Urban Transportation Modelling

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ITE Transportation Boot Camp

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York Region

Why model?

- To identify improvements to support growth
- To understand the impacts of development
- To evaluate the benefits/costs of infrastructure investments
- To understand the impacts of potential socio-economic policies

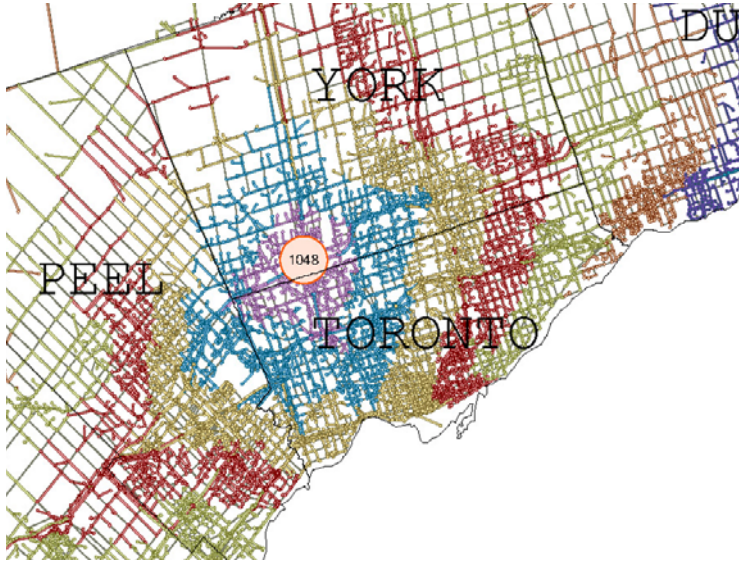
To Plan or Improve Our Transportation System

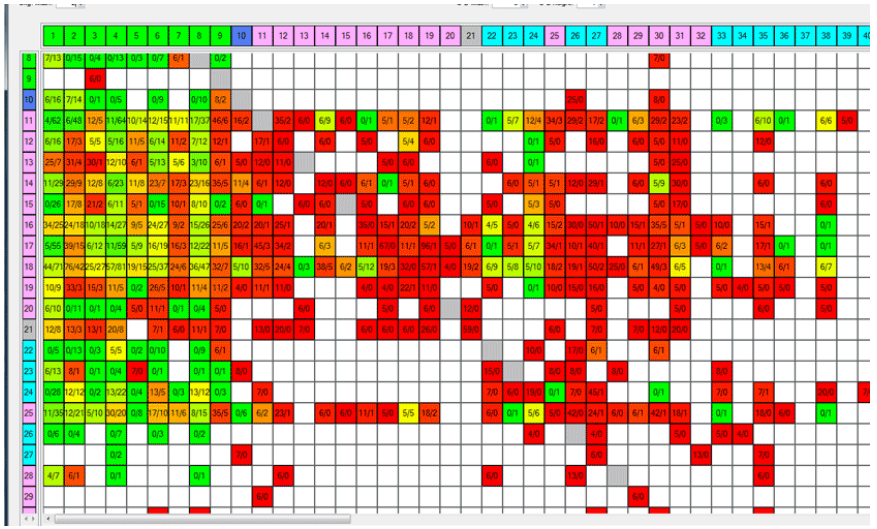
What are the types of modelling?

MACRO	MESO	MICRO
Network or area-wide analysis	Sub-area or corridor analysis	Link or intersection analysis

What are macro models?

- **Travel demand** forecasting models
- Models travel demand for different modes of transport based on an assumed transportation system





What are Macro Models

- Travel demand results from travelers making decisions on how, where and when to travel
- These decisions are affected by many factors such as family situations, characteristics of the person making the trip, and the choices (destination, route and mode) available for the trip

Source: http://www4.uwm.edu/cuts/utp/models.pdf

What are Macro Models

- Mathematical equations are used to represent these decision making processes, i.e. model human behaviour in making choices/decisions
- Models are calibrated & validated to match existing data (TTS, cordon count, ridership)
- Models require a set of assumptions to run
- Models are limited by the input data available to make forecasts

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Why is macro modelling important?

- Modelling and forecasting is a critical part of transportation planning
- Transportation system is a key part of our economy
- “A Transportation Modelling Primer”
- by Edward A. Beimborn; Center for Urban Transportation Studies; University of Wisconsin-Milwaukee; http://www4.uwm.edu/cuts/utp/models.pdf
- **Our work impacts public policy a great deal!**

Why is Macro modelling important?

