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OTM 8.0 Demand Models: Comprehensive Re-estimation and Methodological Advances for Greater Copenhagen

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Abstract

This paper presents the re-estimation of the OTM 8.0 travel demand models for Greater Copenhagen, representing the most significant update of the OTM demand modelling framework since OTM 7.1 (base year 2015). All tour-frequency and mode-destination models were re-estimated using National Travel Survey (TU) data from 2016-2019 and 2022-2025, updated 2023 level-of-service data, revised socioeconomic information, and updated values of travel time.

A key methodological contribution is the separation of the former car-driver alternative into Single-Occupancy Vehicle (SOV) driver and High-Occupancy Vehicle (HOV) driver alternatives. Combined with a revised cost-sharing formulation based on purpose-specific average vehicle occupancies, this improves the representation of travel-time valuation, cost sensitivity, and substitution patterns between travel modes. The model also introduces generalized public transport travel times, improving consistency between route-choice and demand-model representations, together with new distance-correction terms that enhance the replication of observed tour-length distributions.

The resulting models reproduce observed mode shares and trip-length distributions well across most travel purposes and generate behaviorally plausible elasticity estimates. Comparisons with OTM 7.1 indicate improved behavioral realism, particularly for business travel and policies affecting travel costs. The introduction of separate SOV and HOV alternatives further strengthens the model's ability to evaluate congestion charging, parking management, and other pricing-based transport policies.

The updated modelling framework provides a robust foundation for transport forecasting and policy appraisal in Greater Copenhagen, supporting the assessment of future mobility strategies, infrastructure investments, and sustainability-oriented transport measures.

1 Introduction

The Greater Copenhagen transport system has changed substantial since the estimation of OTM 7.1, which represents travel behavior in the 2015 base year. Network expansions, evolving travel patterns, changes in travel costs, and updated socioeconomic conditions have altered travel behavior across the region. At the same time, transport planning has increasingly focused on policies such as congestion charging, parking regulation, and measures promoting sustainable mobility. These developments require travel demand models that accurately represent current travel behavior while providing a robust basis for forecasting and policy appraisal.

The OTM 8.0 demand-model re-estimation represents more than a routine model update. While the project updates the model to a 2023 base year using travel survey data from 2016-2019 and 2022-2025, together with revised level-of-service data, socioeconomic inputs, and values of travel time, it also introduces several methodological enhancements aimed at improving behavioral realism, policy sensitivity, and forecasting performance.

Previous versions represented all car drivers within a single alternative, implicitly assuming identical behavioral responses regardless of vehicle occupancy. This limited the model's ability to represent differences in travel-time valuation, travel-cost sensitivity, and substitution patterns between solo and shared-car travel. The new specification, combined with a revised cost-sharing formulation based on purpose-specific average vehicle occupancies rather than observed party size, provides a substantially more behaviorally consistent representation of car travel. The improvement is particularly important for evaluating policies that directly influence travel costs, including congestion charging and parking pricing.

Additional methodological developments further strengthen the modelling framework. Public transport level of service is now represented using generalized travel times expressed in bus-equivalent minutes, ensuring consistency between the demand model and the public transport route-choice model. Revised distance-correction terms improve the reproduction of observed trip-length distributions, while an automated data-processing framework standardizes tour construction, trip classification, and missing-data treatment, improving both reproducibility and efficiency for future model updates.
Table 1 summarizes the main enhancements introduced in the estimation of OTM 8 demand models.

Table 1 – Main enhancements introduced in OTM 8.0 demand models

Enhancement	Key improvement
Driver mode segmentation	The car driver alternative is divided into SOV and HOV to improve representation of differences in travel times and cost sensitivity, as well as more realistic substitution patterns.
Car cost-sharing methodology	Purpose-specific average HOV occupancy replaces party size, eliminating endogeneity in the car cost-sharing formulation.
Public transport LoS	Public transport level of service is represented in weighted generalized travel times, ensuring consistency between route choice and demand modelling.
Value of time	Values of travel time are updated to 2023 price levels and differentiated across car drivers, passengers and public transport users.
Data preprocessing automatization	Data preparation includes automated tour construction, trip purpose and mode classification, and missing-data imputation.

The objective of this paper is to present the principal methodological developments introduced in the OTM 8.0 demand model and to evaluate their implications for model performance. Rather than documenting every aspect of the estimation process, the paper focuses on the methodological innovations that distinguish OTM 8.0 from previous model versions and demonstrates how these improvements enhance behavioral realism and policy relevance. Detailed estimation procedures, model specifications, parameter estimates, and implementation details are documented in the OTM 8 Estimation Report (Monteiro, 2026).

The remainder of the paper is organized as follows. Section 2 summarizes the datasets and estimation methodology. Section 3 evaluates model performance using observed mode shares, trip-length distributions, and elasticity analyses. Section 4 discusses the implications of the methodological developments for transport forecasting and policy appraisal in Greater Copenhagen.

