TRANSIMS Training Course at TRACC
Transportation Research and Analysis Computing Center

Part 10

Trip Table Conversion

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**Introduction**

- TRANSIMS has been designed as an activity-based simulation tools based on census population data and activity surveys for the area being modeled
  - TRANSIMS depends heavily on the availability and quality of survey data
  - Surveys are expensive to obtain and need frequent updates
  - The complexity of modeling increases significantly by building a synthetic population and creating suitable activity patterns for the entire population

- Therefore, TRANSIMS can also be operated based on available trips and trip distribution data available from metropolitan planning organizations
  - Trip data is the basis for typical MPO planning purposes
  - Starting with existing data makes it much easier to create a metropolitan TRANSIMS model from scratch
  - Populations and activities can be added in the future based on the need for modeling specific scenarios
  - Trip data is typically based on traffic analysis zones with centroids being connected to the road network to load traffic demand appropriately
The Complete TRANSIMS Model

- Input Data for Modules
  - Transportation Network
    - Streets, Intersections, Signals
    - Transit Routes and Schedules
    - Land Use Data, Zoning Information
  - Transit Lines and Schedules
  - Census Data for Population*
  - Household Activity Surveys*
  - Itinerant Travelers and Trips
  - Vehicle Characteristics and Prototypes

* Trip-based models do not need this data
**Simplified Trip-Based TRANSIMS Models**

- Create a Road Network
- Create a Transit Network
- Obtain Transit Schedules

**Methodology #2**
- Obtain Trip Tables
- Obtain Diurnal Distributions
- Run Trip Converter

- Create Travel Plans from **Trips** using the Router
- Test the Travel Plans in the Microsimulator
- Iterate Between Router and Microsimulator
The TRANSIMS Network and Trips

Primary Challenges:
- How can trips be undertaken without having ever built an actual population?
- Where do trips start and end? How do traffic analysis zones and activity locations correlate?
- How is aggregate trip data extrapolated for use of a synthetic population?
- What format does trip data come in typically and how is it converted?
**Typical Trip Data**

- Typical trip data comes in form of tables describing how many trips are being taken from any traffic analysis zone to any other traffic analysis zone for a given time interval (typically a day, see sample data on the right).
- Trip data is typically aggregated for the whole day.
- Zones are at a relatively low resolution compared to TRANSIMS street networks.
- For Chicago, there are 1,950 traffic analysis zones.
- Trip tables are often available for specific subsets such as
  - HBW
  - HBO
  - Transit …
Diurnal Distributions

- Diurnal distributions describe the total number of trips as a function of daytime.
- Diurnal distributions vary widely from area to area and from trip purpose to trip purpose.
- They represent another form of aggregate data and can be used in combination with the corresponding trip tables to reconstruct detailed trips from aggregate data.
- Smoothing can be used to make diurnal distributions more suitable for trip conversion (the SmoothData tool).
Typical Trip Data and the ConvertTrips Tool

- Transims provides a tool ConvertTrips to create approximated specific trips for an entire synthetic population based on available trip tables
  - Without a synthetic population based on Census data, ConvertTrip creates an artificial person and vehicle for each specific trip to place it onto the network
  - Without basing the trips on the activities of a specific person, otherwise related trips appear to be undertaken by different individuals
- Trips start and end points are extrapolated from aggregate zoning locations to specific TRANSIMS activity locations
  - A real work tour is being represented by some individual leaving at some time in the morning from somewhere close by and retuning as a different individual at some time in the afternoon to yet another location close by
- Diurnal distributions must match the corresponding trip table to lead to defensible results
Resolution of Zoning Data versus Road Network
Using Trip Tables in TRANSIMS

