

The Dutch National Model System (LMS): methodology

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History LMS

- **1985: LMS operational**
- **1990: Netherlands Regional Models (NRM)**
- **1999: Re-estimation -> version 7**
- **2007-2011: Re-estimation -> base year 2010.**

Objectives LMS

Mobility (e.g. passenger km per mode and purpose) and traffic forecasts (network use) in the medium to long run (used in many official transport documents).

Effects of infrastructure projects and other policy measures at the national scale (used in cost-benefit analyses following OEI-guidelines).

Main principles of LMS

1. Spatial model (**1379 zones in NL, 1600 in total**) and network model (**road: 80 000 links**).
2. Disaggregate submodels: unit of observation is person or household.
3. Pivot-point method: models give growth per OD cell 2010-2030, which is applied to base OD matrix (source: traffic counts) to give future year OD matrix.
4. Choice models.
5. Prototypical Sample and expansion factors.

Choice models

Utility functions in mode choice:

$$U_{\text{car}} = \beta_0 + \beta_1(\text{travel cost}_{\text{car}}) + \beta_2(\text{travel time}_{\text{car}}) + \beta_3(\text{age}) + e_{\text{car}}$$

$$U_{\text{PT}} = \beta_4(\text{travel cost}_{\text{PT}}) + \beta_5(\text{travel time}_{\text{PT}}) + e_{\text{PT}}$$

Car chosen if $U_{\text{car}} > U_{\text{PT}}$

Researcher: probability distribution for e_{car} and e_{PT}

Then: $P(U_{\text{car}} > U_{\text{PT}})$

Model estimation

Most submodels estimated on *Revealed Preference* data (observed behaviour): OVG.

Departure time choice models estimated on *Stated Preference* data.

Multinomial logit and nested logit models.

Prototypical Sample (PS) and expansion factors

More than 70 000 households from OVG.

Distributed over 342 categories (household size, workers, age, income).

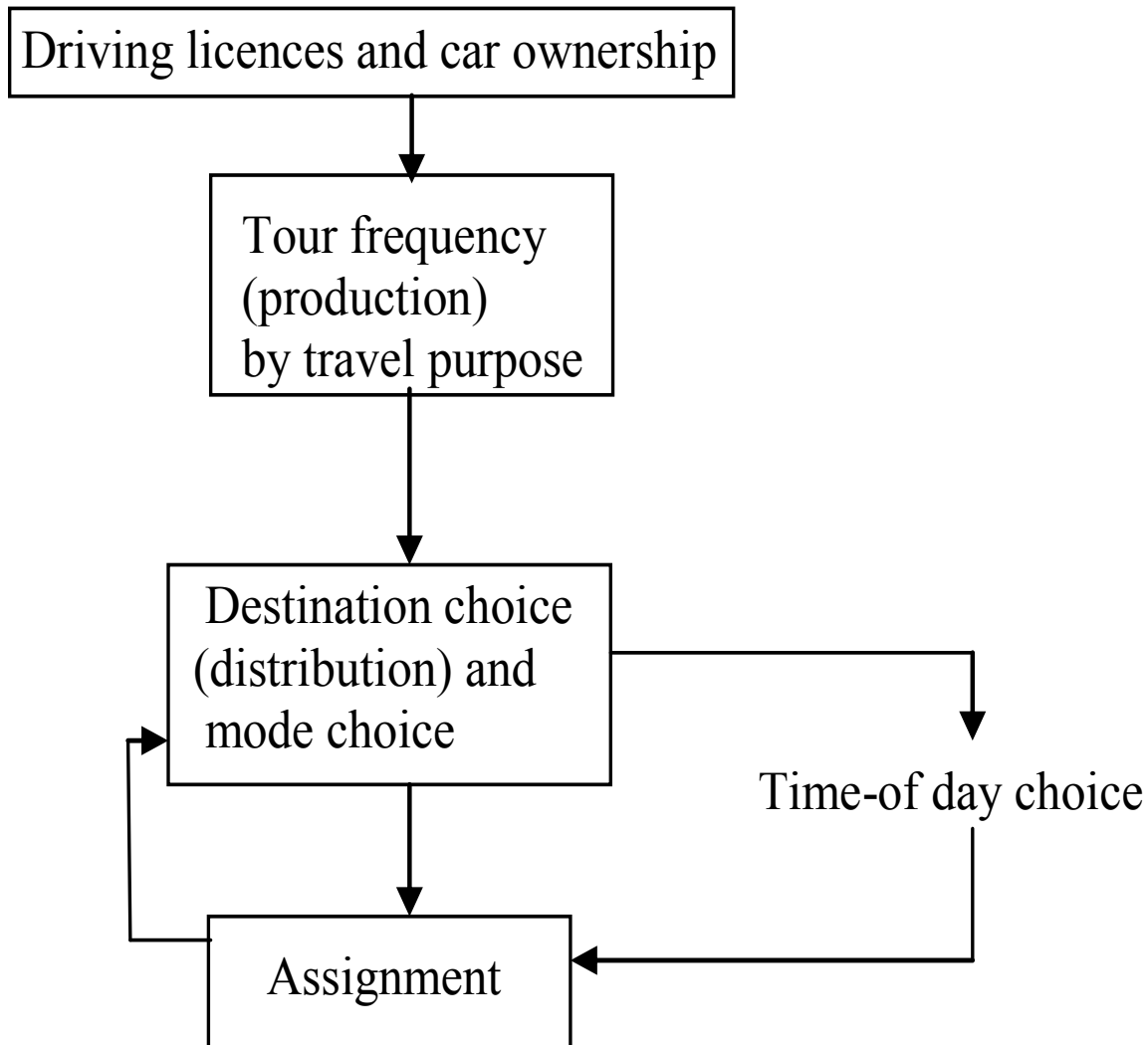
Also established distribution for each of 1379 zones -> 1379 x 342 expansion factors.

