Closing the gap between travel demand modelling and project evaluation in North America

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Metrolinx
WHO IS METROLINX?

68.5 m annual riders
222,000 daily rail boardings
49,000 daily bus boardings

81 locomotives
716 train coaches

500+ buses

GO Rail
7 lines
1800+ weekday trips

GO Bus
43 routes
2400+ weekday trips

66 stations
15 bus terminals
1100+ bus stops

CLOSING THE GAP BETWEEN TRAVEL DEMAND MODELLING AND PROJECT EVALUATION IN NORTH AMERICA
Our Mandate: Trusted partners in world-class project evaluation that provide sophisticated economic analysis while facilitating comprehensive strategic, financial, and operational analyses for business cases.
A Business Case is a collection of evidence assembled in a logical and coherent way. It explains the contribution of a proposed investment to organizational objectives, and helps to ensure that a particular investment is a good use of public funds.
Recommendations are made considering all four cases.
ECONOMIC EVALUATION

Benefits

- GHG emissions
- Safety
- Vehicle operations

Costs

- Lifecycle operating
- Capital
PAST ECONOMIC EVALUATION CURRENT PRACTICE

- Historically, cost-benefit analysis and four stage travel demand models functioned in isolation from one another.
- A four stage travel demand model was thought of as nothing more than a ridership forecasting tool.
- Travel demand modelers predict ridership, while cost-benefit analysts independently assess the direct user benefits and social impact (externalities) of a project.
GREATER GOLDEN HORSESHOE MODEL

- The **Greater Golden Horseshoe model (GGHM)** is the Province of Ontario’s **Regional Travel Demand model**, a software tool used to predict how changes to transportation networks or land use patterns may impact where and how people will travel in the GGH.

- The model produces many outputs that inform evidence-based decision making, including:
  - Travel Demand Forecasting
  - Mode Shares (auto, transit, walk/cycling)
  - Ridership Forecasts
  - Capacity Constraints
  - Travel Times
THE ISSUE: INDIVIDUAL IMPACTS ARE NOT ALWAYS SOCIETAL IMPACTS

Private User Impacts

- Private user costs/benefits consider the direct impact on a user
- Travel demand models evaluate changes in travel behaviour and mode shift based on changes in *private user* costs/benefits.

Societal Impacts

- Social costs/benefits are concerned with the use and allocation of resources in society
- Cost-Benefit Analysis evaluates the overall welfare generated by a project by looking at changes in *social* costs/benefits

Private User Impacts ≠ Societal Impacts
THE ISSUE: *INDIVIDUAL IMPACTS ARE NOT ALWAYS SOCIETAL IMPACTS*

- Private User Impacts
  - Transit Fares
  - Road Tolls
  - Gas Tax
- Societal Impacts
  - Travel Time
  - Most Auto Costs
  - GHG Emissions
  - Auto Congestion
  - Road Safety
THE ISSUE: *INDIVIDUAL IMPACTS ARE NOT ALWAYS SOCIETAL IMPACTS*

**Private User Impacts**
- Transit Fares
- Road Tolls
- Gas Tax

**Societal Impacts**
- Travel Time
- Auto Costs
- GHG Emissions
- Auto Congestion
- Road Safety

**“Transfer Payments”**
- Who has the money doesn’t matter
- A transfer payment will not impact the total amount of money and/or resources in society
THE SOLUTION: PRIVATE USER IMPACT ADJUSTMENT

- Compensate for the transfer payments captured in the demand model

![Diagram showing Private User Impacts and Societal Impacts]

Private User Impacts:
- Transit Fares
- Road Tolls
- Gas Tax

Societal Impacts:
- Travel Time
- Most Auto Costs
- GHG Emissions
- Auto Congestion
- Road Safety
1. Karen considers her fare when choosing mode (private user impact)

2. If Karen chooses transit, her benefit is reduced by the cost of her fare

3. Benefits are monetized (including fare disbenefit)

4. The private user’s fare cost is added back as a benefit to neutralize their disbenefit (societal impact)
THE ISSUE: *DOUBLE COUNTING OF BENEFITS*

2. *Double counting* between modelled/perceived benefits and what is monetized in cost-benefit analysis:

- For cost-benefit analysts, one of the first benefits of transit improvements to new users that comes to mind are the savings on auto costs such as fuel.

- The travel demand model accounts for fuel costs in the mode choice stage when determining a user’s benefit.

- Adding fuel savings as an additional benefit in the economic appraisal results in the benefit being captured twice.
TIMEOUT: EXPLAINING GENERALIZED JOURNEY COST

- In this example, a user would choose to drive, as the “generalized journey cost” of all the factors that go into their decision results in a trip by car being $5 more valuable.

- All the user’s perceived factors are considered in the equation.

- Factors not considered include unperceived user benefits (ie. Variable depreciation) and externalities (ie. Pollution).
TIMEOUT: EXPLAINING GENERALIZED JOURNEY COST

- In this example, a new transit line was built that reduced travel time and improved comfort

- The user would now choose transit over driving

- The user’s benefit would be the difference between the driving option and the New Transit option

- This change in generalized journey cost is often reported as travel time savings

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![Diagram showing cost components for driving, new transit, and old transit]

- Comfort / Crowding
- Transit Fares
- Maintenance
- Parking Cost
- Fuel Cost
- Travel Time
ALMOST DONE: **CALCULATING BENEFITS**

- In demand models, it is often difficult to derive the users specific generalized cost before a mode choice switch.

- It is not necessary to know this, as the generalized cost of the previous mode did not substantively change.

- Because the previous mode did not change, the only benefit to be captured is related to the changes to the transit mode.

![Graph showing potential benefits](chart.png)
THE ISSUE: *DOUBLE COUNTING OF BENEFITS*

- Savings on gas and other private out-of-pocket costs are understood and internalized at the time a decision is made to switch modes.

- The travel cost of their previously used mode is *embedded in the choice* to use the new mode. Counting benefits that are already considered in the mode choice decision results in double-counting of those benefits.
THE ISSUE: **MISSING BENEFITS**

- On the contrary, other cost savings may exist but not be perceived or internalized at the time a decision is made to switch modes (e.g., vehicle depreciation costs). These cost savings which are not captured under the Travel Demand Model, should be accounted for in CBA.
THE METROLINX SOLUTION

• Close relationship between the transport demand modeling and project evaluation teams
  • Collaboration on projects
  • Modelling team teaches the evaluation team on the model, its inner working and outputs
    • Thus not a mysterious black box
  • Ensure we accurately consider the difference between the perceived private costs used for modelling, and the social costs necessary for Cost-Benefit Analysis
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<th>Social Cost (For Business Case)</th>
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IMPLICATIONS

- Projects that rely upon improving travel time for riders perform better than under previous evaluation practices.
- Projects that rely upon converting drivers to transit users perform worse than under previous evaluation practices.
- Fare policy matters
Questions