Stated preference survey 2025 on mode, route and departure time choices

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Abstract

The Stated Preference (SP) survey 2025 incorporates several improvements compared to the 2021 survey such as higher realism in the calculation of revealed preference (RP) travel costs or simplified departure time choice experiments, focusing on a respondent's current travel mode. The selection process for the RP reference trip has been updated, enhancing the representativeness of the trips. Certain attributes have been removed, allowing for a simplified structure where all respondents are shown the same set of attributes. The layout of the SP questionnaire has been redesigned to improve clarity and user experience. Furthermore, the combination of SP experiments and types has been extended, enabling a more tailored assignment of individual questionnaires. The SP experimental designs themselves have been refined. And finally, qualitative questions related to mode choice have been included, offering additional relevant behavioural insights.

Keywords

Stated preferences; experimental designs; survey design; reference trip; mode choice; route choice; departure time choice

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1 Introduction

The Stated Preference (SP) survey on travel choices is conducted since 2010 under the lead of the Swiss Federal Office for Spatial Development (ARE). It is directly linked to the revealed preferece (RP) survey "Swiss Mobility and Transport Microcensus" (MTMC) conducted by the Swiss Fedeal Office of Statistics (SFOS) in collaboration with the ARE. The primary objective is to measure sensitivities and preferences regarding various transport-related level-of-service (LOS) attributes, such as travel time, travel cost, etc., through revealed and stated decision situations. Respondents, selected from the MTMC sample, are asked to make choices between different transport modes, routes and departure times, which are pivoted around their actual travel behaviour as observed in the MTMC.

The SP survey allows for the evaluation of aspects that are difficult or impossible to observe in real-world conditions, including hypothetical features (e.g., peak time charges), rarely varying factors (e.g., travel costs), or highly correlated attributes (e.g., travel time and costs). The collected data serves as a statistical foundation for the Swiss National Passenger Transport Model (NPTM), the evaluation of transport policy measures (e.g., cost-benefit analyses) and analyses of future transport trends (e.g., transport perspectives).

The survey targets the Swiss resident population aged 18 and older who is mobile during the MTMC reference day. It is conducted via online or paper questionnaires following the MTMC survey (conducted by computed assisted telephone interview, CATI), with a sample size of approximately 5,000 respondents (5-10% of the MTMC sample). Participation is voluntary. Surveys were carried out in 2010, 2015 and 2021 (the 2020 survey had been postponed to 2021 due to the COVID pandemic) already, while currently the SP survey 2025 is running. The survey results are merged to the MTMC dataset, making rich sociodemographic data available. Data collection spans a full calendar year (over a pre-test and three main waves) and is published approximately one year after completion.

The aim of the current paper is to give an overview over the updated survey design 2025. While the basic structure and content of the survey, as described in Section 2.1, has not been changed much over time, several improvements have been implemented since the previous survey in 2021, as outlined in Section 2.3. Most importantly, the SP survey 2025 comes with a completely restructured and simplified layout. It targets each respondent more individually and flexibly to obtain more efficient, robust and reliable results. Novel are also the qualitative questions related to respondents' mode choice, which are hard to measure objectively, but may nonetheless be important decision factors and hence should be asked.

Since 2021, a new framework investigating departure time choices has been included, enabling the analysis of behavioural responses to measures aimed at smoothing peak travel periods. Based on the findings from the SP survey 2021, this framework has been improved as well and is outlined in the current paper.

2 Content and overview of the SP survey 2025

2.1 General content

As in 2021, four stated preference (SP) experiments are conducted in the SP survey 2025:

- **SP1** experiment on **mode choice**,
- **SP2** experiment on **route choice by car**,
- **SP3** experiment on **route choice by public transport** (PT),
- **SP4** experiment on **departure time choice** by car or PT.

