

Development of Activity-Based Modeling in Portland

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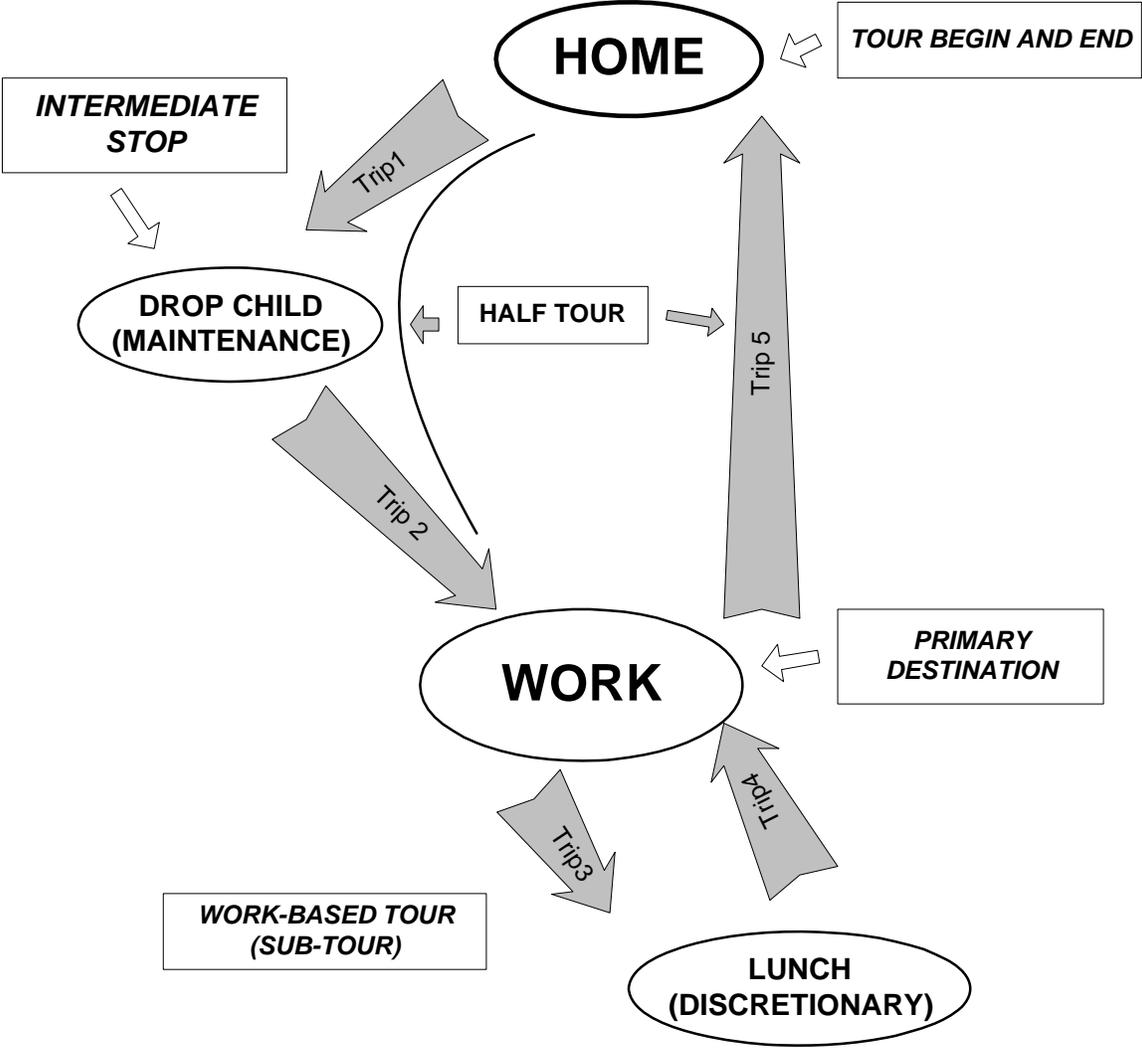
**Slides for presentation at the
Oregon Symposium on Integrating
Land Use and Transport Models**

