location
  - Work duration
    - Hours
  - Number of jobs
- **Work Location Model**
  - Doubly constrained model for workers with out-of-home work location

RTP 2024 Approach

- **Work Schedule Flexibility Model**
  - Number of days per week working at primary job
    - Five days per week,
    - Less than five days per week
    - More than five days per week
  - Work flexibility at primary job
    - none, moderate and high
  - Availability of compressed week option at primary job
    - Available and not available
- **Coordinated Daily Activity Pattern Model**

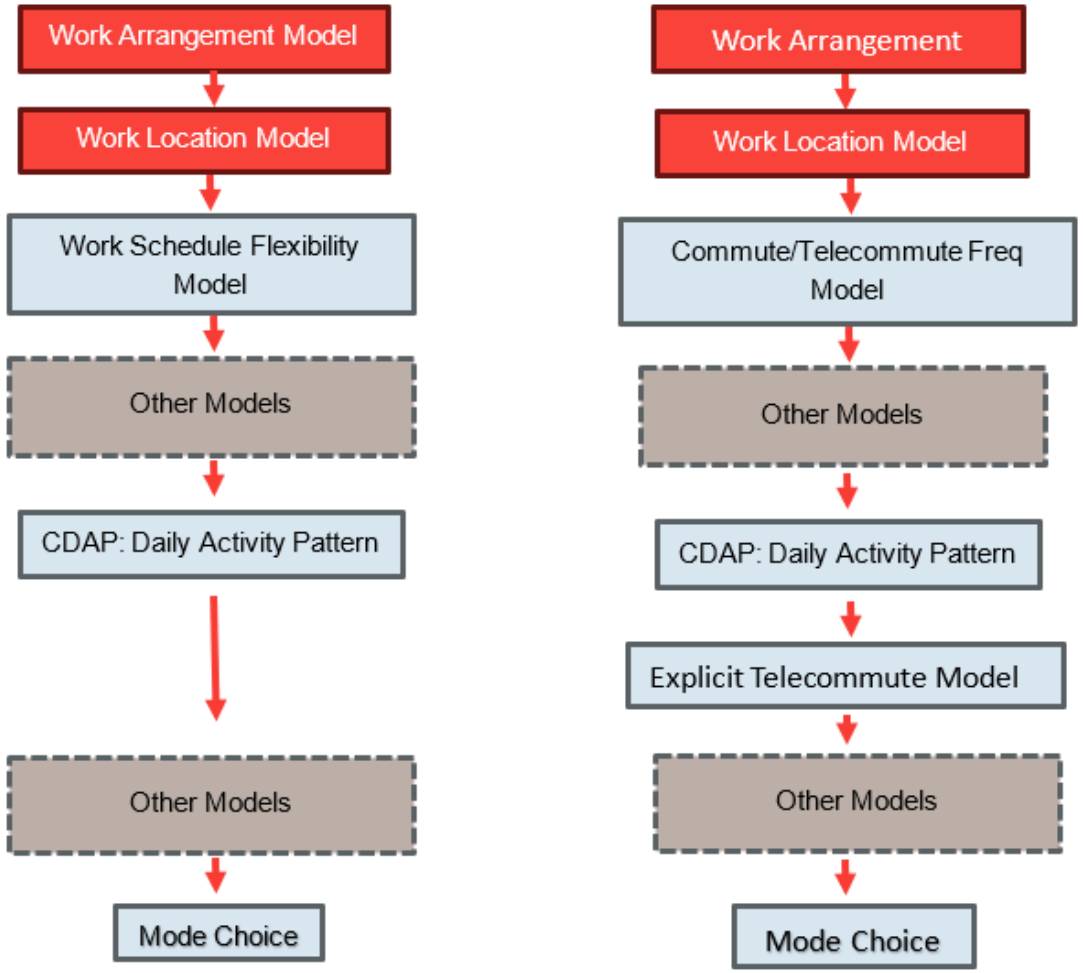
Limitations with the current approach

- **Cannot differentiate these different patterns**
  - Telecommuters who work-from-home on the simulation day
  - Workers who are not working (sick/vacation) and stay home
  - Permanent home-based workers
- **Misstates the "rebound" effect of telecommuting, as telecommuters'**
  - non-mandatory activities are not constrained in the simulation by the need to work while at home
- **Does not facilitate the analysis of the behavior of telecommuters vs. non-telecommuters**