2 Data and Methods

This section provides an overview of the datasets and estimation methodology used in the OTM 8.0 re-estimation. As the paper focuses on the principal methodological developments and results, only the most relevant aspects are presented here. A comprehensive description of the data preprocessing procedures, model specifications, estimation framework, and model implementation is provided in Monteiro (2026).

2.1 Data

The demand-model estimation relies on three primary data sources: travel survey observations from the Danish National Travel Survey (TU), transport level-of-service (LoS) data, and zonal attraction data. Together, these datasets provide the behavioral, network, and land-use information required for estimating the tour-frequency and mode-destination models.

2.1.1 Travel Survey Data

The estimation dataset is derived from the TU session, journey, and trip tables for the Greater Copenhagen region. To ensure consistency with the OTM framework, location information originally coded at the GMM zoning level was converted to the OTM zoning system.

A standardized preprocessing procedure was developed to support future model re-estimations. The procedure applies a series of temporal, spatial, and behavioral filters, retaining only weekday observations and excluding records with incomplete location information, intrazonal public transport tours, and infeasible car-driver choices for individuals without a driving license or household vehicle access.

Tours are reconstructed from observed trip chains and assigned a primary destination using a purpose hierarchy that prioritizes work, business, and education activities over discretionary travel. Similarly, the primary travel mode is identified using a hierarchy that classifies a tour as public transport whenever public transport is used for any segment of the tour. Time-of-day alternatives are defined using the eleven OTM time periods, with outbound and return periods combined for home-based tours and only outbound periods considered for non-home-based trips.

Following preprocessing, the estimation sample comprises more than 30,000 tours and trips across seven travel purposes. Table 2 presents the resulting modal composition of the estimation dataset.

Socioeconomic variables were preprocessed before estimation. Labor-market categories were consolidated into model-relevant groups, while missing or inconsistent personal and household income values were imputed using Random Forest regression based on demographic, socioeconomic, and household characteristics. All income values were converted to 2023 price levels.

Table 2 - Tour and trip sample sizes by purpose and mode (row percentages)

Purpose	Public transport	Car driver SOV	Car driver HOV	Car passenger	Bicycle	Walk	Total
Work tours	1306 19.45%	2846 42.38%	53 0.79%	133 1.98%	2135 31.79%	242 3.60%	6715 100.00%
Business tours	82 17.94%	218 47.70%	7 1.53%	10 2.19%	124 27.13%	16 3.50%	457 100.00%
Education tours	585 20.77%	100 3.55%	10 0.35%	464 16.47%	1114 39.55%	544 19.31%	2817 100.00%
Other tours	808 8.52%	2018 21.29%	673 7.10%	887 9.36%	1702 17.96%	3391 35.77%	9479 100.00%
Shopping tours	153 4.52%	801 23.66%	324 9.57%	282 8.33%	509 15.04%	1316 38.88%	3385 100.00%
NHB Business/ work trips	51 6.76%	330 43.77%	20 2.65%	76 10.08%	204 27.06%	73 9.68%	754 100.00%
NHB Other trips	618 8.32%	1768 23.80%	1133 15.25%	599 8.06%	1881 25.32%	1429 19.24%	7428 100.00%

2.1.2 Level-of-Service Data

Level-of-service (LoS) information was available for walking, cycling, public transport, and car travel. Walking LoS is represented by distance, converted to time using a constant walking speed of 5 km/h. Cycling and public transport LoS are segmented by purpose group but not by time of day.

The representation of public transport has been substantially revised in OTM 8.0. Instead of separate in-vehicle, waiting, transfer, and access-time components, public transport service quality is represented through generalized travel times expressed in bus-equivalent minutes. These generalized times incorporate in-vehicle travel, access and egress movements, waiting and transfer penalties, as well as bike-and-ride and bike-on-board options. This ensures consistency between route-choice and demand-model representations of public transport services, although separate estimation of sensitivities to individual time components in the demand models is no longer possible.

Car LoS is provided by purpose and time interval and explicitly distinguishes between SOV and HOV travel. Total travel time combines free-flow time, congestion delay, and parking-search time, with congestion multipliers used to convert congested time into free-flow equivalents. Travel costs include distance-based operating costs, tolls, and parking charges. Consistent with current payment practices, a parking-cost adjustment factor previously included in OTM 7.1 (Fox, Patruni and Glenesk, 2018) to reflect cash-payment inconvenience has been removed.

2.1.3 Zonal Data

The zonal dataset contains attraction variables, or size variables, that represent the activity opportunities available within each zone. The specification follows the OTM 7.1 framework and includes variables such as employment, study places, retail activities, and population. The same definition as in OTM 7.1 was used. Table 3 shows the attraction variables included in each model.

For work and business travel, total employment is used as the primary attraction measure, whereas education models use the number of study places. Shopping destinations are represented by retail employment. For discretionary and non-home-based other travel, multiple attraction measures are included, with population specified as the base size variable and the attractiveness of other activities estimated relative to population.