- We plan the arteries and skeleton of urban areas
  - Roads (highways, arterials, collectors)
  - Transit (commuter rail, subway, LRT/BRT, etc)
- In the case of the GTHA:
  - Province, Metrolinx, Regions, Municipalities create transportation plans
  - Big Move - $50 B
  - York Region's TMP - $18 B

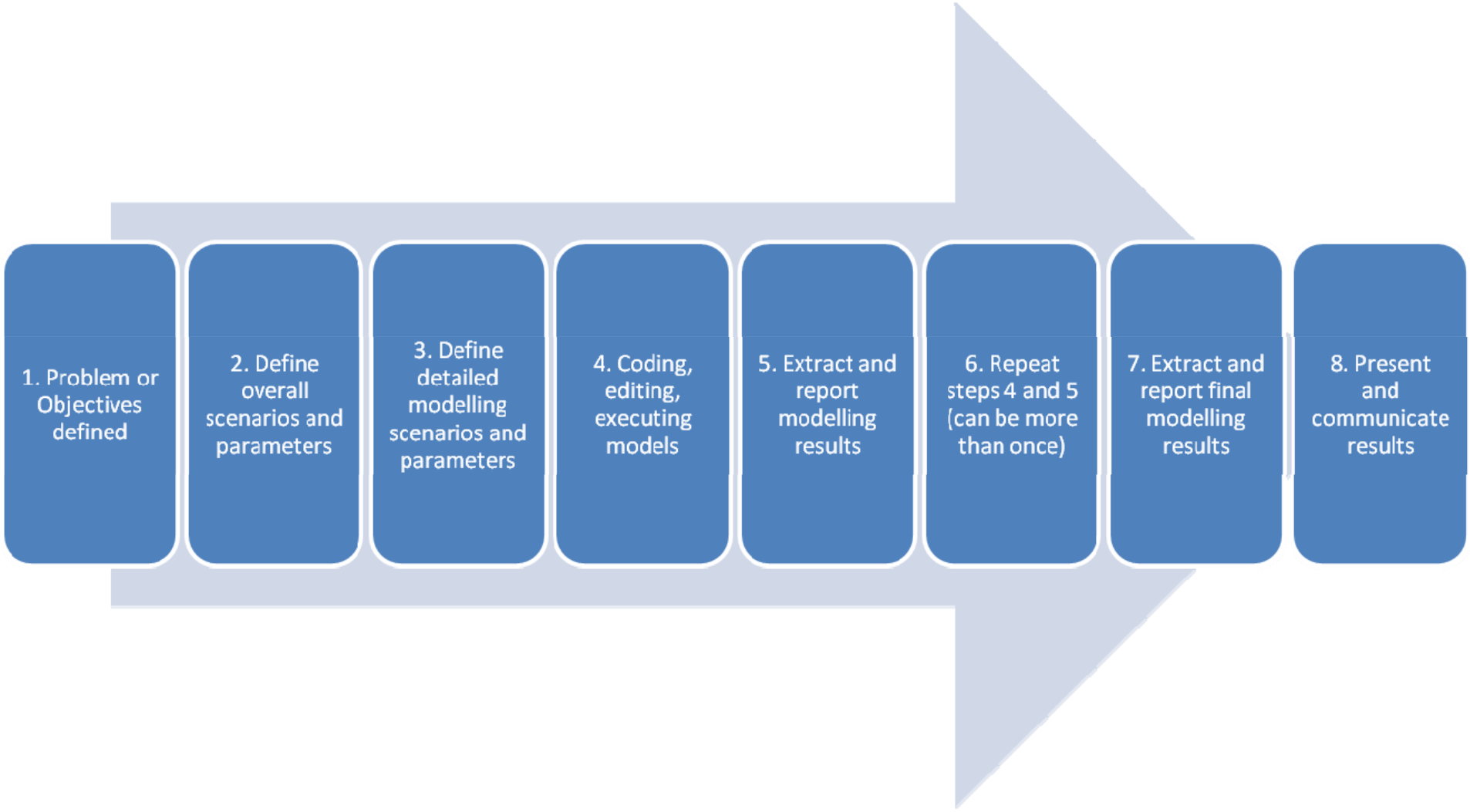
Types of Macro Models

- Aggregate models
  - Based on traffic zone system
  - 4-steps (generation, distribution, mode split, assignment)
  - 3-steps (generation, distribution, assignment)
- Disaggregate models
  - Tour or activity-based
  - Simulate the decisions of individual travellers

Meso & Micro Models

- Focuses on the trip assignment step
- Requires increasing details of the network
  - geometric design (lane widths, turn lane lengths)
  - traffic signal timing (cycle length, phases, etc)
  - transit signal priority measures
  - vehicle (driver) behaviour
- Analyse the operational details of road and transit segments

What is the Forecasting Process? Where does modelling fit in?