Improvements to the telecommute model for RTP 2028

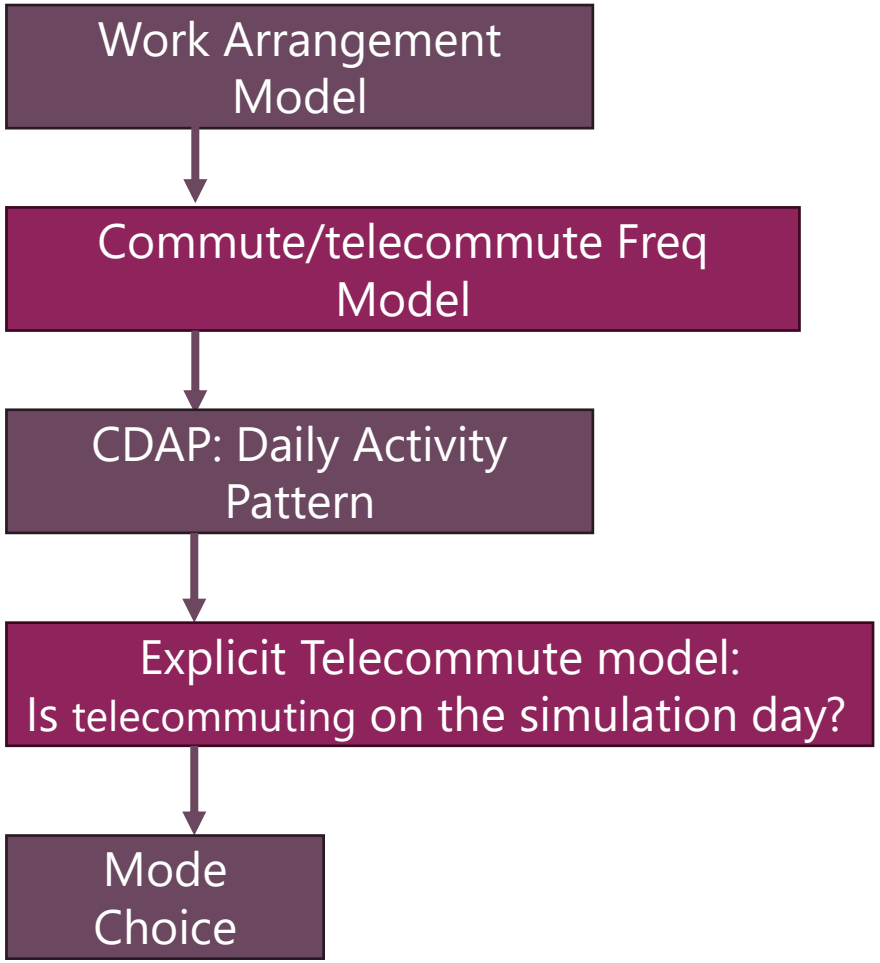
Who	What	When	Where	Why
• Telecommuters is explicitly identified	• Time spent working at home is identified as such, i.e., a work activity	• Time spent telecommuting at home is explicit, i.e., scheduled	• Telecommuters have an out-of-home work location, i.e., we know where they are not traveling to.	• Telecommuters' occupations and industries aligns with ability of those types of jobs to telecommute; commute impedance should influence telecommuting choice.

Updates to the model framework



- ABM Framework: RTP 2024 (left) and modified (right) with telecommute improvements

Updates to the model framework



Updates to Work Arrangement Model

- No Structural Changes
- **Work location type definitions update**
  - Fixed out-of-home work location (includes hybrid workers),
  - Variable work location and
  - Home work location (does not include hybrid workers)

Updates to Work Schedule Flexibility Model

- **Commute/Telecommute Frequency Model**
  - Still a long-term model
  - Not a decision day model
- **This model has two dimensions**
  - Number of days commuting
  - Number of days telecommuting
- **Uncalibrated Model outputs**

Number of days commuting	Number of days telecommuting					
	0	1	2	3	4	5
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%
1	0.2%	0.1%	0.1%	0.3%	1.7%	0.0%
2	0.5%	0.2%	0.2%	0.8%	0.0%	0.0%
3	0.9%	0.5%	0.6%	0.0%	0.0%	0.0%
4	1.2%	1.0%	0.0%	0.0%	0.0%	0.0%
5	91.1%	0.0%	0.0%	0.0%	0.0%	0.0%