Table 3 - Size variables included for each model purpose

Purpose	Size variable description
Home-work	Total number of jobs (Jobs)
Home-business	Total number of jobs (Jobs)
Home-education	Total number of study places (Stu)
Home-shopping	Workplaces: Grocery retail and retail trade (Com2, Com3)
Home-other	Population, total number of jobs in wholesale, repair services, restaurants and entertainment, financial and private office services and educational institutions (POP, COM1,ENT,LSE,EDU)
NHB business	Total number of jobs (Jobs)
NBH other	Population, total number of jobs in wholesale, repair services, grocery retail and retail trade, restaurants and entertainment, financial and private office services, public administration and educational institutions (POP,COM1,COM2,COM3,ENT,LSE,PSE,EDU)

2.2 Method

This section summarizes the modelling framework and the principal methodological developments introduced in OTM 8.0. The demand models are estimated using discrete choice models implemented in ALOGIT version 4.5 (Daly, 2022). Detailed descriptions of specification testing, parameter estimation, and implementation procedures are provided in Monteiro (2026).

2.2.1 Tour Generation Models

Tour-frequency models were estimated using a sequential stop/go framework, in which individuals choose whether to stop at the current number of tours or continue to an additional tour, with an open-ended final alternative allowing for higher travel demand levels. The models were re-estimated separately for each travel purpose and retain the same structural specification as OTM 7.1 (Fox, 2006; (Fox, Patruni and Glenesk, 2018).

The estimated parameters are generally consistent with previous model versions, indicating stable behavioral relationships. Consequently, the principal contribution of the frequency-model re-estimation is the update from a 2015 to a 2023 behavioral base year. The main methodological innovations introduced in OTM 8.0 are concentrated within the mode-destination models.

2.2.2 Mode-Destination Models

The mode-destination models simultaneously represent travelers’ choices of transport mode, destination, and, for car-driver alternatives, time of day. OTM 8.0 retains the overall nested and multinomial structures adopted in OTM 7.1 while introducing several important methodological enhancements.

2.2.2.1 Model Alternatives

Seven purpose-specific mode-destination models were estimated: Home-Work, Home-Business, Home-Education, Home-Shopping, Home-Other, NHB-Business, and NHB-Other. The available travel modes are:

- Car driver in a Single-Occupancy Vehicle (SOV)
- Car driver in a High-Occupancy Vehicle (HOV)
- Car passenger
- Public transport
- Bicycle
- Walk

In addition, car-driver alternatives include a choice among eleven OTM time periods. Destinations are represented by the 4,040-zone OTM zoning system.
Table 4 summarizes the main characteristics of the estimated models.

Table 4 - Summary of model characteristics

Purposes	Modes	Destinations	Time periods
Home-Work Home-Business Home-Education Home-Shopping Home-Other NHB-Business NHB-Other	Driver in a single occupancy vehicle (SOV) Driver in a high occupancy vehicle (HOV) Passenger in a HOV Public transport Cycle Walk	4040 zones	03:00–04:59 (UM1-E) 05:00–05:59 (UM2) 06:00–06:59 (MM3) 07:00–07:59 (MM1) 08:00–08:59 (MM2) 09:00–14:59 (UM3) 15:00–15:59 (EM1) 16:00–16:59 (EM2) 17:00–17:59 (EM3) 18:00–20:59 (UM4) 21:00–02:59 (UM1-L)

A key methodological advance in OTM 8.0 is the explicit separation of the former car-driver alternative into SOV and HOV driver alternatives. In OTM 7.1, solo drivers and drivers travelling with passengers were represented by a single alternative, limiting the model's ability to distinguish differences in travel-time valuation, cost sensitivity, and mode substitution. The introduction of separate SOV and HOV alternatives aimed to improve behavioral realism and strength the models' ability to evaluate policies that directly affect car-use costs. The resulting increase in the number of alternatives should therefore be interpreted as a refinement of behavioral representation rather than an increase in complexity for its own sake.

Table 5 compares the number of mode-destination alternatives in OTM 7.1 and OTM 8.0. The expansion reflects the explicit representation of SOV and HOV travel, which was previously embedded within an aggregated car-driver alternative.

Table 5 – Comparison of the number of mode-destination alternatives in OTM 7.1 and OTM 8.0 by model purpose

Model	OTM 7.1	OTM 8.0
Home-Work	158.886 (35 TP combinations[1])	298.960 (35 TP combinations)
Home-Business	118.146 (25 TP combinations)	210.080 (24 TP combinations)
Home-Education (NL)	92.920 (19 TP combinations)	153.520 (17 TP combinations)
Home-Shopping (NL)	134.442 (29 TP combinations)	177.760 (20 TP combinations)
Home-Other (NL)	203.700 (46 TP combinations)	282.800 (33 TP combinations)
NHB-Business	61.110 (11 TP combinations)	105.040 (11 TP combinations)
NHB-Other	61.100 (11 TP combinations)	105.040 (11 TP combinations)

[1] TP combinations refer to time period combinations considered for time-of-day choice for car drivers

2.2.2.2 Car cost sharing

The separation of the former car-driver alternative into Single-Occupancy Vehicle (SOV) and High-Occupancy Vehicle (HOV) drivers enabled a revised representation of car cost sharing in OTM 8.0. In OTM 7.1, car costs were allocated using observed party-size information from the travel survey, which could lead to unrealistic behavioral responses. In particular, when the observed choice is solo driving, the car-passenger alternative effectively receives a zero travel cost, resulting in an unrealistically large shift towards car-passenger travel in response to increases in car costs.