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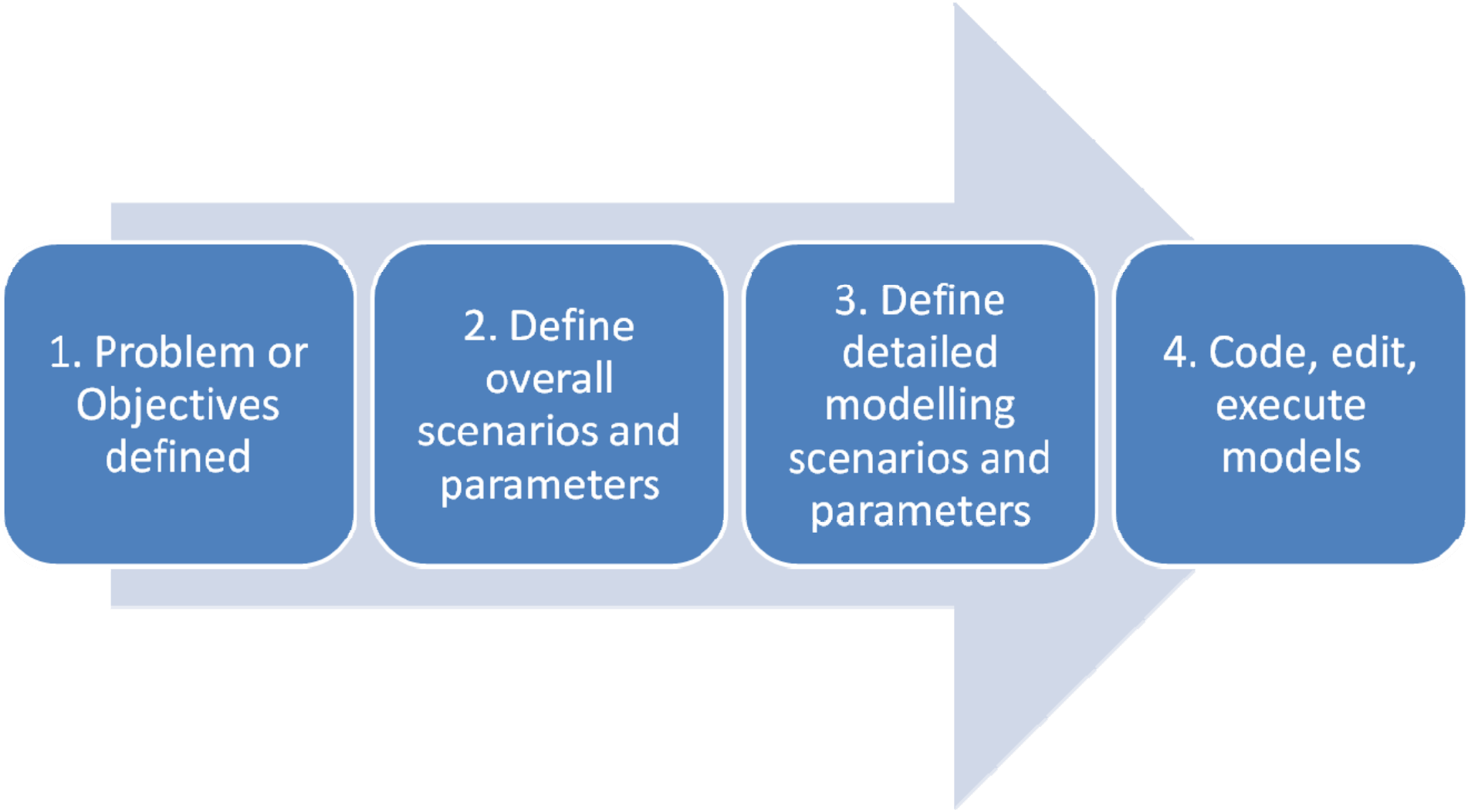