The questionnaire starts with a reminder of the trip described by the respondent in the MTMC interview, which has been selected as the "reference trip" (RP trip) for the SP survey (i.e., the trip for which the SP questions are pivoted around). This reflects one of the core principles of the survey, providing personalized questionnaires for each respondent to ensure behavioural realism and improved engagement.

The questionnaire has been designed to be comparable to the SP survey 2021 questionnaire; e.g. the numbering for the common experiments (SP1, SP2, SP3 and SP4) was kept unchanged to facilitate comparisons. The experiments are based on the design of the SP survey 2021, but with some adaptations (removal of certain attributes and simplification of choice questions, new layout, etc.), as further discussed below.

The SP4 experiment has been reviewed and completely redesigned. This experiment is no longer a combined choice between the choice of departure time and the mode, as it was in the SP survey 2021, but focuses solely on the choice of departure time. This allows to reduce the cognitive load for respondents.

2.2 Applying dynamic pricing to the SP survey 2025

A new pricing scheme is applied to the survey to enable us to estimate the impact of a dynamic pricing policy on respondents' behaviour with respect to mode choice, route choice and departure time choice.

Dynamic pricing is usually defined by differentiation in time and space. The spatial differentiation of dynamic pricing is not explicitly applied to the attributes of the SP survey for the following reasons:

- the territories/regions that could be subject to the different types of pricing have not yet been defined,
- once we have estimated choice models for different user types, we can test different definitions of these territories within the four-stage transport model (NPTM),
- incorporating a spatial differentiation into a Swiss-wide survey would significantly increase the burden on respondents (i.e., creation of a map with definition of zones around conurbations and possibly along busy roads, further explanations and the presentation of a map in the survey).

The implementation of spatial differentiation was explained in the introduction to the SP survey, stating that a peak charge is included if a respondent travels within a congested area. An area is congested if the origin and/or destination of the trip is in an "urban" or "intermediate" commune according to the FSO's "Urban-Rural Typology 2012" (FSO, 2012).

Temporal differentiation however is explicitly reflected in the attributes of the SP survey. Additional costs are explicitly added - and separately presented - to travel costs if the respondent travels during peak hour and in a congested area. Time differentiation is also explicitly presented in the departure time choice experiment, where the respondent has the choice of traveling off-peak with no additional charge or during the peak period by paying a peak charge.

Peak hours are defined as the period from 7 AM to 9 AM and from 4 PM to 6 PM on working days (Monday to Friday). The cost is a kilometer surcharge applied to all car drivers and public transport (PT) users with or without a season ticket. The analogy in the presentation of the additional costs for car and PT modes is important to be in coherence with corresponding concepts discussed in Switzerland.[1]

[1] See e.g. ASTRA: https://www.astra.admin.ch

Finally, the various dimensions of dynamic pricing (spatial differentiation, temporal differentiation, etc.) lead to the conclusion that we need to test sufficiently wide value ranges for the cost attributes to cover the cases of congested and uncongested areas and different levels of a peak hour surcharge.

2.3 Main improvements of the SP survey 2025

The main changes and improvements compared to the SP survey 2021 are listed below. These changes were made on the basis of lessons learned from the previous survey, the model results and feedback from the project team and accompanying group, in order to best meet the expectations of the survey specifications.

The main improvements of the SP survey 2025 are as follows (details are given in each corresponding section):

- higher accuracy and realism in the calculation of RP travel costs (see Section 3),
- improved selection process of the RP reference trip (see Section 4),
- removal of certain SP attributes, to end up with one single attribute set shown to all respondents; see Section 5.1.1),
- neater layout of the SP questionnaire (see Section 5.1.2, Section 5.2.2, Section 5.3.2),
- extending the combination of different SP experiments/types for a more tailored assignment of individual questionnaires (see Section 6),
- improvement of the SP experimental designs: e.g. trade-off ranges; see Section 7),
- inclusion of qualitative questions related to the RP mode choice (see Section 8).