October 2, 1998

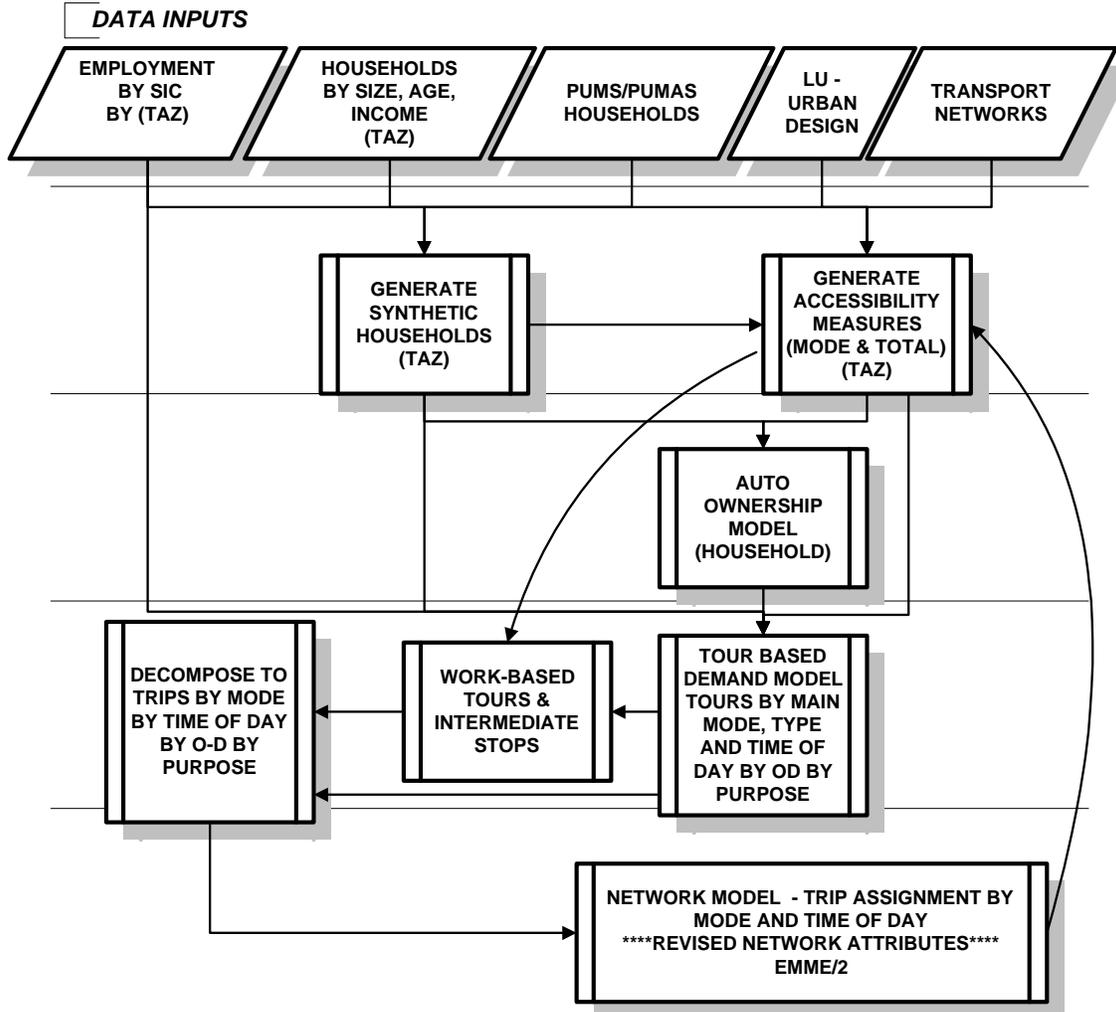
Project history

- TMIP model development project, with METRO, J. Bowman, M. Ben-Akiva and Cambridge Systematics
- FHWA/ODOT congestion pricing study in Portland, with METRO, Eco Northwest
- NCHRP project on new approaches for emissions forecasting, with Cambridge Systematics
- TMIP model development project, as an Activity Generator for the TRANSIMS Portland Case Study, with METRO, Los Alamos (LANL)