- ConvertTrips generates large trip tables with one record for each specific trip undertaken in the simulation area.
- The records specify details such as:
  - Start and estimated end time for each trip
  - The exact activity locations for both start and destination
  - The mode of travel
- It also creates one new synthetic person and one new vehicle for each trip.
- These records can be used by the TRANSIMS router to create exact travel plans for subsequent use in the microsimulator.
- The extrapolation of aggregated trip and diurnal distribution data leads to large trip files, e.g. 1.4GB for 25,500,000 daily automobile trips in the Chicago Metropolitan Area.
Combining Multiple Data Sets

- ConvertTrips can operate on a large number of data sets.
- Each data set can have its own diurnal distribution.
- Weight can be applied for both choosing the destinations or origins of trips.
- Diurnal distributions can be complex, and an internal scripting language can be used to assign specific diurnal distributions to each traffic analysis zone.
- For Chicago, there are 10 data sets for HBW, HBO, NHB, Airport Travel, and several classes of trucks, plus 3 transit and 3 park and ride data tables.
- All these can be converted in a single run of ConvertTrips.
- An example control file is shown on the next slide to illustrate the control keys.
Sample ConvertTrips Control File

# DEFAULT_FILE_FORMAT TAB_DELIMITED
# TRANSIMS network files to be used as input for this run
# NET_DIRECTORY ../../network/production
# NET_ACTIVITY_LOCATION_TABLE FullArea_Activity_Location
# NET_PROCESS_LINK_TABLE FullArea_Process_Link
# New TRANSIMS files to be created by this run
# NEW_TRIP_FILE ../../../activity/Trip
# NEW_POPULATION_FILE ../../../household/Population
# NEW_HOUSEHOLD_FILE ../../../household/Household
# NEW_VEHICLE_FILE ../../../vehicle/Vehicle
# General conversion parameters
# STARTING_HOUSEHOLD_ID 1
# STARTING_VEHICLE_ID 1
# TIME_OF_DAY_FORMAT SECONDS
# RANDOM_NUMBER_SEED 12345
# PLAYER_TYPE_FILE ../../../vehicle/VehicleType

#---- airport trips ----
TRIP_TABLE_FILE_1 ../../.././CMAP/Trips/Version4/Input_Trips.airpo
TRIP_TIME_FILE_1 ../../.././trips/diurnal.airpo
TRIP_PURPOSE_CODE_1 1 # counter
TRAVEL_MODE_CODE_1 2 # drive
AVERAGE_TRAVEL_SPEED_1 15 # m/s
VEHICLE_TYPE_1 1 # car
ORIGIN_WEIGHT_FILE_1 USER1
DESTINATION_WEIGHT_FILE_1 USER2

#---- external trips ----
TRIP_TABLE_FILE_2 ../../.././CMAP/Trips/Version4/Input_Trips.autopo
TRIP_TIME_FILE_2 ../../.././trips/diurnal.autopo
TRIP_PURPOSE_CODE_2 2 # counter

#---- hbo trips ----
TRIP_TABLE_FILE_3 ../../.././CMAP/Trips/Version4/Input_Trips.hbo
TRIP_TIME_FILE_3 ../../.././trips/diurnal.hbo
TRIP_PURPOSE_CODE_3 7 # counter
TRAVEL_MODE_CODE_3 2 # drive
AVERAGE_TRAVEL_SPEED_3 15 # m/s
VEHICLE_TYPE_3 1 # car
ORIGIN_WEIGHT_FILE_3 USER1
DESTINATION_WEIGHT_FILE_3 USER2

#---- nhb trips ----
TRIP_TABLE_FILE_4 ../../.././CMAP/Trips/Version4/Input_Trips.nhb
TRIP_TIME_FILE_4 ../../.././trips/diurnal.nhb
TRIP_PURPOSE_CODE_4 8 # counter
TRAVEL_MODE_CODE_4 2 # drive
AVERAGE_TRAVEL_SPEED_4 15 # m/s
VEHICLE_TYPE_4 1 # car
ORIGIN_WEIGHT_FILE_4 USER1
DESTINATION_WEIGHT_FILE_4 USER2