More details will be published in the final report of the project in summer 2026, as it would go beyond the scope of this paper.

3 Calculation of RP travel costs

3.1 Car variable costs

One major improvement of the SP survey 2025 is to use more accurate, personalized travel costs to generate the RP data. Apart from using more realistic cost attributes, the main motivation is to increase the variation in travel costs and to "break" the correlations with other attributes, such as travel time, which is often a problematic issue especially in RP data (see e.g. Cherchi and Ortúzar, 2002; Train, 2009; Schmid *et al.*, 2019). In the case of car use, we additionally consider the information from the MTMC vehicle questionnaire about the car type used for a specific trip. In past SP surveys, an average cost factor was used to obtain the car travel costs, only depending on the distance travelled.

In the MTMC vehicle dataset each car is characterized by a type number (*Typenscheinnummer*, variable *mf_tysnr*). The type number can be linked with various vehicle attributes from the official vehicle database, the *Informationssystem Verkehrszulassung* (IVZ) database, covering more than 200'000 vehicles types. The IVZ database is provided by the Federal Roads Office (ASTRA).This database covers fixed costs but not variable costs. Luckily, Touring Club Switzerland (TCS) provided a database with 1'980 frequently used cars of different types and segments, including ariable costs (fuel/energy, service and material prices for year 2024). By combining these data sources, the car variable costs are obtained in the SP survey 2025, as explained below.

Variable costs are, by definition, relevant in a short-term choice context (such as mode, route and departure time choice), while fixed costs should not be relevant when making a specific trip. Fixed costs are *sunk* costs; once paid, they do not matter anymore when choosing which mode to use (see e.g. discussion in Schmid *et al.*, 2022). According to the definition of the TCS[2], the variable costs contain fuel/energy and wear-and-tear (including service, repair, tires and impairment due to traveling) costs. Using this definition and values also ensures that the values are in line with the Swiss national passenger transport model (NPTM; ARE, 2020).

The IVZ was merged with the TCS database via the type number to relate the car characteristics (such as e.g. engine power, fuel type, weight, drive type and size) to the variable costs, leading to 1'476 observations with a successful match. Based on

[2]https://www.tcs.ch/de/testberichte-ratgeber/ratgeber/kontrollen-unterhalt/kilometerkosten.php

preliminary regression analyses, the maximum engine power (in kilowatt; kW), the fuel type (gasoline/other[3], diesel, hybrid and electric) and the weight of a vehicle (in tons; t) were shown to be the most relevant factors in explaining the variation in variable costs expressed in Swissfrancs per kilometer (CHF/km) (see Table 1 for summary statistics). These explanatory variables are used in a log-linear regression model of the form

$$\log(\mathrm{vc}_i) = \alpha + \boldsymbol{x}_i\boldsymbol{\beta} + \epsilon_i \tag{1}$$

where vc_i is the variable cost factor (in CHF/km) of car i, α is the constant, $\boldsymbol{x}_i$ is a vector of car attributes, $\boldsymbol{\beta}$ is the corresponding parameter vector and ϵ_i is the remaining error term, assumed to follow a normal distribution. Results with different model specifications (M1 to M4, with M3 and M4 including interaction terms) are presented in Table 2.

Table 1: Summary statistics of variable car costs and attributes in estimation sample (N = 1'476; matches between the IVZ the TCS database).