To address this limitation, OTM 8.0 replaces the party-size formulation with a cost-sharing framework based on purpose-specific average HOV occupancies. Average occupancies were calculated using only tours that included at least one passenger, thereby representing genuine shared-car travel. The resulting occupancies range from 2.24 persons per vehicle for shopping tours to 2.66 for education tours (Table 6).

Table 6 - Mean car occupancy by tour purpose (for tours with passengers)

Tour purpose	TU data 2016–2019 and 2022–2025
Work	2.26
Business	2.42
Education	2.66
Other	2.49
Shopping	2.24

The estimated occupancies were used to define cost-sharing multipliers for HOV drivers and passengers. Different cost-sharing rates were tested for each travel purpose, with final values selected based on model fit and the behavioral plausibility of the resulting elasticity estimates.

Table 7 summarizes the final cost-sharing rates and corresponding cost multipliers adopted in OTM 8.0. The multipliers were derived using the cost-sharing formulation adapted from Rich and Fox (2024) [2]. The results indicate that HOV drivers continue to bear most of the travel costs for all purposes, while passengers contribute a purpose-specific share that varies according to average occupancy and the estimated cost-sharing rate.

Table 7 - Final cost sharing rates and equivalent cost sharing multipliers

	Work	Business	Education	Shopping	Other	NHB Business	NHB Other
Cost sharing rate	**0.25**	**0.25**	**0.25**	**0.5**	**0.75**	**0.25**	**0.25**
Total share paid by HOV driver	0.8606	0.8533	0.8440	0.7232	0.5512	0.8533	0.8504
Total share paid by car passengers	0.1394	0.1467	0.1560	0.2768	0.4488	0.1467	0.1496
Cost multiplier for HOV driver	0.8606	0.8533	0.8440	0.7232	0.5512	0.8533	0.8504
Cost multiplier for car passenger (equivalent to 1 passenger)	0.1106	0.1033	0.0940	0.2232	0.3012	0.1033	0.1004

The revised formulation represents an important methodological improvement because it generates more realistic behavioral responses to changes in travel costs. In particular, it avoids the unrealistic zero-cost passenger alternative that could arise in previous model versions and therefore provides a more credible

[2] The formula for the cost share multiplier for car passengers was adapted to make sure that it reflects the value that only one passenger would pay in the travel, i.e., a fraction of the total share of costs that should be paid for all the passengers together.

representation of cost sensitivity. This is particularly important for the evaluation of congestion charging, parking-pricing, and fuel-cost policies.

2.2.2.3 Value of Travel Time

Values of travel time (VTT) were updated to 2023 price levels using estimates derived from the 2017 stated-preference survey for residents of the Greater Copenhagen Area, as described by Overgård (2025). Compared with OTM 7.1, average free-flow VTTs for car drivers increased by approximately 19-30%, depending on travel purpose.

For public transport, VTTs were derived by applying mode-specific car-to-bus valuation ratios from the DATIV stated-preference study. For business travel, a ratio of 1.0 was adopted because the original DATIV ratio was considered unrealistically high. This approach is consistent with the representation of public transport level of service in OTM 8.0, where all travel-time components are expressed in bus-equivalent units.

Table 8 presents the resulting average free-flow values of travel time for car drivers, car passengers, and public transport users. The non-home-based business value is applied to both home-based and non-home-based business travel.

Table 8 - Average free-flow values of travel time (DKK/hour, 2023 prices)

Travel purpose	Free flow VTT Car driver (DKK/h)	Free flow VTT Car passenger (DKK/h)	VTT Public transport (DKK/h)
Home-Work (HW)	81.3	77.6	78
Home-Education (HE)	80.7	70.6	76.7
Home-Shopping (HS)	61.9	62.8	68.7
Home-Leisure (HO)	72	67.9	78.5
Non-home-based leisure trips (NHBO)	69.7	69.7	67.6
Non-home-based business (NHBB)	222.9	221.1	222.9

Unlike previous versions of OTM, separate values of travel time are estimated for car drivers and car passengers. To maintain a utility specification with a single generic time coefficient, all time and cost components are converted into equivalent car-driver free-flow time units before estimation. This approach preserves consistency with previous OTM model formulations while allowing mode-specific differences in travel-time valuation to be represented explicitly.

As in OTM 7.1, values of travel time are adjusted according to personal income and trip length, preserving behavioral heterogeneity across travelers and travel purposes. The resulting conversion factors are subsequently used to express car travel time, car costs, public transport travel time, and public transport fares in a common utility scale. This conversion approach has been implemented since OTM 5 (Fox and Sivakumar, 2006).

