


Subarea Model Development – Integration of Travel Demand across Geographical, Temporal and Modeling Frameworks



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Objective

Development of a sub-area summer travel demand model for a highway study from the Greater Golden Horseshoe (GGH) model and roadside travel survey with a market-based approach to forecast different trip purposes

- Work
- Discretionary
- Tourism / Recreational
- Commercial Vehicles



Overview of Subarea Model

Region 1

GGH Model
•Work
•Discretionary

Region 2

Census Place of Work
•Work

Roadside Travel Survey
•Discretionary

Roadside Travel Survey
•Recreational

GGH Model
•Commercial Vehicle



Demand Integration Issues

- Demand from various sources
 - GGH travel demand model
 - Roadside summer survey
 - Census Place of Work

- Demand from various points of time
 - Transportation Tomorrow Survey - Fall 2006
 - Roadside travel survey – Summer 2009
 - Different stations surveyed on different days
 - Census Place of Work – Spring 2006
 - Traffic Counts – 2006 to 2009 – all seasons

- Integrating demand across regions within the subarea
 - One part of the subarea from the GGH model
 - Other part built from Census Place of Work and Roadside travel survey
 - Integrating the demand at the boundaries



Temporal Integration

- GGH model demand from Fall 2006 to be translated to Summer 2009
 - Account for impact of recession between 2006 and 2009 – reduced overall travel in 2009
 - Account for difference in trip making between Fall and Summer – lower work trips and higher discretionary trips in summer
- Combined these two adjustments to account for the temporal differences



Temporal Integration

- Used an earlier O-D survey to estimate reduction in travel demand between 2006 to 2009
 - Work and discretionary trips decreased from 2006 to 2009, while recreational trips increased
- Used ensembles to estimate relationship between fall and summer demand for work and discretionary purposes
 - Compared roadside survey trips to Transportation Tomorrow Survey (TTS) to develop factors on an O-D basis at the municipality level
- Further adjustments to account for higher tourism-based local work trips during the summer

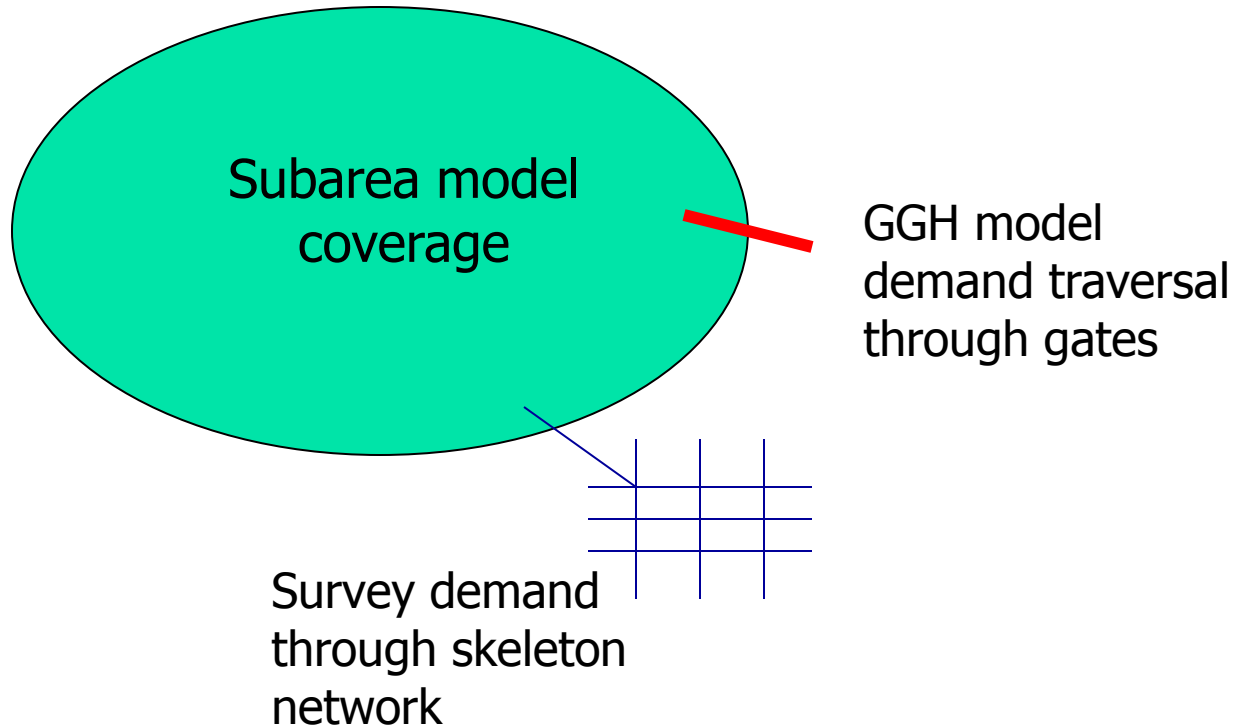
- Insufficient data points - a concern for confidence in the factors applied