Attribute	**%**	**Min.**	**1st Qu.**	**Median**	**Mean**	**3rd Qu.**	**Max.**
Variable costs [CHF/km]	–	0.13	0.26	0.30	0.37	0.39	2.00
Kilowatt [kW]	–	48.00	96.00	130.00	167.80	195.00	964.00
Weight [t]	–	0.57	1.45	1.70	1.74	2.00	2.97
Fuel type: Gasoline	34.3	–	–	–	–	–	–
Fuel type: Diesel	16.7	–	–	–	–	–	–
Fuel type: Hybrid	29.7	–	–	–	–	–	–
Fuel type: Electric	19.0	–	–	–	–	–	–
Fuel type: Other	0.3	–	–	–	–	–	–

Results in Table 2 are highly significant and robust across the different specifications. Model 2 (M2) only including the linear main effects indicates that if kW increases by 100 units, the predicted variable cost factor increases by 28% on average, a similar effect as if the weight increases by 1 ton (increase by 26%), ceteris paribus. Furthermore, if the fuel type of the car is electric (relative to gasoline/other cars), the predicted variable cost per km decreases by 46% on average. M2 already leads to a high model fit with an adj. R^2 of 0.86. In M3 and M4 non-linear (quadratic) and second-order interaction effects were added which further improves the model fit (up to an adj. R^2 of 0.89). E.g., an increase in kW exhibits a significant and negative effect for electric cars (relative to gasoline/other cars), while an increased weight leads to a significant and positive effect for electric cars (relative to gasoline/other cars; see M4).

[3]Fuel type categories "gasoline" and "other" were combined in the model estimation for efficiency reasons.

Table 2: Estimation results: Model to predict variable car costs. Dependent variable: log(CHF/km).

	M1 Coef./(SE)	**M2** Coef./(SE)	**M3** Coef./(SE)	**M4** Coef./(SE)
Constant	-1.74^{***}	-1.89^{***}	-2.02^{***}	-2.14^{***}
	(0.03)	(0.02)	(0.12)	(0.11)
kW/100	0.28^{***}	0.26^{***}	0.75^{***}	0.68^{***}
	(0.01)	(0.00)	(0.08)	(0.07)
weight [t]	0.09^{***}	0.28^{***}	0.11	0.33^{**}
	(0.02)	(0.01)	(0.14)	(0.14)
Fuel type: Diesel		-0.02^{*}	-0.01	-0.13^{*}
		(0.01)	(0.01)	(0.07)
Fuel type: Hybrid		-0.13^{***}	-0.12^{***}	0.15^{***}
		(0.01)	(0.01)	(0.05)
Fuel type: Electric		-0.46^{***}	-0.44^{***}	-0.45^{***}
		(0.01)	(0.01)	(0.07)
weight^2 [t^2]			0.12^{***}	0.02
			(0.04)	(0.04)
kW/100 x weight [t]			-0.34^{***}	-0.33^{***}
			(0.08)	(0.07)
kW/100 x weight^2 [t^2]			0.04^{**}	0.07^{***}
			(0.02)	(0.02)
kW/100 x Fuel type: Diesel				-0.05^{*}
				(0.03)
kW/100 x Fuel type: Hybrid				0.02
				(0.01)
kW/100 x Fuel type: Electric				-0.16^{***}
				(0.01)
weight [t] x Fuel type: Diesel				0.12^{**}
				(0.05)
weight [t] x Fuel type: Hybrid				-0.16^{***}
				(0.04)
weight [t] x Fuel type: Electric				0.15^{***}
				(0.05)
Number of observations	1476	1476	1476	1476
Number of parameters	3	6	9	15
Adj. R^2	0.70	0.86	0.87	0.89
RMSE	0.22	0.15	0.14	0.13

Standard errors: $^{***}: p < 0.01$, $^{**}: p < 0.05$, $^{*}: p < 0.1$

The final (back-transformed into CHF/km) distribution of the prediction based on M4 is shown in Fig. 1 on the left, indicating a right-skewed pattern (i.e., a few cars with very high variable costs of up to 4.35 CHF/km, for a *BUGATTI Chiron* with 1360 HP; values > 1.25 CHF/km are omitted from the figure) with a mean of 0.33 CHF/km and a median of 0.31 CHF/km. These values are close to the TCS sample car with variable costs of 0.28 CHF/km.