2.2.2.4 Availability Conditions

The availability of mode-destination alternatives is determined by destination- and mode-specific constraints that vary by travel purpose. Destinations are considered unavailable if they correspond to port zones (zones 4023-4040) or if the relevant attraction variable equals zero. Attraction variables are specified on a purpose-specific basis to represent the opportunities relevant to each activity, including employment, education, and retail opportunities, as summarized in
Table 9.

Mode availability is determined by a combination of level-of-service data, individual characteristics, and maximum distance thresholds. Walking alternatives are limited to 15 km, while cycling alternatives are limited to 60 km for home-based tours and 30 km for non-home-based trips in order to avoid unrealistic choice sets. Public transport alternatives are available only when a valid generalized travel time is available for the specific destination. Car-passenger travel is assumed to be available to all individuals, whereas car-driver alternatives are available only to licensed individuals residing in households with access to at least one vehicle.

Table 9 - Relevant attraction variables by model purpose

Purpose	**Attraction variable**
Home-work	Jobs (Total number of jobs)
Home-business	Jobs (Total number of jobs)
Home-education	Stu (Total number of study places)
Home-shopping	Com2 + Com3 (Workplaces: sum of grocery retail and Retail trade places)
Home-other	-
NHB business	Jobs (Total number of jobs)
NBH other	-

3 Results

The principal methodological developments introduced in OTM 8.0 concern the mode-destination models. Consequently, the evaluation focuses on assessing whether the revised specifications improve the model's ability to reproduce observed travel behavior while maintaining behaviorally plausible responses to changes in level of service. Model performance is evaluated using three complementary indicators: (i) observed versus predicted mode shares, (ii) trip-length distributions, and (iii) demand elasticities.

3.1 Mode Share Validation

Across all seven travel purposes, the re-estimated mode-destination models reproduce observed mode shares closely (see Figure 1). The predicted distributions capture the dominant travel modes for each purpose while maintaining realistic shares of less frequently chosen alternatives. Work and business travel are dominated by car-driver SOV and cycling, whereas education travel is characterized by relatively high shares of cycling, walking, public transport, and car-passenger travel. Shopping and other discretionary tours exhibit substantial walking activity, while non-home-based trips show relatively large shares of car-driver SOV and cycling.

The close correspondence between observed and predicted mode shares demonstrates that the methodological enhancements introduced in OTM 8.0 have not compromised the overall behavioral consistency of the model despite the substantially richer choice structure. The explicit separation of SOV and HOV driver alternatives increases behavioral detail while preserving aggregate prediction accuracy, indicating that the additional complexity reflects meaningful behavioral differences rather than unnecessary model complexity.

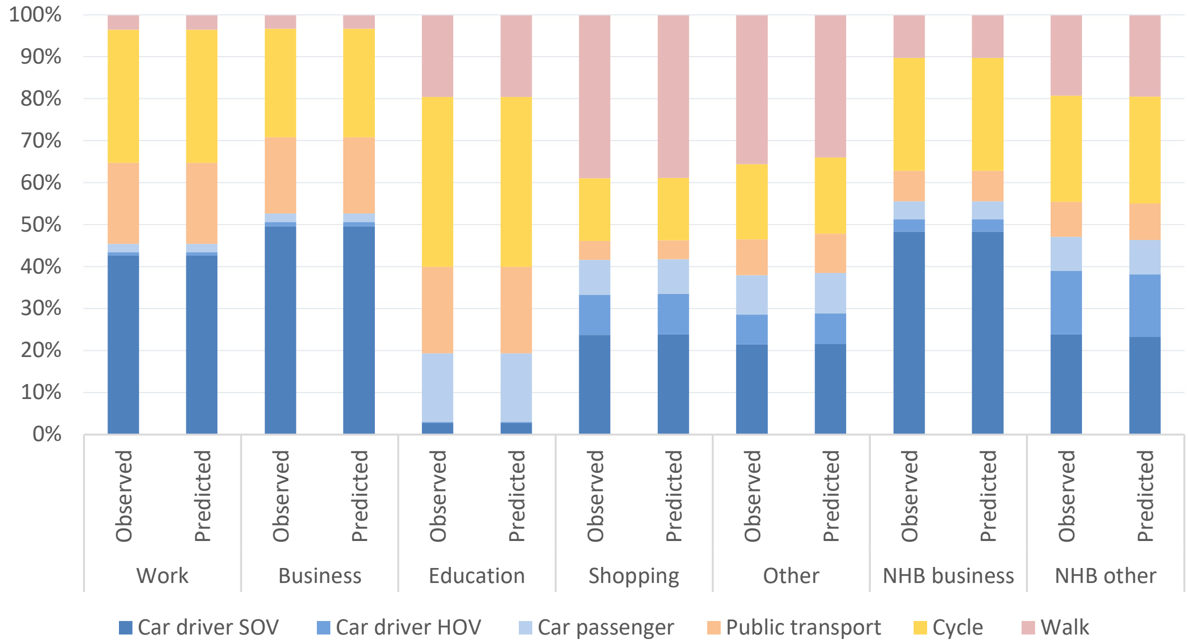

Figure 1 - Observed versus Predicted Mode Shares in OTM 8.0

3.2 Trip-Length Distributions

Accurately reproducing trip-length distributions is essential because destination choice largely determines travel demand, network loading, and infrastructure appraisal. Figure 2 - Figure 4 compare observed and predicted trip-length distributions for representative travel purposes.

