Framework for the Ontario provincial model

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A paradox
Analytical requirements

**Trip-based models can address**
- Project prioritization
- Community connectivity
- Links to economic and trade models
- Links to freight models
- Links to urban travel models
- Links to emissions models
- Energy impacts (aggregate)
- Travel demand management
- High-speed rail (HSR) studies
- Safety impacts
- Transit demand and revenue
- Modal redundancy studies
- Network resilience measures (rough)
- Economic impact analyses (aggregate)

**Activity-based models can address**
- *The trip-based model issues, plus:*
  - Congestion duration
  - Pricing studies
  - Managed lane studies
  - Most cost-benefit analyses
  - Financial and social welfare measures
  - Equity analyses
  - Active transport analyses
  - Health impacts
  - Energy impacts (detailed)
  - Fuel price impact analyses
  - Economic analyses (detailed)
  - Bottleneck analyses

**Integrated land use-transportation models can address**
- *The trip-based and activity-based issues, plus:*
  - Induced growth analyses
  - Integration with land use models
  - Complex equity analyses
  - Growth management conformity
  - Economic analyses (second, third order effects)
Differing approaches
Inspiration

Multi-scale geography

North American level

Provincial level

Urban scale

Multi-scale entities

Financial network

Logistics (supply chain) network

Physical transportation network

Producers

Distribution centers

Plant

Retailers

Cost information

Demand or order information

Travel time information

Incident information

Emerging trends

Person travel modelling
- Tour and activity-based travel behavior
- Travel substitution and telecommuting
- Autonomous and shared vehicles
- Complex trip chaining
- Inter-household interactions
- Explicit representation of visitors

Crossover
- Multi-level models (national, provincial, regional) rather than single scale
- Linkages to macroeconomic models
- Agent-based simulation
- Passive data collection instead of costly surveys
- Expanded use of stated preference surveys
- Dynamic response to pricing and congestion
- More robust CBA and evaluation

Freight modelling
- Fully multimodal rather than truck trips
- Representation of complex truck tours
- Inclusion of distribution centers and their effect on freight flows
- Focus on value of commodities carried, not just number of vehicles
- Represent the supply chain context

Ideal model qualities

The score associated with each quality is shown in parentheses:

Usefully informs decision-making (4.7)  
Supports strategic thinking (4.7)  
Visualization/reporting capabilities (4.0)  
Scalability and flexibility (3.8)  
Data requirements/tractability (3.5)  

Resource needs/achievability (3.3)  
Multi-level structure (3.3)  
Maintainability (3.0)  
Transparency (3.0)  
Link/value to other MTO systems (2.7)
Common modelling elements

- Provincial freight model(s)
- Multimodal person travel model(s)
- Integrated land use-transportation model

**Common modelling elements**

1. Multimodal transportation networks
2. Household and population data
3. Establishment and employment data
4. Macroeconomic data
Person layer

Interim land use and economic models

Common modeling elements

Synthetic population of Ontario

Synthetic visitor population

Northern Ontario: trip-based travel demand model
Includes components shown in Figure 35(a)

Southern Ontario: activity-based travel demand model
Includes components shown in Figure 35(b)

Visitor travel model: a separate set of travel models can be used if desired (design assumes they will be included in resident travel models)

Static traffic assignment
Used for entire province until dynamic traffic assignment becomes feasible for province

Dynamic traffic assignment
Initially optional for Southern Ontario, will eventually replace static assignment for entire province

Evaluation tools (CBA, emissions, etc.)
Freight layer

Key data required for model development and application

- Economic forecast(s)
  - Trade statistics

- Rail waybill data
  - Commodity flow data
  - Input-output data
  - Commercial vehicle survey

- Establishment surveys
  - Distribution centre data

- iCorridor data
  - Commercial vehicle counts

Common modelling elements
- Macroeconomic, household, establishment, and network data

Macroeconomic
- Economic and trade time series and scenario testing models

Commodity flow
- Commodity generation and destination and mode choice models

Tour-based freight
- Commodity flows transformed into daily vehicle tours by mode

Network analysis
- Two-level traffic assignment and network appraisal

Aggregate (macro) models operating at highly aggregated geography

Disaggregate (agent-based) models operating at firm level within traffic analysis zones

Static macroscopic and/or dynamic mesoscopic traffic assignment models
Data path

Activities that will be accomplished during initial provincial model development

1. Existing TSRC survey data
2. Analysis of MI-OH-OR survey data
3. Transferable trip characteristics
4. 2006 Transportation Tomorrow Survey

- Analysis and synthesis of secondary data sources
- Intercity travel characteristics
- NO trip characteristics and parameters
- SO trip characteristics and parameters

- OD matrix estimation
- Initial model validation
- Fully operational multimodal provincial model

Improvements dependent upon new data

- Expanded TSRC for Ontario
- Re-estimation and recalibration of selected model components
- Second generation provincial model
- Future Transportation Tomorrow Survey

Legend:
- Travel data described in Section 5.4.1 (page 82)
- Model component or development activity
- Italicized: Synthesized data used for model development and application
<table>
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<tr>
<th>Common modelling elements</th>
<th>Simplified land use and economic models</th>
<th>Northern Ontario travel model</th>
<th>Southern Ontario travel model</th>
<th>Network analysis models</th>
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<tbody>
<tr>
<td>Develop initial data architecture and interfaces</td>
<td>Develop static economic forecast(s)</td>
<td>Develop synthetic trip rates</td>
<td>AB model specification</td>
<td>Implement and test static assignment</td>
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<td>First generation databases</td>
<td>Economic model(s)</td>
<td>Trip-based travel demand model</td>
<td>Import AB framework</td>
<td>Evaluation tools (CBA, …)</td>
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<td>Passive data collection pilot and specification</td>
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<td>Long distance trip-based model</td>
<td>Calibrate AB framework</td>
<td>Local transit service model</td>
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<td>Expanded establishment survey (part of freight model enhancements)</td>
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<td>Refine models with AirSage data</td>
<td>Re-estimate selected model components</td>
<td>Analytical DTA pilot</td>
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<td>Small urban area validations</td>
<td>Transition to linkage with DTA model</td>
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Fully operational multimodal provincial person travel model

Note that tasks and ordering may change during full specification of the models and supporting data requirements. Acronyms: AB=activity-based (travel model), CBA=cost-benefit analysis, DTA=dynamic traffic assignment.
A different path

Multi-year transitions

SE and land cover trends

Minutes to hours

Activity locations

Daily inventories

Emissions models

Spatial context → Agent synthesis → Goal satisfaction → Impact analyses → Evaluation

Annual trends

Economic drivers

Continuous time?

Travel choices

Weekly long-distance, hourly local travel

Network analyses