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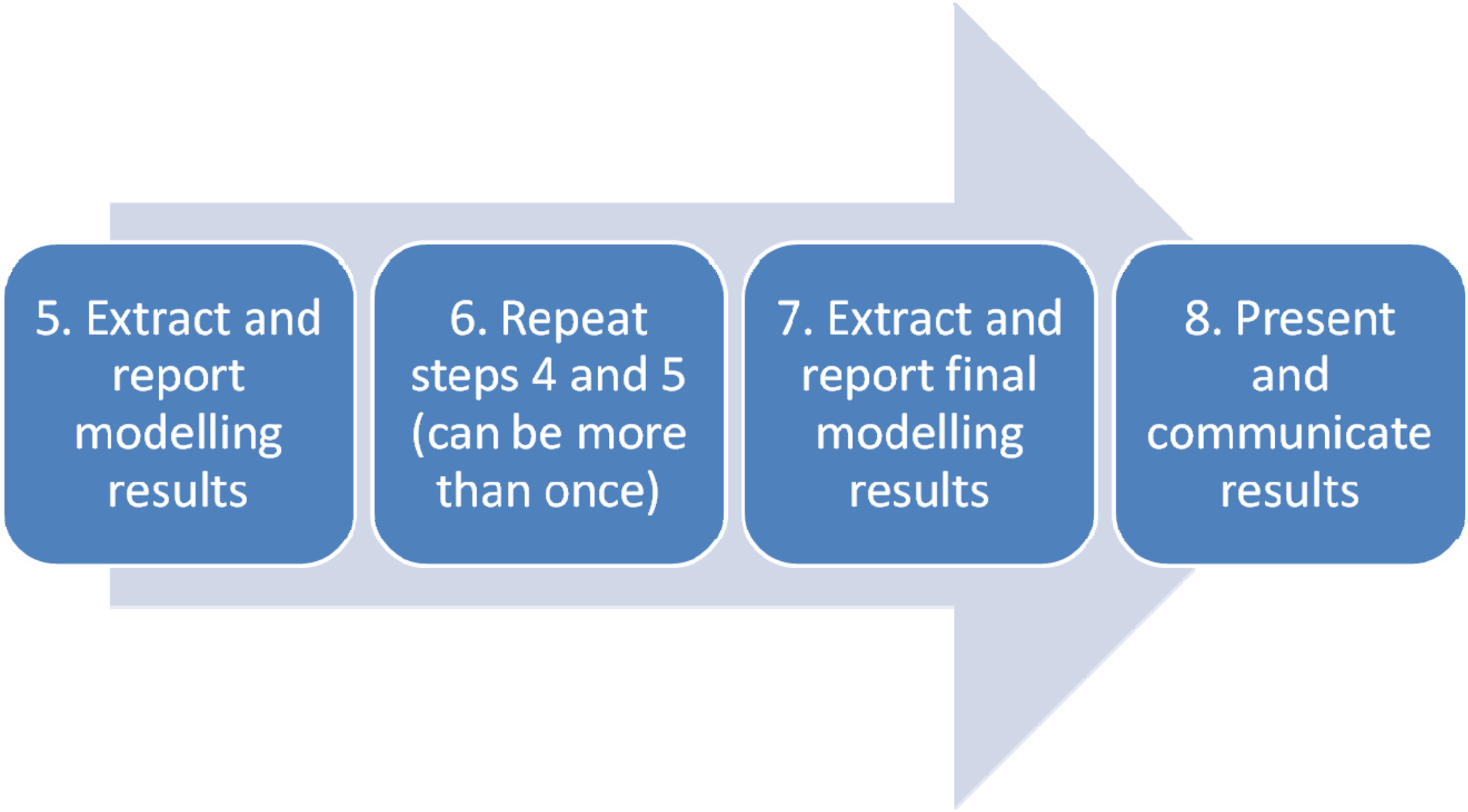


What are we modelling?

- Network-wide analysis through transportation master plans, regional and secondary plans
- Define and validate where, what and how much transportation improvements are needed to meet the travel demand
  - Roads (highways, arterials, collectors)
  - Transit (commuter rail, subway, LRT/BRT, etc)
  - Other modes (HOV, TDM, cycling, etc)

What are we modelling?