#---- hbw trips ----
TRIP_TABLE_FILE_5 ../../.././CMAP/Trips/Version4/Input_Trips.hbw
TRIP_TIME_FILE_5 ../../.././trips/diurnal.hbw
TRIP_PURPOSE_CODE_5 10 # counter
TRAVEL_MODE_CODE_5 2 # drive
AVERAGE_TRAVEL_SPEED_5 15 # m/s
VEHICLE_TYPE_5 1 # car
ORIGIN_WEIGHT_FILE_5 USER1
DESTINATION_WEIGHT_FILE_5 USER2
Sample ConvertTrips Control File

- #
- DEFAULT_FILE_FORMAT  TAB_DELIMITED
- #
- # TRANSIMS network files to be used as input for this run
- #
- NET_DIRECTORY          ../../network/production
- NET_ACTIVITY_LOCATION_TABLE FullArea_Activity_Location
- NET_PROCESS_LINK_TABLE  FullArea_Process_Link
- #
- # New TRANSIMS files to be created by this run
- #
- NEW_TRIP_FILE            ../../activity/Trip
- NEW_POPULATION_FILE      ../../household/Population
- NEW_HOUSEHOLD_FILE       ../../household/Household
- NEW_VEHICLE_FILE         ../../vehicle/Vehicle
Sample ConvertTrips Control File

- #
- # General conversion parameters
- #
- STARTING_HOUSEHOLD_ID 1
- STARTING_VEHICLE_ID 1
- TIME_OF_DAY_FORMAT SECONDS
- RANDOM_NUMBER_SEED 12345
- VEHICLE_TYPE_FILE ../../../vehicle/VehicleType
- #
Sample ConvertTrips Control File

- #---- airport trips ----
- #
- TRIP_TABLE_FILE_1 ../../../CMAP/Trips/Version4/Input_Trips.airpoe
- TRIP_TIME_FILE_1 ../../../trips/diurnal.airpoe
- TRIP_PURPOSE_CODE_1 1 # counter
- TRAVEL_MODE_CODE_1 2 # drive
- AVERAGE_TRAVEL_SPEED_1 15 # m/s
- VEHICLE_TYPE_1 1 # car
- ORIGIN_WEIGHT_FIELD_1 USER1
- DESTINATION_WEIGHT_FIELD_1 USER2
- #
- ...
Problem Resolution: Access Restrictions

- Example for a typical misconfiguration:
- Assignment of trips to activity locations may lead to truck being placed on roads that don’t allow truck traffic
- Solution: LocationData tool and weights
Problem Resolution: Path Building

- Setting weights for external entry and exit points when assigning trips to activity locations prevents external trips on one-ways connectors to encounter path-building problems (see user1 and user2 in the How-To).
Additional Settings

- ConvertTrips is well-documented in a general tool description as well as in one of the How-Tos available from the TRANSIMS site

- A selected list of features:
  - Zone equivalency: Zone groups represent large geographic areas or governmental entities (see sample on the right)
  - Trip Purpose
  - Travel Mode
  - Return Trip Offset
  - ConvertTrips can be run successively to append trips from multiple runs
  - And much more …

Sample Zone Group File

1 0 Portland CBD - 1
1 1 1..16
2 0 West Suburbs - 2
2 1 79..307, 1248..1253
3 0 Southwest Suburbs - 3
3 1 308..403, 931..933
4 0 Southeast Suburbs - 4
4 1 404..557, 934..943, 1254..1258
5 0 East Portland - 5
5 1 561..563, 714..721, 731..738, 763..929, 949..961, 963..969
6 0 East Suburbs - 6
6 1 558..560, 564..713, 722..730, 739..762, 1259..1260
7 0 West Portland - 7
7 1 17..78, 930, 944..948, 962, 1247
8 0 Clark County - 8
8 1 970..1246
Credits and Acknowledgements

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