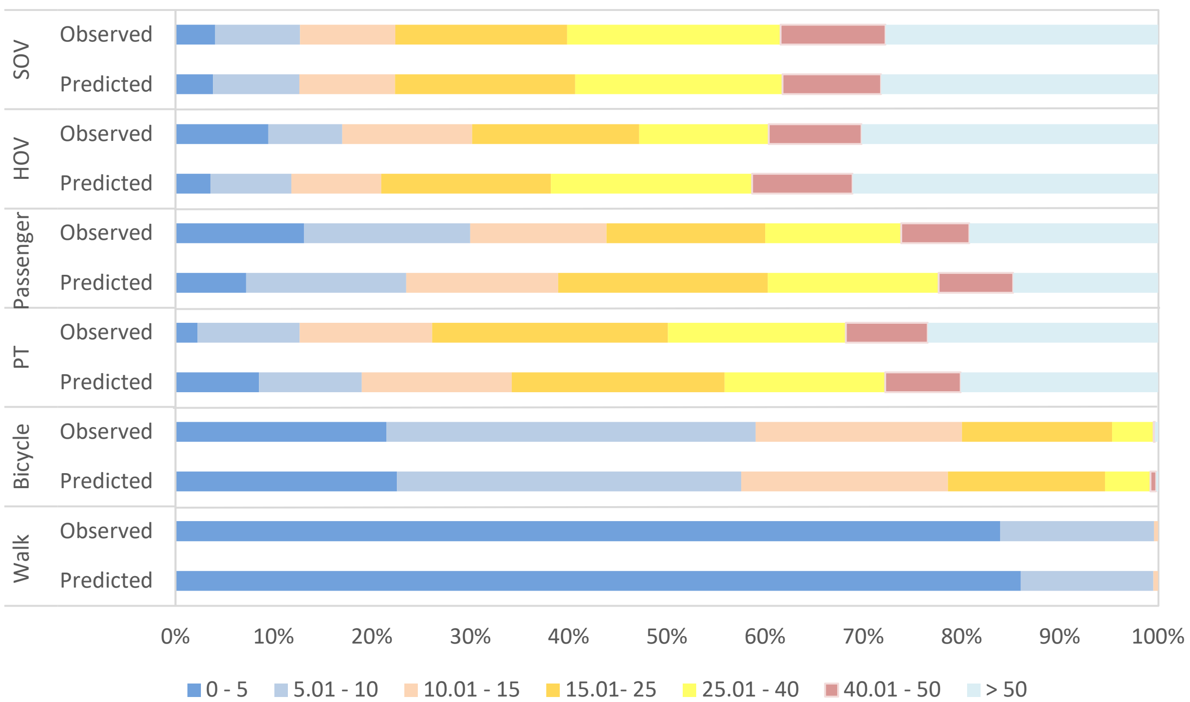

Figure 2 - Observed and Predicted Trip-Length Distributions by Mode for Work Tours (km)

For work tours, the agreement between observed and predicted distributions is generally very good across all travel modes. The introduced distance-correction terms substantially improve the representation of public transport trip lengths compared with previous model versions. Some discrepancies remain for longer public transport trips, where predicted distances tend to be slightly shorter than observed values. This difference should be interpreted cautiously because public transport distances are approximated using equivalent car-network distances rather than dedicated public transport network distances.

The education models also reproduce observed trip-length distributions well, particularly for cycling and walking, which represent a substantial proportion of education travel. This result is important because active modes dominate education travel, making accurate representation of short-distance travel particularly relevant. The small number of HOV driver tours observed limits the reliability of comparisons for that alternative but does not significantly affect the overall validation.