TOUR CONCEPTS



MODEL SYSTEM OVERVIEW

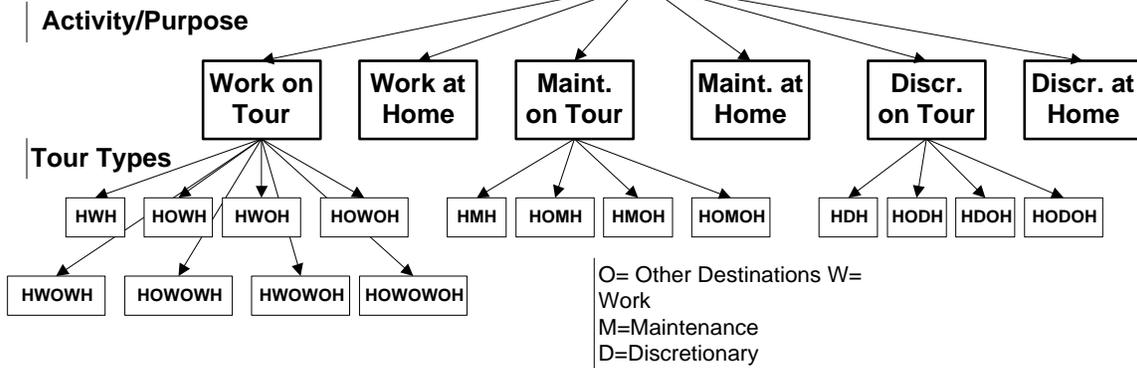


DAY-LONG ACTIVITY PATTERN

Currently weekdays only, age 18+
Work & School combined as "Work"

Given All Household and Person Variables

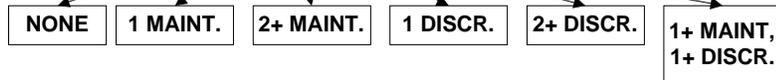
PRIMARY ACTIVITY



8+1+4+1+4+1 = 19 Alternatives

EACH HAS:

