

Travel Demand Modeling Needs for Road Pricing

Challenges and Opportunities

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Some Issues in Using Models for Road Pricing Analysis

- Shifts in travelers' times-of-day
- Distributional shifts
- Effects of bottlenecks and oversaturation of networks
- Aggregation error
- Quality and applicability of stated-preference data
- Lack of revealed-preference research
- Uncertainty of travel times from day-to-day

Time-of-Day Shifts

- **Conventional models – time-of-day shifts not considered**
- **Activity-based models – trip/tour-level time-of-day choice models**
- **BUT...**
 - **Many models do not include cost variables in time-of-day choice**
 - **It is difficult to estimation effects of congestion on time-of-day choice**
- **Data on very short periods is elusive**

Distributional Shifts

- Road pricing can affect many decisions

Short-term

- Route
- Mode
- Destination
- Time-of-day
- Whether to perform an activity

Long-term

- Auto ownership
- Workplace location
- Residential location

How Price is Considered in Models

- **Conventional models**

- Mode choice
- Route choice (assignment)
- Trip distribution (possibly)
- Location decisions (if integrated land use model used)

- **Advanced models**

- Mode choice
- Higher-level models (via mode choice logsums)
- Location decisions (if integrated land use model used)

Bottlenecks and Oversaturated Networks

- **Most models (even advanced) use static equilibrium assignment**
- **Travel time estimation issues**
 - **Oversimplified volume/capacity/speed relationships**
 - **Lack of highway attributes in network data**
 - **Link time based only on volume on that link**
- **Traffic microsimulation available at corridor-level, inevitable at regional-level**

Implementation of Regional Microsimulation

- Detailed signal timing/intersection geometrics not always available everywhere
- Data can be synthesized, but accuracy will vary

Proposal

- Obtain data for a small number of key intersections
- Synthesize for remaining locations

Aggregation Error

- Prevalent in conventional models – inadequate segmentation, zone definitions, etc.
- ***Individual values of time*** are critical in decisions on use of priced roadways
 - Vary even among travelers of similar income levels
 - Values of time could be simulated in disaggregate activity-based models
 - Need for additional research into value of time distributions

Applicability of Stated-Preference (SP) Data

- **Has a mixed reputation at best in transportation planning**
 - **Misapplication**
 - **Poor choice experiment design**
 - **Treatment of data as revealed-preference (RP)**
- **Models developed from RP data valid only over range of experience of surveyed population at the time of the survey**

Proposal

Prepare a guidance document on conducting SP experiments and using SP data in model development

Need for Revealed-Preference Research

- So far little revealed-preference data available for road pricing analysis, despite many existing examples
- Need data on different conditions
 - Urban/rural, radial/circumferential, availability of alternative routes, roads/bridges/tunnels
 - Variety of pricing levels
 - Both toll road users and non-users
 - Actual versus perceived travel time savings
 - Impact of electronic toll collection
 - Reliability of travel times

Proposal

Major research effort (Federal?) obtaining and analyzing these data

Uncertainty of Travel Times

- Reliability of travel times is a reason for paying a toll
- All models currently use “average” travel times
- Traffic microsimulation uses single travel time condition for each run, but the variability is not directly considered

Proposal

- Use data from multiple traffic microsimulation runs
- Validate through observed data

Summary of How Models Handle the Issues

Issue	Conventional	Advanced
Time-of-day shifts	No	Limited
Distributional shifts	Very limited	Limited
Bottlenecks/oversaturation	No	No
Aggregation error	No	Yes (but needs to be tested)
Stated-preference data	Could use	Could use
Lack of observed research	Could use	Could use
Travel time uncertainty	No	No

Conclusions

- **No model is perfect**
- **Need to be honest about model limitations**
- **Recommendations**
 - **Use real data for key intersections in microsimulation**
 - **Guidance document on stated-preference surveys**
 - **Revealed-preference data research program**
 - **Use and validate microsimulation results to incorporate travel time reliability**