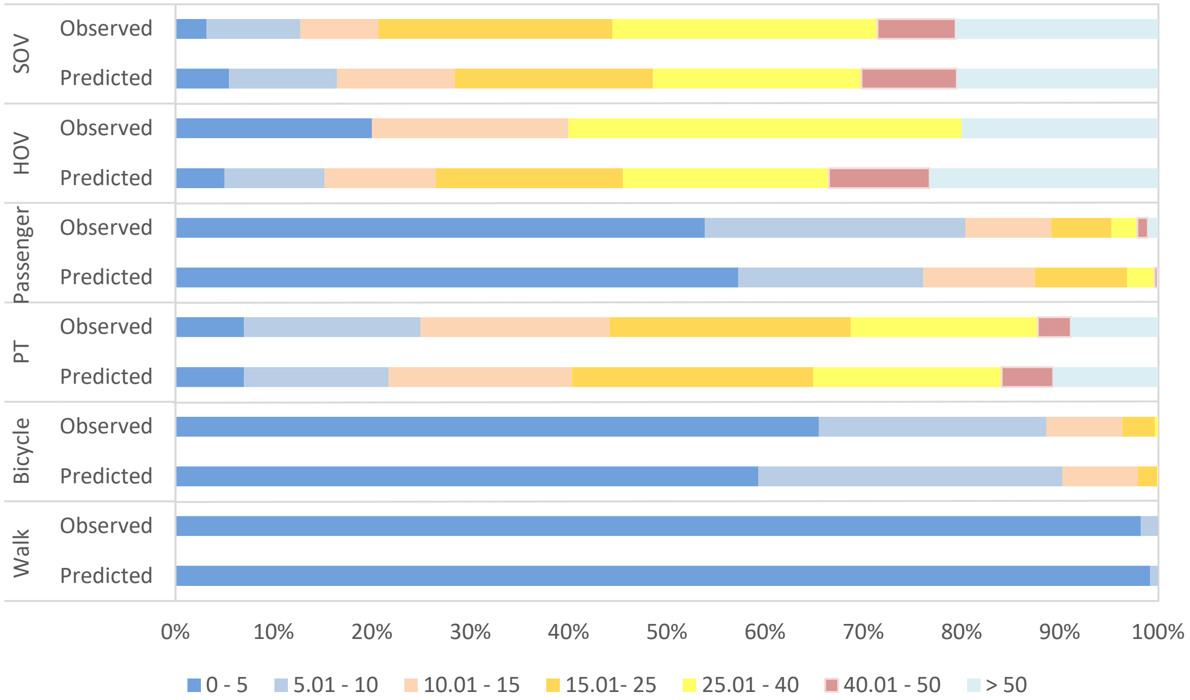

Figure 3 - Observed and Predicted Trip-Length Distributions by Mode for Education Tours (km)

For discretionary travel purposes (Home-other), larger deviations are observed than for mandatory travel. This outcome is expected because discretionary activities are inherently more heterogeneous with respect to destination choice and travel behavior. Nevertheless, the estimated models reproduce the overall shape of the observed distributions across all travel modes, providing confidence that the revised specifications capture the principal behavioral relationships influencing destination choice.

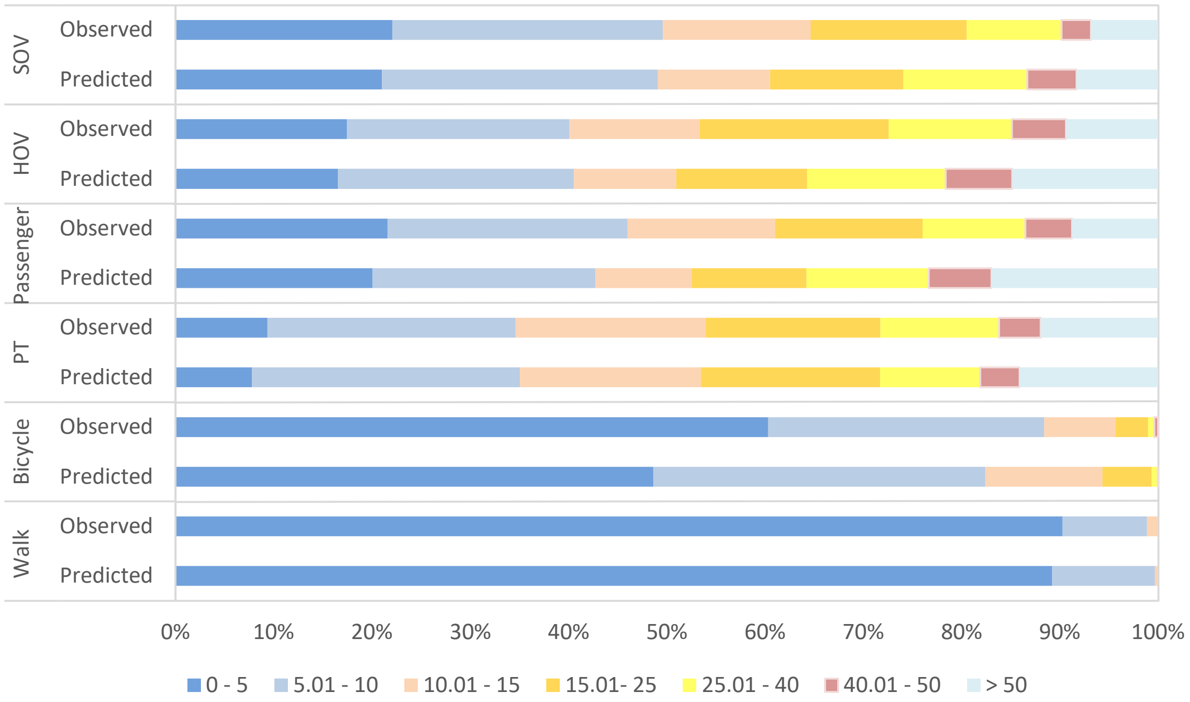

Figure 4 - Observed and Predicted Trip-Length Distributions by Mode for Other Tours (km)

Overall, the validation results demonstrate that the updated specifications successfully reproduce both aggregate mode choice and spatial travel behavior, supporting the behavioral realism of the revised mode-destination models.