- With comprehensive models, we are asked to help define & assess transportation policies
  - Area congestion pricing
  - transit fare structure
  - economic impact of congestion
  - GHG emission, fuel cost, tolling, etc

How to Use Macro Model Results

- Macro models are designed for strategic or "broad-brush" level analysis
- Therefore, use results at the macroscopic end of the "accuracy spectrum"
  - Proportions (e.g. modal split, %, growth rate, etc)
  - Orders of magnitude (e.g. 1800 vs 1752)
- Best for determining differences or changes between alternatives

What to use Macro results for

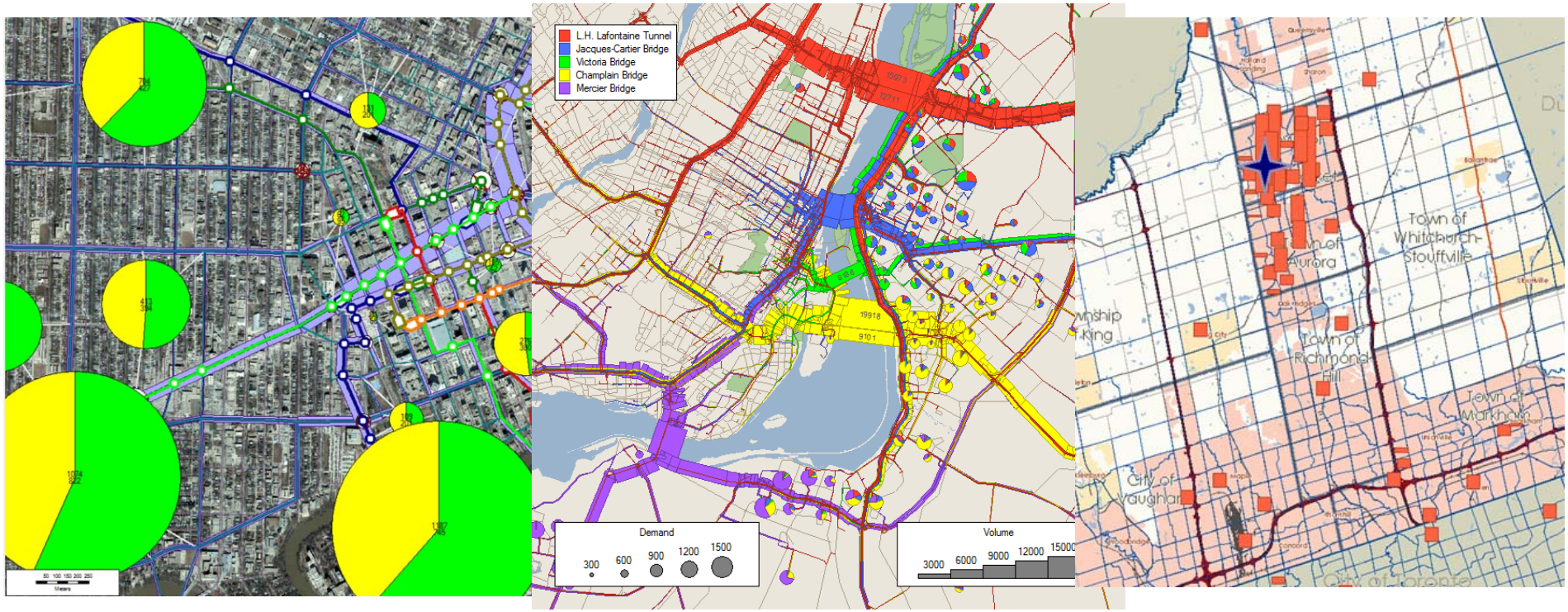
- Depends on a number of things
  - Revolves around design of the model
  - Spatial disaggregation/aggregation
- Answers big picture questions
  - Area O-D volumes and modal splits
  - Link volume orders of magnitude
  - Change in amount of travel or impacts

What NOT to use Macro results for

- Exact numbers
  - Individual link volumes
  - Intersection volume details
  - Short distance trip forecasts
  - Travel times

Communicating & presenting Model results

- Relevant info that answers the original problem or objectives of the analysis
- Interpretation of results can differ



Communicating & presenting Model results

- Use numbers & graphics to convey info
- Careful not to use graphics to “sex-up” option
- Use of graphics can “conceal” important data
- Ultimately must be able to defend data contained in presented results
- Increasing use of meso/microscopic simulations to present macro model results

The Art of Macro Modelling

- Developing macro models is based on science
- Applying them properly requires experience & understanding of how the model behaves under different conditions
- That is, applying models is not a science
- Risk and uncertainty are always involved

- **Modelling/forecasting is an art**
- **Pushing buttons is not modelling**