

Strategic Plan for MWCOG Modeling Program

SWOT Analysis

presented to

Travel Forecasting Subcommittee

presented by

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Sources for SWOT analysis

- COG/TPB model documentation including calibration/validation reports and user's guides
- COG/TPB GitHub issues
- Model sensitivity testing memorandums and reports
- Stakeholder and peer agency surveys
- Structured discussions with COG/TPB modeling and planning staff to discuss issues not covered elsewhere

Evaluation criteria

- Policy sensitivity
- Technical soundness and behavioral representation
- Validation and reasonableness
- Transparency and reproducibility
- Ease of use
- Runtime and computational requirements
- Data requirements
- Documentation quality
- Maintainability
- Ability to support stakeholder needs
- Consistency with state and federal planning requirements

Strengths

- An existing internal characteristic or capability that helps the system accomplish its purpose
  - Long-standing rigorous practices in model governance
    - QAQC, coordination, collaboration, accountability, communication
    - User support
  - Technical innovation
    - Workflow automation
    - Feature development in Gen3



Strengths

- Established role in regional planning and regulatory applications
  - Collaborative development/guidance of TFS stakeholders is uncommon among MPOs
  - Backbone of the region's federally mandated planning process for more than 30 years – Gen2 since the 2000s
    - MTP (e.g., Visualize 2050)
    - Air Quality Conformity
  - Other productive applications
    - WMATA regional ridership and transit benefits
    - I-495 & I-270 priced managed lanes study
    - Starting point for local analyses – Fairfax, Prince William, Loudon, Montgomery, Arlington, Prince George
- Socioeconomic data coverage and concurrence with jurisdictions, counties, states
  - Cooperative “top-down, bottom-up” approach, multiples sources and reconciling differences
- Validated procedures
  - Gen2 – 2010, 2014, 2018; Gen3 – 2018
  - Undergoing post-COVID validation; more to come with 2026/27 survey
  - Rigorous best practices in highway AND transit validation

Strengths

- Staff knowledge, governance practices, and documentation
  - Surveyed users give high marks for user support and documentation
  - Strong technical team – in-depth investigations to understand Gen3 ABM and other model components (e.g., tolling)
  - Cloud computing, workflow automation, dashboards, and reproducible model results
    - In-house development of tools
    - Reduce barriers to productive use, instill confidence
  - Clear process and staff resources for user support, maintenance, and enhancement
- Stability of results and forecasts
  - Consistent versioning control practices
  - Testing on a variety of application cases to set user expectations
    - Recent examples: congestion pricing, increased telecommuting, Metrorail Red Line extension, automobile operating-cost changes, bridge closure, increased high-capacity transit frequency, and hypothetical autonomous-vehicle ownership

Strengths

- Technical advances in the representation of travel behavior
  - ActivitySim activity-based model behavioral realism
    - Tour-based, intra-household consistency across travel choices
    - Temporal choice realism
    - Disaggregate representation of households and persons and their attributes
    - Telecommuting sub-model
    - Congestion pricing sensitivity
    - Walking and bicycling mode choice representation, multi-modal accessibility
- Integration with emissions and equity analysis
  - MOVES support, Gen3 provides peak spreading
  - Equity emphasis areas (EEA), EJ analysis

Weaknesses

- An existing **internal** limitation, deficiency, or constraint that reduces the system's effectiveness
  - Issues common to modeling practice
  - Data needs
  - Known model performance issues



Weaknesses

- Gen3 complexity means higher computational burden
  - Computing resources needed for Gen3 much greater than Gen2. Recommended:
    - 32 core processors
    - 256 GB RAM
    - 1.2 TB hard drive
  - Cloud computing a potential solution
- Regional network resolution, coding, and user friendliness
  - Unified network database may not be easy to edit for many external users
  - Requests for simpler transit network editing and zone splitting tools
- Challenges in debugging or traceability
  - Gen3 complexity makes it more difficult to debug than Gen2
  - Ability to trace individuals in Gen3 but guidance needed on how to use for trouble shooting

Weaknesses

- Data needs for special markets
  - Visitor and Taxi sub-models based on very old data; not in synch with TNC usage
  - Truck model based on old data, does not reflect e-commerce era
  - External stations based on AirSage data now about 10 years old
- Limitations in transit and active transportation analysis
  - Drive access trips to/from transit not assigned to the network
  - P&R lots not capacity constrained in model
  - Significant stakeholder interest in non-motorized travel, but zone structure for walk and bike trips is coarse in many places

Weaknesses

- Limitations in tolling and parking cost
  - Current toll setting method is challenged to match both observed tolls and express toll lane usage; no simple solution
  - Impact of tolls on telecommuting needs additional testing and adjustments
  - Non-transit parking rates based on old survey data, need updating
- Limited sensitivity to emerging automated vehicles
  - Deadhead AV travel behavior not well represented
- Lack of land use interaction
  - Without feedback cannot model impact of accessibility improvements on development patterns