Apply choice models to PS.

Expand outcomes for every zone.

Different expansion factors for 2010 and 2030.

The model structure



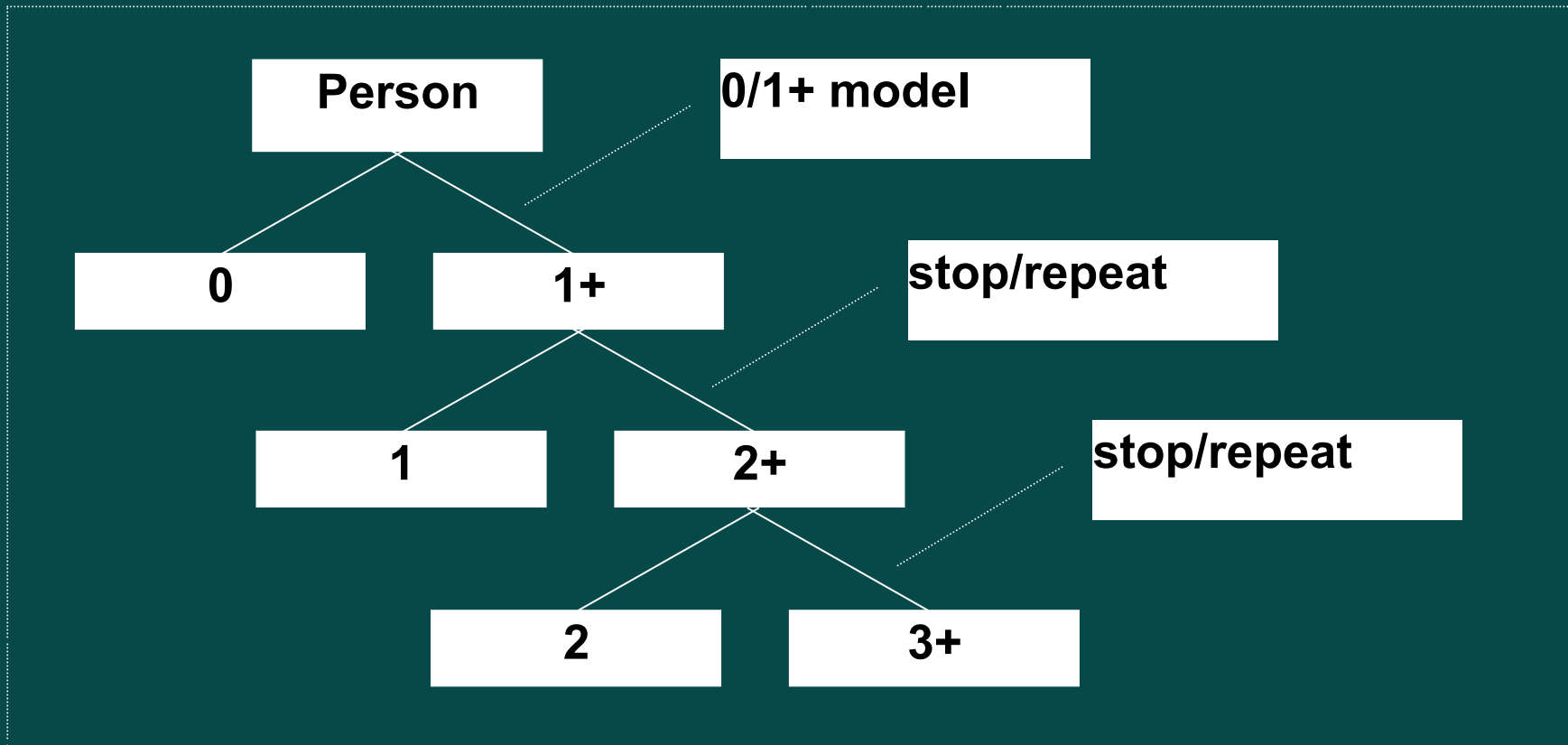
Submodel for number of tours per person per day