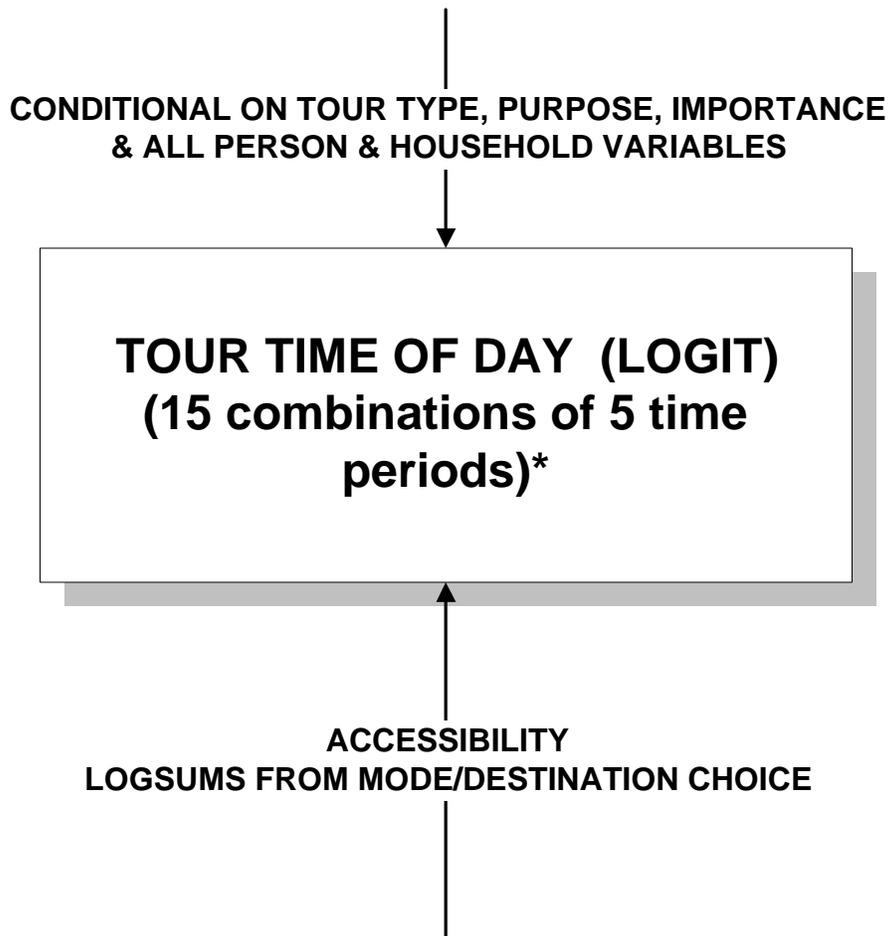
Secondary Tours



TOTAL: 19x6= 114 Alternatives

ACCESSIBILITY LOGSUMS FROM
MODE/DESTINATION & TIME OF DAY

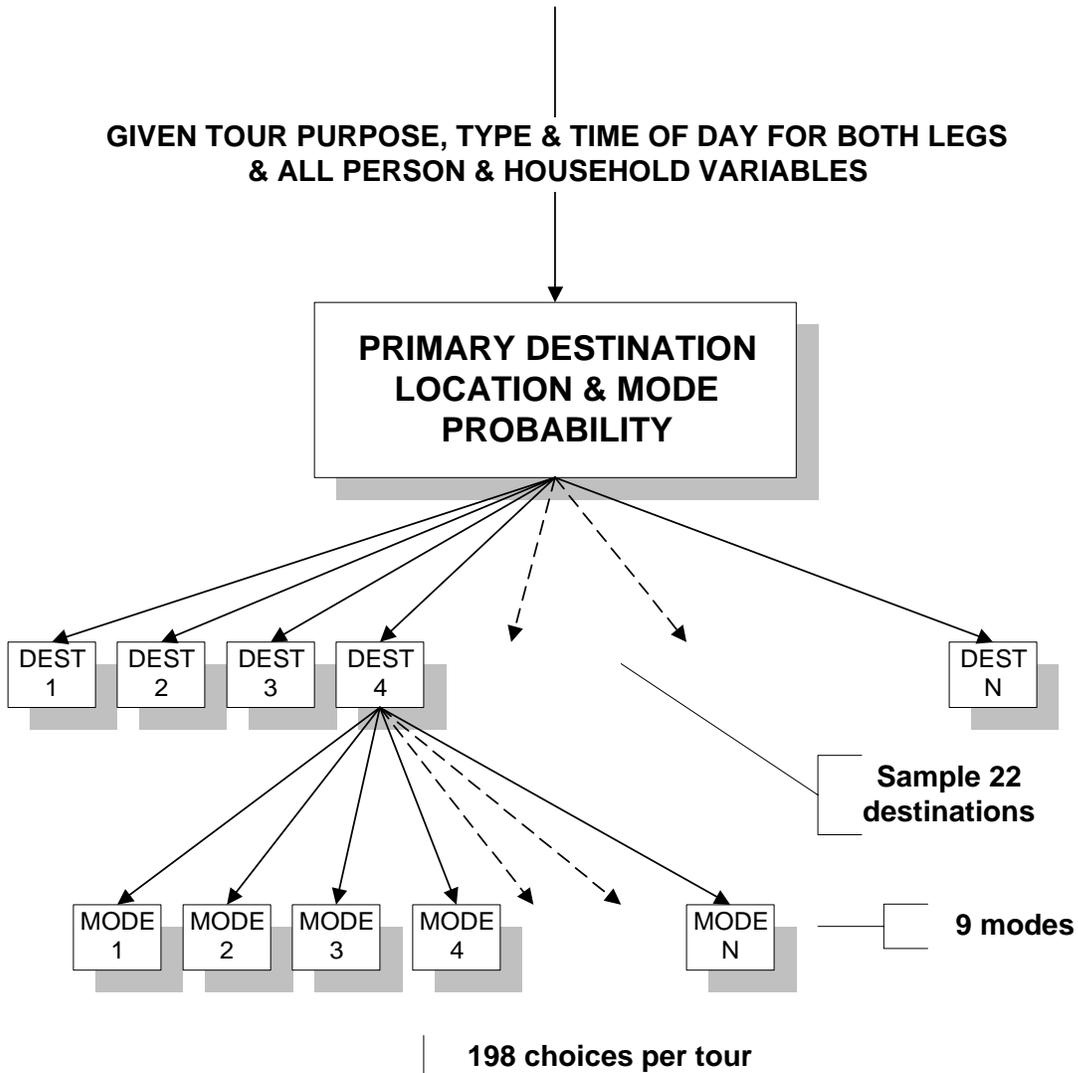
TIME OF DAY



*Time Periods: Early, AM Peak, Mid-day, PM Peak, Night

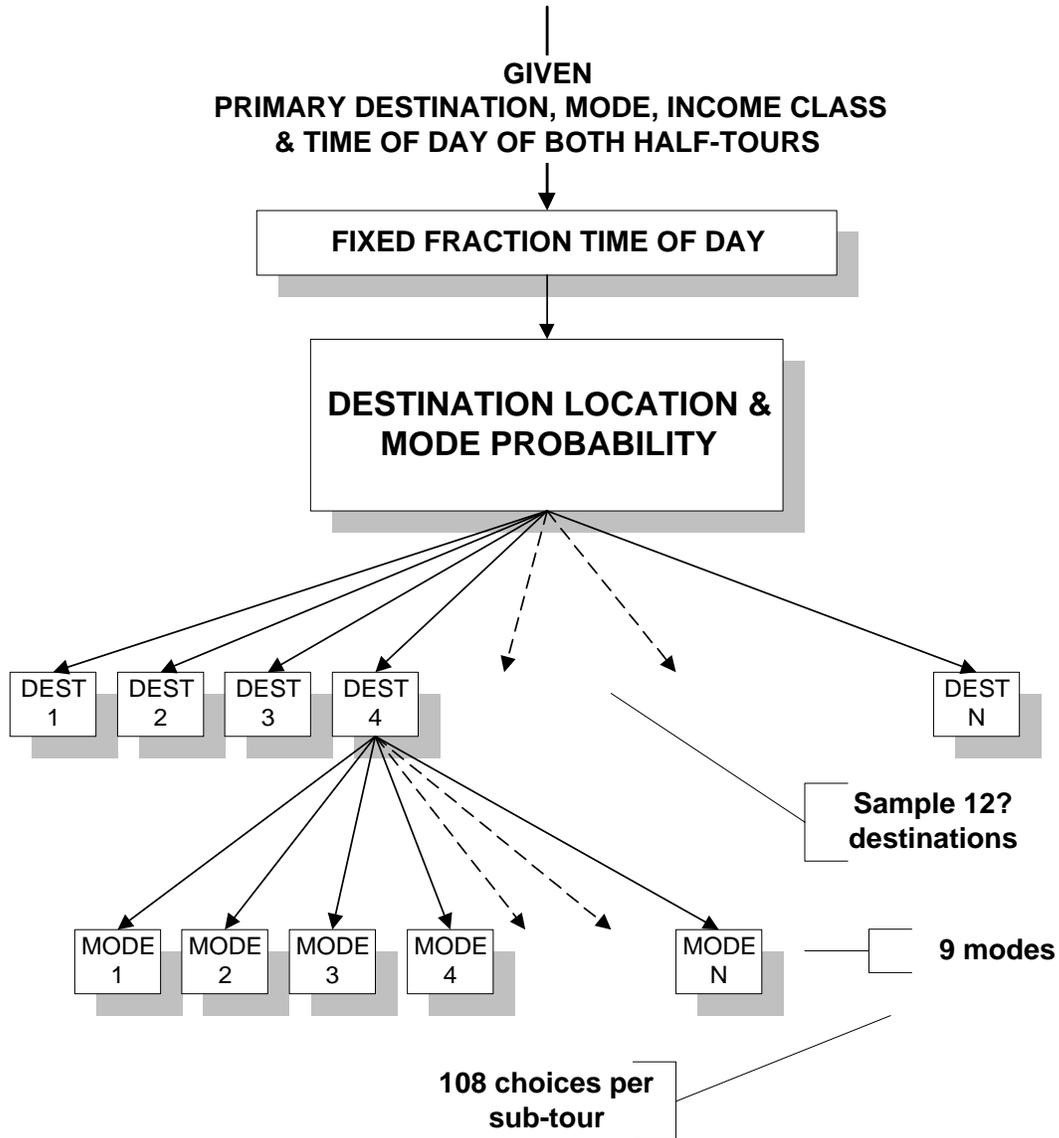
PRIMARY DESTINATION & MAIN MODE CHOICE

GIVEN TOUR PURPOSE, TYPE & TIME OF DAY FOR BOTH LEGS
& ALL PERSON & HOUSEHOLD VARIABLES



This is disaggregate, by tour taken from the sample of households from each zone.

WORK-BASED SUB-TOURS

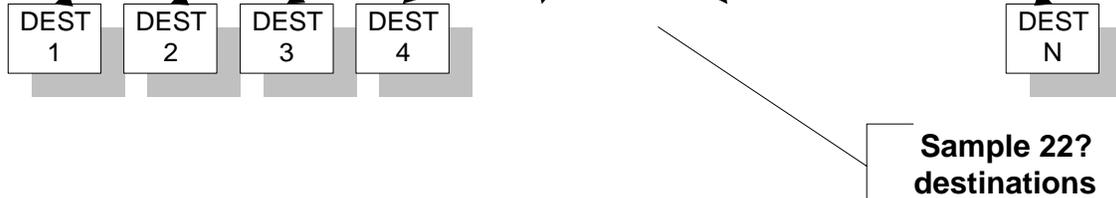


Note: This model is aggregate initially, applied by work zone.