Updates to Coordinated Daily Activity Pattern Model

- **Definition differences**
  - *Mandatory pattern*
    - Old: person makes a mandatory out-of-home work activity
    - New: person may undertake out-of-home or at-home work activity
- **Remove old work schedule flexibility terms from the model specification**
  - Hybrid work option, work flexibility, compressed work week

New Model: Explicit Telecommute model

- **This sub-model comes right after the CDAP model in the overall model sequence**
- **Applied for all out-of-home workers for whom the CDAP model predicted a mandatory pattern**
- **Explicitly predicts the commute type on the simulation day**
  - Commute
  - Telecommute
- **Simple specification currently**
  - Converting the odds based on the number of days commuting and number of days telecommuting into a discrete choice
  - For example, if the number of days commuting is 4 and number of days telecommuting is 1, then this model would yield probabilities of

$$\text{Prob(telecommute)} = \exp(\log(1)/(\exp(\log(1)+\exp(\log(4)) = 1/(1+4) = 0.2$$

New Model: Explicit Telecommute model

- New sub-model output file
- Third column is the decision output: 1 means that the person is not telecommuting and 2 means that the person is telecommuting
- Telecommute decision is also added to the standard person output.

	A	B	C	D
1	pid[i	hhid[i	explicitTelecommuteChosenAlt[i	choiceRn[d
2	732	270	2	0.916414694
3	9628	3123	1	0.188169113
4	25060	7889	1	0.574976374
5	27598	8630	1	0.527112056
6	29766	9263	1	0.165177476
7	33862	10635	1	0.232784327

usualWorkExplicitTelecommute.csv

Updates to Mode Choice Model

- Prior to mode choice model, the work location made is as home location for hybrid workers who are telecommuting on the simulation day
- Ensures that the tour formation spatial-temporal constraints and mode choice decisions are made with the appropriate work location
- For the simulation day telecommuters, during the trip output writing step, the trip mode is designated as “15”
  - if the trip origin is home and trip destination is work (or vice versa)

Example activity patterns of telecommuters

- **Example 1**
  - The person starts the telecommute at 176 minutes (from 3:00 AM) and works for the next 630 minutes (10.5 hours)
  - Two virtual telecommute trips are included in the trip list
    - No impact on highway assignment or transit assignment

Tour Trip #	Tour Purpose	Orig Purp	Dest Purp	Orig TAZ	Dest TAZ	Trip Dist	Trip Depart	Trip Arrive	Mode
1	1	0	1	11079	11079	0.30	176	177	15
2	1	1	0	11079	11079	0.30	806	807	15
1	6	0	5	11079	11194	13.00	881	898	3
2	6	5	6	11194	11171	6.31	935	942	3
3	6	6	0	11171	11079	6.79	987	997	3