3.3 Elasticities

Behavioral realism was further assessed through elasticity testing using 10% changes in car travel cost, car travel time, public transport fares, and public transport in-vehicle travel time. The estimated elasticities are consistent with transport-economic theory and demonstrate that the revised model produces plausible responses across all travel purposes.

Mandatory travel generally exhibits greater sensitivity to travel time than to monetary cost, reflecting the scheduling constraints associated with commuting and business travel. In contrast, discretionary travel shows relatively stronger responses to public transport fares, consistent with the greater flexibility of these travel purposes and the updated fare representation incorporated in the OTM 8 level-of-service data (see Table 10).

The revised SOV/HOV car driver specification provides one of the clearest behavioral improvements. Across all travel purposes, HOV drivers consistently display lower cost elasticities than SOV drivers because travel costs are shared among vehicle occupants. This outcome confirms that the revised cost-sharing formulation produces more realistic behavioral responses than the previous party-size-based specification, particularly for policies targeting vehicle operating costs.

Comparison with OTM 7.1 Fox, Patruni and Glenesk, 2018) further illustrates the benefits of the re-estimation. The updated models generally preserve the expected magnitude of travel responses while improving behavioral consistency. Business travel provides the clearest example: car-driver time elasticity increases from -0.08 in OTM 7.1 to -0.33 in OTM 8, while cost elasticity decreases from -0.18 to -0.09, reflecting the updated values of travel time and the revised representation of driving costs. These changes produce responses that are more consistent with observed travel behavior and improve the credibility of policy analyses involving congestion charging and parking pricing.

Table 10 - Tour elasticities

Purpose		SOV	HOV	Passenger	Public transport
Work	Cost	-0.227	-0.148	0.209	-0.678
	Time	-0.309	-0.322	-0.304	-0.571
Business	Cost	-0.088	-0.047	0.132	-0.342
	Time	-0.325	-0.33	-0.765	-0.783
Education	Cost	-0.263	-0.217	-0.005	-0.512
	Time	-0.374	-0.392	-0.129	-0.401
Shopping	Cost	-0.207	-0.126	-0.03	-1.651
	Time	-0.183	-0.247	-0.559	-0.729
Other	Cost	-0.199	-0.083	-0.059	-0.781
	Time	-0.184	-0.272	-0.348	-0.503
NHB business	Cost	-0.147	-0.096	0.125	-0.567
	Time	-0.332	-0.348	-0.427	-1.11
NHB other	Cost	-0.269	-0.214	0.137	-1.31
	Time	-0.197	-0.233	-0.528	-0.763

Moreover, across all purposes, kilometer elasticities exceed the corresponding tour elasticities, indicating that travelers are more likely to respond to changes in travel costs and travel times by adjusting destination choice and trip length than by changing mode. This distinction is important for policy analysis, as relatively modest changes in mode shares may still result in substantial impacts on vehicle kilometers travelled, congestion levels, and transport-related emissions.

Thus, the validation results demonstrate that the methodological enhancements introduced in OTM 8.0 improve behavioral realism without sacrificing predictive performance. The models accurately reproduce observed travel behavior while generating plausible responses to policy interventions, providing a stronger basis for transport forecasting and appraisal in Greater Copenhagen.

4 Discussion and Policy Relevance

The OTM 8.0 demand models represent a substantial update of the Greater Copenhagen travel demand modelling framework. The validation results indicate that the updated models reproduce observed travel behavior well while providing improved behavioral representation for policy analyses.

A central improvement is the explicit distinction between SOV and HOV car-driver alternatives. The results show that this additional behavioral detail can be introduced without reducing predictive performance. More importantly, it allows the model to represent differences in cost sensitivity between solo and shared-car travel. This is particularly relevant for policies where the financial consequences of car use are central, including congestion charging, parking pricing, and other measures affecting vehicle driving costs.

The revised cost-sharing formulation further improves the interpretation of car travel behavior. By replacing observed party size with purpose-specific average car occupancies, the model avoids unrealistic cost allocations that could distort responses to changes in travel costs. The resulting elasticity patterns provide evidence that the revised formulation produces more plausible behavioral responses.

The updated representation of public transport level of service also improves consistency within the modelling framework. By using generalized travel times expressed in bus-equivalent minutes, the demand model is better aligned with the route-choice representation of public transport supply. Although this approach improves consistency, it also means that the demand models no longer separately estimate sensitivities to individual public transport components such as waiting time, transfer time, and in-vehicle time.

The updated data-processing framework represents another important contribution. Automated tour construction, standardized classification procedures, and systematic treatment of missing socioeconomic information improve reproducibility and reduce potential inconsistencies in future model updates.

Despite these improvements, some limitations remain. The validation results show that discrepancies persist for certain travel purposes and modes, particularly where observed behavior is highly heterogeneous or where the available data provide limited observations.

Overall, OTM 8.0 provides a stronger foundation for transport forecasting and policy appraisal in Greater Copenhagen. The combination of updated behavioral data revised methodological specifications, and improved validation performance increases confidence in the model's ability to assess future infrastructure investments, mobility strategies, and sustainability-oriented transport policies.

5 References

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