Finally, the IVZ database enriched with the predicted variable cost factors is merged via the type number with the MTMC vehicle database, which then is used to calculate the car variable costs for a given individual and trip. In the MTMC, the information if a car from the household (variable *f51310a*) – and if yes, which car (variable *f51310b*) – was used for a specific trip is available in the trip-leg dataset. If no car was used for the trip, but would be available, the variable *f30700_hpnr1* indicates which car from the household the respondent usually uses (relevant if a household has multiple cars). In case of missing values (for about 30% of the MTMC vehicle dataset with a missing type number, or in case another car not from the household of the respondent was used), an average value of 0.3 CHF/km is imputed. In case a carsharing vehicle (e.g. *Mobility*) was used, a value of 0.8 CHF/km is imputed.

After the routing of the RP trips, the variable cost factor $\mathrm{vc}_{n,t}$ for individual n (and RP trip t, since an individual may use different cars for different trips) is applied to the routed distance, $\mathrm{dist}_{n,t}$ (in km), to calculate the travel costs $\mathrm{tc}^{\mathrm{car}}_{n,t}$ (in CHF). To better reflect reality (see below) and avoid a completely linear relationship between travel cost and distance, similar as in previous SP surveys (ARE, 2012, 2017, 2022), a degressive approach of the form

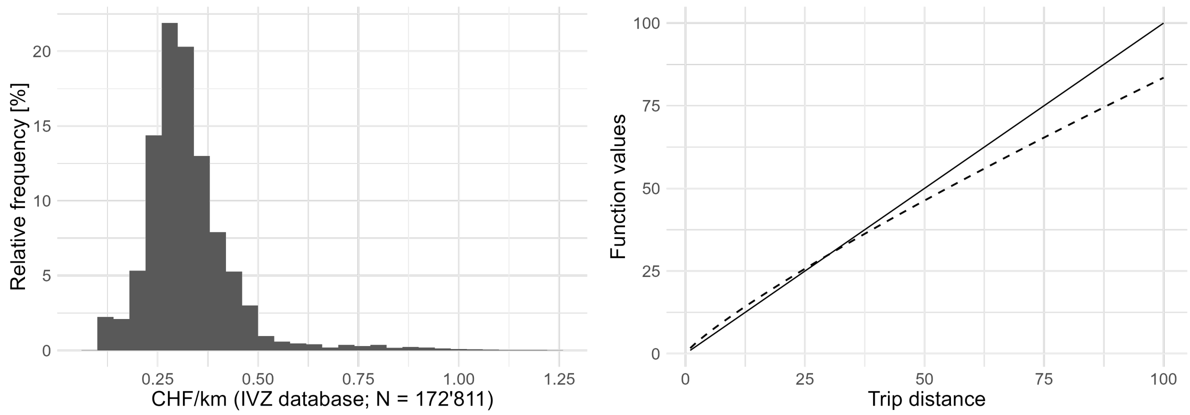
$$\mathrm{tc}^{\mathrm{car}}_{n,t} = \mathrm{vc}_{n,t} \cdot 30 \cdot (\mathrm{dist}_{n,t}/30)^{0.85} \tag{2}$$

is applied to the trip distance, such that the travel costs per km are slightly decreasing for longer distances (intersecting the 45°-line at a trip distance of 30 km).[4] This is based on the fact that the costs per kilometer traveled tend to be higher for shorter distances (e.g., in cities the car more often has to start, accelerate and stop; a cold engine generally requires more fuel/energy; long-distance traveling on a highway is, per km, more efficient).

[4]The point of intersection corresponds to (ARE, 2012), but has no clear empirical evidence. It just ensures that for relatively small distances, the value is slightly above and for longer distances slightly below the 45-degree line to break the correlations.

The functional form is illustrated in Fig. 1 on the right (dashed line).

Figure 1: Left: Distribution of predicted variable costs (in CHF/km) in the IVZ database. Right: Linear (solid line) vs. degressive (dashed line) approach for increasing trip distance (in km).