Example activity patterns of telecommuters

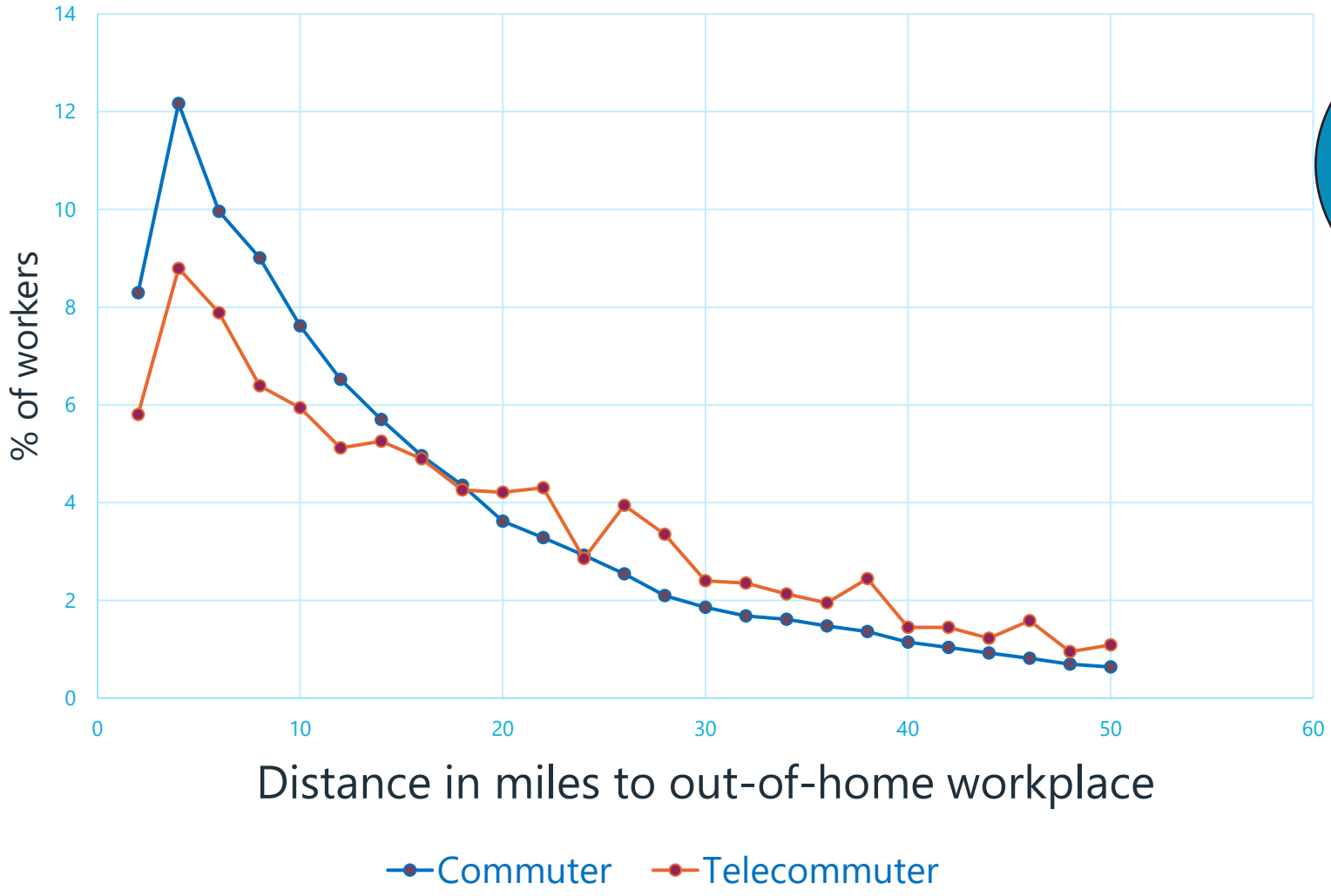
- **Example 2**
  - A telecommuter who is doing a breakfast activity (out-of-home) and school pick-up activity as part of “work tour”

Tour Trip #	Tour Purpose	Orig Purp	Dest Purp	Orig TAZ	Dest TAZ	Trip Dist	Trip Depart	Trip Arrive	Mode
1	1	0	71	11067	11089	6.1	111	131	1
2	1	71	1	11089	11067	6.1	220	240	1
3	1	1	412	11067	11180	7.6	711	721	1
4	1	412	0	11180	11067	7.6	756	766	2

Uncalibrated Results after implementation

Commuting Type	Share
Commuter	75%
Telecommuter	3%
Based-at-home worker	9%
Worker taking a day off	13%
Grand Total	**100%**

Uncalibrated Results after implementation



Telecommuter's out-of-home workplace is farther than commuter's

Uncalibrated Results after implementation

Person Type	Commutertype	VMT	PMT
Full-time Worker	Based-at-home worker	19	25
	Commuter	36	42
	Telecommuter	7	10
	Worker not working	16	22
Part-time Worker	Based-at-home worker	19	27
	Commuter	31	38
	Telecommuter	7	11
	Worker not working	17	24

Conclusions

- Work schedule flexibility model was re-designed: number of commute days and number of telecommute days.
- Telecommuters are explicitly represented in the simulation allowing for their analysis.
- Mandatory pattern is defined as someone who does mandatory activity – whether it is at home or outside.
- Telecommuters have a mandatory activity pattern and engage in a mandatory tour. The destination for the mandatory tour is the home location.
- Telecommuters are allowed to make stops on the mandatory tours to their at-home workplaces, which allows escorting and shopping to occur at the beginning or end of the workday. This allows us to leverage the activity-scheduling intelligence of CT-RAMP2.
- Telecommuting movements from home to the home-based workplace are tagged as a cost-free telecommuting mode and not assigned to the transportation network.

Next steps

- Model estimation using new household travel survey and SWAA data
- Auto calibration routine for the new commute/telecommute model based on policy targets by industry/income etc.

THANK YOU!

For more information, please visit: WWW.SCAG.CA.GOV

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