TOUR: chain of TRIPS that begins and ends at home. Frequency depends on person and household characteristics, incl. licence and car ownership.

Travel purposes:

- **Commuting**
- **Business (home-based, non-home-based)**
- **Education (12-, 12+)**
- **Shopping (12-, 12+)**
- **Social, recreational and other (12-, 12+, non-home-based)**

Tours : 0/1+ model and stop/repeat model



Mode and destination choice

Given 1379 origin zones there is a choice among 1379 destination zones and 6 modes:

- Car-driver
- Car-passenger
- Train
- Bus/tram/metro
- Walking
- Cycling.

Mode and destination choice

Depends on time and cost (from networks, train timetables), attractiveness of zones and socio-economics.

$$V_{zijp} = \beta_p T_{zj} + \chi_{pi} \ln(C_{zj}) + \delta_p D_{pj} + \dots$$

z: origin zone

i : person type

j: destination zone and transport mode combination

p: travel purpose

V: representative utility

T: travel time (comprising various components with their own coefficients)

C: travel cost

D: attractiveness of the destination zone (destination utility) for a specific activity

Departure time choice

Internally: choice among 9 periods

Outputs:

- Morning peak (7-9 h.)
- Evening peak (16-18 h.)
- Rest of the day.

On basis of travel time and cost

Network assignment (road)

Trips instead of tours.

Truck OD matrix added from freight model.

Q-blok: congestion-dependent, effect of a link on another link.

New travel times fed back to choice of mode, destination and departure time.

Strong points

- **Detail on households and persons, and on traffic flows (base matrix).**
- **Theoretical foundation: utility maximisation.**
- **Use of tours instead of trips.**
- **Large number of zones and explicit networks.**
- **Includes departure time choice.**
- **Congestion is treated.**
- **Provides a welfare measure for project evaluation and confidence intervals.**

Weak points

- **Not explicitly *activity-based* (but can use ALBATROSS).**
- **Locations of households and firms are taken as given (but can use TIGRIS-XL).**
- **For some applications one needs more detail (but can use NRM).**
- **The amount of truck traffic does not react to congestion.**
- **Departure time choice is only for car-driver.**
- **Run time.**

Significance: family tree