Model Frameworks

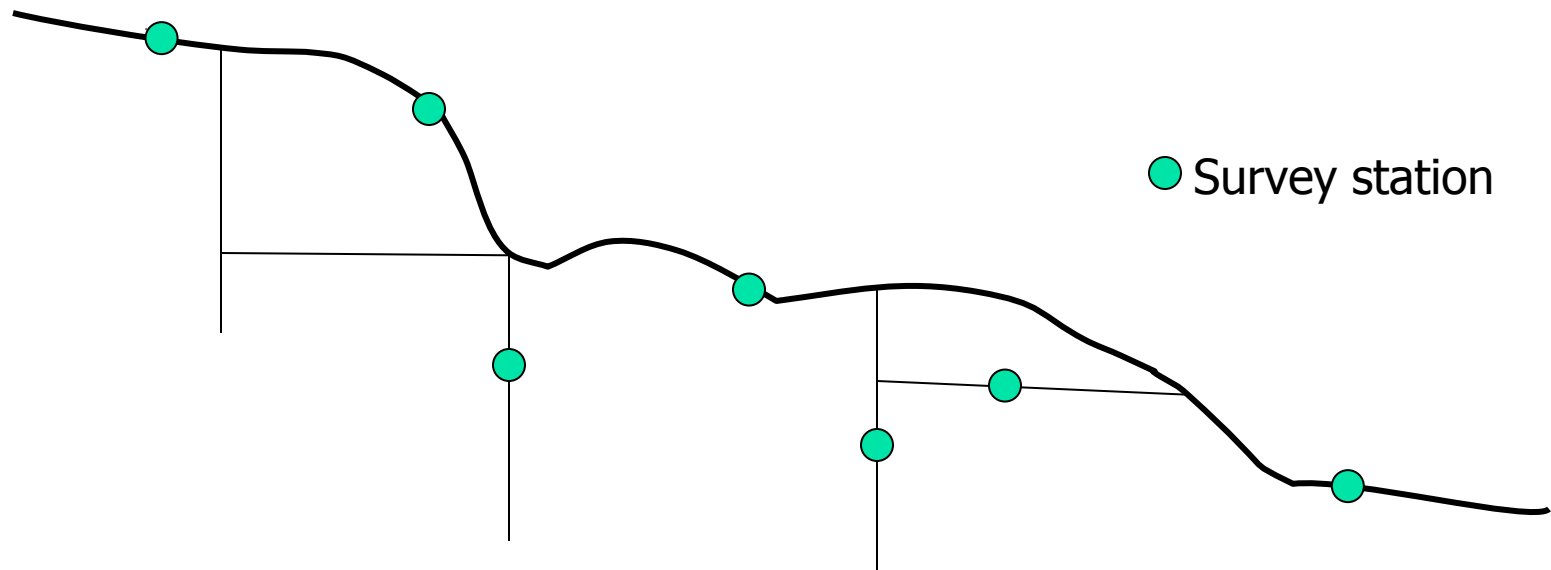
- GGH model zone system different from the roadside survey zone system
 - Survey zones geo-coded at municipality level outside study area
- Two options explored
 - Develop single zone system for all demand
 - Have the two zone systems co-exist in the subarea model
- The two zonal systems were used in combination
 - Skeleton network built outside the study area to represent appropriate routing
 - This allows for the model to determine routing under various network scenarios, as the survey demand need not have pre-determined routing through the traversal gates

Model Frameworks



Survey Data Integration

- ❑ Roadside survey was conducted over a few days during the summer
- ❑ The discretionary and recreational trips surveyed at the stations could not be summed up easily by tracking the trips passing through multiple stations
- ❑ Integrating the demand for all the stations required estimation of overlap of trips across the stations





Survey Data Integration

- A procedure involving a series of select link network analyses was developed to adjust for the overlap of trips across the stations
- Since select link analysis relies on accuracy of roadway network, a few iterations of network and demand calibration were run to arrive at satisfactory convergence

- Similar network and demand calibration was required for traversals from the GGH model
 - Network fine-tuning from the subarea model calibration was fed back to the GGH model to revise the traversals – given that the subarea is at the edge of the GGH model



Geographical Integration

- ❑ Demand from GGH model and roadside survey for different regions within the subarea was assembled
- ❑ For Region 2:
 - Work trips from Census Place of Work for region 2 covered the entire region 2
 - Discretionary trips from the survey only reflected trip making close to the highway. The rest of the trips were estimated from demand adjustment to make up for difference between counts and model volumes
 - All recreational demand was considered to be captured by the survey since most of the recreational trip making is along the highway
 - Commercial vehicle demand from the GGH model is compared to the truck counts and demand-adjusted, where necessary



Notes on Demand Adjustment

❑ Discretionary trips

- Discretionary trips from the survey only reflected trip making close to the highway. The trips in the rest of region 2 were estimated from demand adjustment to make up for difference between counts and model volumes
- The trips were not allowed to pass through any of the survey stations as those trips were already accounted for

❑ Commercial Vehicle trips

- Commercial vehicle demand from the GGH model is compared to the truck counts and demand-adjusted, where necessary
- Two methods were tested:
 - The entire commercial vehicle demand from the initial GGH model demand was adjusted to match counts
 - The demand from the GGH model was augmented by additional demand so that the total demand satisfied the counts



Validation

- The integration of demand as detailed above was put to test through model validation
 - Trips by purpose at the survey stations
 - within 20% of counts, and
 - $GEH < 5$
 - Link Volumes at count locations – R squared of 0.8
 - Screenline volumes - within 20% of counts
 - Trip Lengths – short, medium and long distance trip shares – match reasonably well



Lessons Learned

□ Modeling Methodology

- Different zone systems for different demand sets within a single scenario
- Data Collection constraints add to extra modeling efforts – trade off between re-collection of data and data manipulation

□ EMME

- Matrix calculations at ensemble level would be easier with the matrix tables
- Path-based assignment was very convenient to run multiple select-link analyses so that the process of integrating survey demand can be streamlined
- It would be interesting to test the Modeller to run a series of select links and feedback loops for network and demand calibration