Opportunities

An **external** development or condition that could be leveraged to improve the system or increase its usefulness

- Continued use of external resources
- Unexplored resources
- Emerging resources



Opportunities

- Big Data
  - Location-based services (LBS) data, connected vehicle data
    - Visitors, Trucks, Externals
  - Transit APC/AFC data, and GTFS data
- Advances in activity-based modeling and open-source platforms
  - Continued participation in ActivitySim Consortium—influence and support
- Improved GUI-based scenario management tool
  - Could be built into network modeling software interface
- A new custom visualizer tool
  - Continued COG/TPB model staff development

Opportunities

- Integration with Dynamic Traffic Assignment (DTA)
  - Potential for better dynamic pricing analysis – more accurate speeds, finer time slices
  - Bridge between planning and microsimulation of operations
  - E.g., NVTA TransAction with DTA Lite and adapted Gen2
- Resilience analyses (extreme weather events) – demonstrate wider value to COG/TPB planners
  - Gen3 ABM behavior well positioned to support with minor enhancements
- Integration with a land use model for feedback of accessibility

Opportunities

- Enhanced spatial resolution
  - Micro-analysis zones (MAZ) layer to support pedestrian and bike mode accessibility and transit access analysis
- Worker industry segmentation for telecommuting
- Person-based travel outcomes in equity analysis
- AI Tools
  - Data extraction and processing; inputs and outputs, QC
  - Workflow automation through LLM generated scripting
  - Modeling process alternatives to current model structures

Threats

- An **external** development or condition that could reduce the system's effectiveness, usefulness, sustainability, or credibility
  - » Issues that have always existed (resource limitations, uncertainty)
  - » Evolving travel behavior
  - » Evolving expectations



Threats

- Rapid changes in travel behavior (perpetual)
  - Telework habits and employer policies
  - E-commerce shopping trends and truck traffic
  - TNC full accounting for VMT
  - Micromobility – e-scooter, e-bikes, shared services – short trips
  - CAV penetration and future business models
  - Future technologies?
- Uncertainty in long-range forecasts and socioeconomic inputs (perpetual)
  - Industry sector growth/decline
  - Household structural trends, migration trends
  - Global economic shifts, pandemic, etc.
- Funding or staffing constraints (perpetual)
  - Prioritizing models and practice maintainability (Gen2->Gen3 phasing)

Threats

- Dependence on specialized software, legacy tools, or key personnel
  - Software vendor business models and level of support may change
  - Technical burden of old models based on old data (visitors, taxis, trucks)
  - Institutional knowledge of key persons (succession planning, active mentoring)
- Data privacy, licensing, or continuity risks
  - Future affordability of travel surveys, privacy restrictions
  - Vendor access limitations, licensing, source changes
- Expectations for policy sensitivity, level of resolution, and transparency
  - Stakeholder dissatisfaction if a model cannot answer their high-priority questions
  - Perceived value of artificial intelligence as a substitute for modeling

Side-by-side Gen2 v. Gen3

Topic	Gen2 Strengths	Gen3 Strengths
Usability and troubleshooting	Familiarity, troubleshooting unexpected results	Household and person-trip tracing and visualization
Computing and operations	Manageable file sizes, CPUs, and memory requirements	Cloud deployment, workflow automation, fast for an ABM
Behavioral and modal representation	Validated for multiple RTPs, extensively used, easy-to-understand structure/steps	Behavioral realism—telework, transit subsidy, temporal choices, walk and bike mode choices
Transit modeling		HB work trips can be off-peak—better for transit
External and exogenous trips	Doubly constrained, reasonable sensitivity	Explicit consideration of external school and transit trips

Side-by-side Gen2 v. Gen3

Topic	Gen2 Strengths	Gen3 Strengths
Freight/truck and commercial vehicles	Established truck model	Same as Gen2
Toll modeling	External toll setting separable and familiar	Integrates toll setting into model flow
Spatial and planning applications	Established regional and jurisdictional workflows, legacy apps	Richer activity-based disaggregate response, potential for wider range of applications (e.g., resiliency)
Data, transparency, and user support	Simple tabular inputs, outputs; simple workflows	GitHub code and issue management; dashboards, flow charts, summary tools
Adoption and transition	Legacy processes, simpler scenarios	Growing internal and external interest

Next Steps

- Strategic plan recommendations
- Prioritization
  - Importance to COG/TPB modeling program capabilities and efficiency
  - Timing of Needs
    - Short – address if feasible by next MTP
    - Medium – as soon as resources permit
    - Long – strategic, more complex planning



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