3.2 PT variable costs

Depending on the type of PT season ticket subscription, the variable PT travel costs for a specific trip can vary substantially. A major change compared to the previous SP surveys is – as discussed above in the case of car – that only variable costs are considered when making a short-term travel decision (such as mode, route or departure time choice; see e.g. discussion in Schmid *et al.*, 2022). In previous SP surveys even respondents with flat-rate PT season tickets for the entire PT network in Switzerland (such as the nation-wide general subscription; *GA*) were confronted with PT travel costs in their choice situations (ARE, 2012, 2017, 2022).[5] For the GA as an example, one has to pay a substantial fixed cost (currently 3'995 CHF per year for an adult in 2nd class). However, once this amount is payed, the costs on a trip-level do not matter anymore. Consider that you own both a GA and a car: When you choose between using PT or the car for your hiking trip to Appenzell, the PT alternative technically involves zero travel costs.

[5]For example, in 2021, the PT reference cost factor for people with a GA was 0.17 CHF/km for 2nd and 0.33 CHF/km for 1st class subscriptions.

Table 3: PT travel cost $\mathrm{tc}_{n,t}^{\mathrm{PT}}$ based on PT season ticket subscription. All values are in CHF. Note that the SBB-tariff (see also Table 4) depends on the distance traveled and exhibits minimum costs.

	Trip starts from or ends at home	
Type of season ticket	**Yes**	**No**
No ticket subscription	Ticket price (or SBB-tariff)	Ticket price (or SBB-tariff)
Half fare card (*Halbtax*)	1/2 of ticket price	1/2 of ticket price
Half fare card PLUS (*Halbtax PLUS*)	$0.75 \cdot 1/2$ of ticket price	$0.75 \cdot 1/2$ of ticket price
General subscription (*GA*)	0	0
GA Night (< 25 years; trip after 7PM)	0	0
Regional subscription (*Zonen-Abo.*)		
purp. = work/educ. & $\mathrm{dist}_{n,t} \leq 25$km	0	0
purp. = work/educ. & $\mathrm{dist}_{n,t} > 25$km	$(\mathrm{dist}_{n,t} - 25) \cdot$ tariff	$(\mathrm{dist}_{n,t} - 10) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} \leq 10$km	0	$(\mathrm{dist}_{n,t} - 5) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} > 10$km	$(\mathrm{dist}_{n,t} - 10) \cdot$ tariff	$(\mathrm{dist}_{n,t} - 5) \cdot$ tariff
Regional subscription + half fare card		
purp. = work/educ. & $\mathrm{dist}_{n,t} \leq 25$km	0	0
purp. = work/educ. & $\mathrm{dist}_{n,t} > 25$km	$1/2 \cdot (\mathrm{dist}_{n,t} - 25) \cdot$ tariff	$1/2 \cdot (\mathrm{dist}_{n,t} - 10) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} \leq 10$km	0	$1/2 \cdot (\mathrm{dist}_{n,t} - 5) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} > 10$km	$1/2 \cdot (\mathrm{dist}_{n,t} - 10) \cdot$ tariff	$1/2 \cdot (\mathrm{dist}_{n,t} - 5) \cdot$ tariff
Route subscription (*Strecken-Abo.*)		
purp. = work/educ.	0	0
purp. $\neq$ work/educ.	Ticket price	Ticket price
Route subscription + half fare card		
purp. = work/educ.	0	0
purp. $\neq$ work/educ.	1/2 of ticket price	1/2 of ticket price
Regional + route subscr. (*Modul-Abo.*)		
purp. = work/educ.	0	0
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} \leq 10$km	0	$(\mathrm{dist}_{n,t} - 5) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} > 10$km	$(\mathrm{dist}_{n,t} - 10) \cdot$ tariff	$(\mathrm{dist}_{n,t} - 5) \cdot$ tariff
Regional + route + half fare card		
purp. = work/educ.	0	0
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} \leq 10$km	0	$1/2 \cdot (\mathrm{dist}_{n,t} - 5) \cdot$ tariff
purp. $\neq$ work/educ. & $\mathrm{dist}_{n,t} > 10$km	$1/2 \cdot (\mathrm{dist}_{n,t} - 10) \cdot$ tariff	$1/2 \cdot (\mathrm{dist}_{n,t} - 5) \cdot$ tariff