LOCATION CHOICE FOR INTERMEDIATE STOPS

GIVEN TOUR PURPOSE, HOME LOCATION, INCOME CLASS,
HALF-TOUR , PRIMARY DESTINATION & MODE
& TIME OF DAY FOR HALF TOUR

INTERMEDIATE
DESTINATION LOCATION
(GIVEN HALF TOUR MODE)



Note: Initial application will be as an aggregate model
for all half tours between each zone to zone pair.
Later applications will be disaggregate.
Applied separately to each half tour

Possible policy effects:
Peak period congestion pricing

	<u>Tours</u>	<u>Mileage</u>
<u>Route & destination choices</u>		
Usage of priced facilities	--	--
Usage of alternative roads	++	++
<u>Mode & destination choices</u>		
Single occupant car mode	-	--
Multi-occupant car mode	+	+/-
Transit, walk and bike	+	+
<u>Activity timing choices</u>		
Car tours during peak periods		-
Car tours outside of peaks		+
Car tours between peaks		+/-
<u>Activity generation and chaining</u>		
Intermediate stops on work tours		-
Discretionary tours and activities		+
Maintenance tours and activities		+/-

**Possible policy effects:
Densification of land use**

Accessibility by car	+
Accessibility by other modes	+
Out-of-home activities	+
Number of trips made	+
Chaining of trips	-
Number of tours made	+
Average trip length	-
Fraction of trips made by car	-
VMT produced by car trips	- / +
Fraction cold vs. hot starts	+
Emissions produced by car trips	- / +

Implementation in TRANSIMS

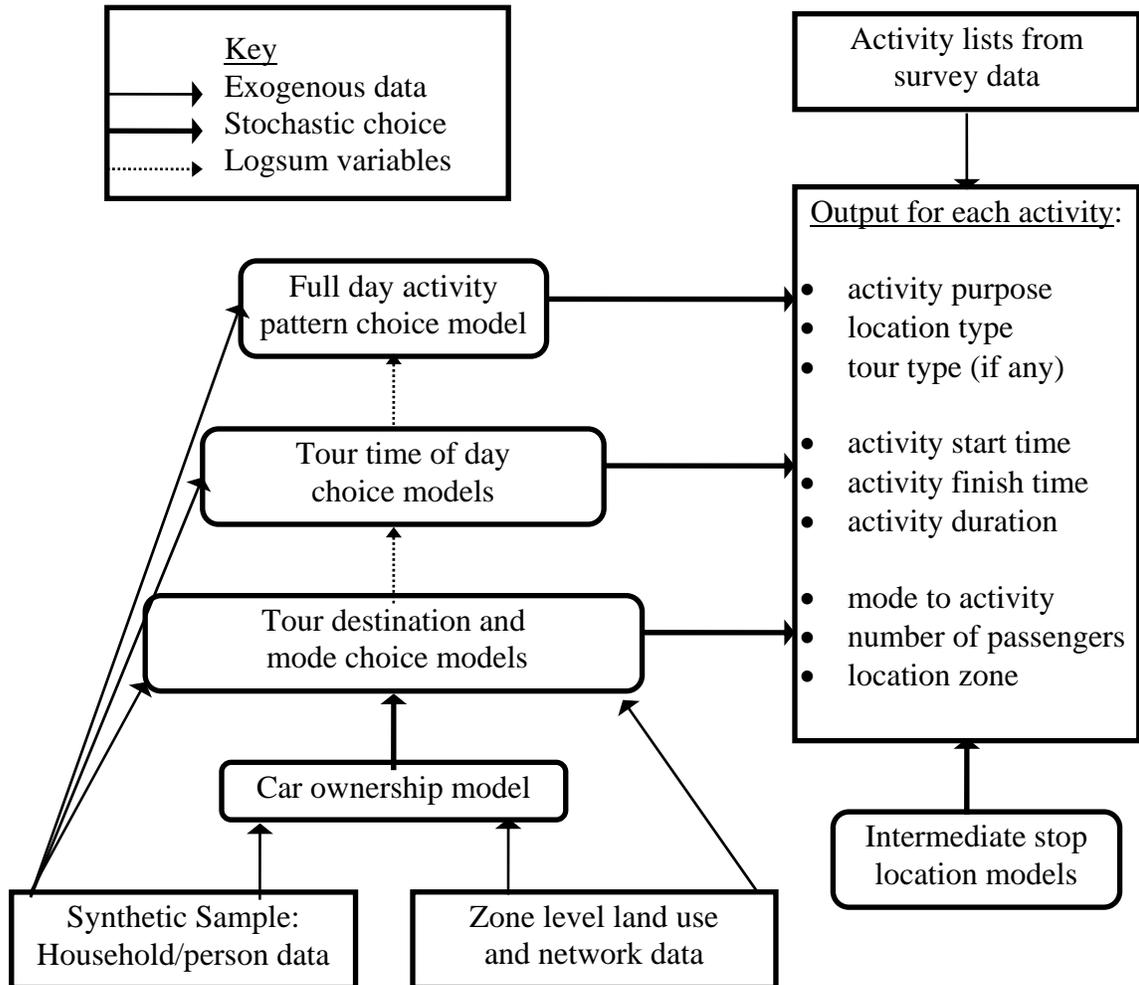
- A complete synthetic sample (all households)
- Add spatial detail: Street segments instead of zones
- Add temporal detail: Short time slices instead of periods
- Add activity type detail: More purpose categories
- Use Monte Carlo approach: Sample from model probabilities
- Incorporate short-term feedback: From Router/Planner, Network Microsimulator
- Incorporate longer-term feedbacks?: Residence and workplace locations

Information required by TRANSIMS

A list of activities for each household, with:

- activity purpose type
- activity priority/necessity
- activity participants (can be a single household member, a list of members who all must participate, or a list of members, any one of which could do it)
- activity start time, end time and duration (can be fixed values or allowable ranges)
- activity location (can be a single location or a list of possible ones)
- mode preferences (can be a single mode or a series of preference weights)

Structure of the Activity Generator prototype



Inputs to the Activity Generator

Synthetic sample of the regional population

- 1.4 million person records for 1994
- Drawn from PUMS 5% sample at the census block group level
- Controlled to joint distribution of household size, number of children, number of workers, age of head of household, household income category

Zone-to-zone level of service data

- from EMME/2 skim matrices or else TRANSIMS Router module
- for 4 time periods (AM peak, PM peak, midday, evening)
- for 5 modes (SOV, carpool, walk to bus, walk/bus to light rail, park and ride)

Zonal land use data

1994 Household survey activity records

Output from the Activity Generator

A “synthetic activity / travel diary survey”

For each activity.....

- household/person identifier
- activity purpose *
- activity location type
- activity location zone
- activity start time *
- activity end time *
- tour type **
- mode to the activity **
- travel time **
- travel distance **
- travel cost **

Can be quickly processed in a flexible manner to produce trip matrices, regional summaries, equity analyses, etc.

* additional detail taken from survey data of actual activity patterns

** only if relevant

Current Status

- Activity sets (including modes and locations) have been simulated for the entire synthetic population, and provided to LANL for testing in TRANSIMS.
- For the full sample of 600,000 households, the model currently takes 24 hours to run on a Pentium 400 PC.
- Programmed in C++; the same code runs on PCs, DEC Alphas at METRO, Sun SPARCs at LANL.
- Parallel processing capability will be added to reduce run time.

Further work: short-term

- Add a model for children under age 16. Will be a relatively simple model conditional on age and simulated activity patterns of household adult(s).
- Add an algorithm for adjusting activity start and end times to be consistent with travel times.
- Test for sensitivity to:
 - random number sequence
 - composition of synthetic sample
 - number of alternative destinations
 - feedback from network assignment
- Work on validating/calibrating the models to external data (to correct for biases in the travel/activity survey data).

Further work: medium term

- Adapt to more detailed network and land use data: street segments instead of zones.
- Link to the TRANSIMS Router module to get travel impedances (instead of using TAZ-based network skims).
- Implement feedback with other TRANSIMS modules.
- Continue work on calibration, dealing with issues such as balancing work locations to match employment forecasts.
- Continue work on sensitivity testing.

Further work: longer term

- Improve mode and destination choice models, taking advantage of more detailed network and land use data.
- Improve activity timing and sequencing models, taking advantage of more accurate travel time estimates and more flexible model structure.
- Add upper level models of household interactions, joint activity decisions.
- Add upper level models of residence and workplace location decisions, or link with a land use microsimulation model.