Purp. = trip purpose; educ. = education; tariff = SBB-tariff (see Table 4)

Table 4: PT variable costs (SBB-tariff) for different distance classes and minimum costs. The cost multiplier for 1st class is always 1.7.

Distance class (km)	**SBB-tariff CHF/km (2nd class)**
1 - 4	0.462
5 - 14	0.439
15 - 48	0.387
49 - 150	0.276
151 - 200	267
201 - 250	0.237
> 251	0.210

Price scheme	**CHF 2nd class**	**CHF 1st class**
Minimum cost (full price; 1/1)	3.0	5.2
Minimum cost (half fare; 1/2)	2.2	2.6

All cases are summarized in Table 3. The information on individual PT season ticket subscription is obtained from the MTMC personal questionnaire (variables *f41600a* - *f41600j*). In the case of a GA, the calculation of PT travel costs for individual n and RP trip t, $\text{tc}_{n,t}^{\text{PT}}$, is simple; the amount is always zero. Similarly, people without any PT subscription or just a half fare card (*Halbtax*)[6] either pay the full or half of the ticket price, respectively.

However, in the case of regional or route subscriptions, the calculation gets more tricky, because we do not know from the MTMC data, if a specific trip lies (or would lie) within a specific PT region/zone(s). Also, we do not know for which trips or trip purpose(s) a person uses the subscription. However, we know that people often use a regional subscription (which usually is a combination of different zones) for their regular work/commuting or education trips. The diameter of such regions rarely exceeds 25 km (it is often around 10 km; see e.g. the zone plans published by various PT fare networks such as ZVV in Zurich and Libero in Berne), in which case we assume that the variable PT travel costs are zero – the same logic as for the GA. Similarly, for trip purposes other than work/commuting or education and with a distance below 10 km, we assume that the travel costs are zero. In all other cases (i.e., for "irregular" trips that reach outside a PT region/zone), a PT ticket (full or half fare) has to be purchased. Specific combinations of subscriptions are also

[6] *Halbtax PLUS* is also considered, assuming an additional reduction of about 25% according to the examples on the Swiss Federal Railways (SBB) website (https://www.sbb.ch/de/billette-angebote/abos/halbtax-plus.html).

considered, which imply different assumptions for the calculation of travel costs (e.g. route subscriptions, which are primarily used for longer distance work/commuting or education trips and are only valid for a specific route). Also, we distinguish between trips that do or do not start from or end at home, implying a slightly different distance threshold for the cost calculation. We base this assumption on the fact that the regional subscription usually covers the residential location area.

The way the distance-dependent PT ticket prices are calculated in these "special" cases depend on the SBB-tariff as shown in Table 4, a cost factor that is applied to the routed distance in the PT network.[7] As soon as a ticket has to be purchased, minimum costs of 3 CHF (full price) or 2.2 CHF (half fare) apply. And finally, the 1st class ticket prices are considered if a person owns a 1st class regional or route subscription and the trip distance exceeds the defined threshold, assuming that in such a case the person would purchase a 1st class ticket. Unfortunately, we do not know, if a person without a regional/route subscription or half fare card travels (or would travel) in the 1st or 2nd class; we therefore always assume a 2nd class ticket price.

3.3 Travel cost contributions by third parties

The MTMC 2021 indicates that almost 11% of all car trips were conducted in a business or company car or "other type" of car (trip-leg dataset; variable *f51310a*). However, it is not clear to what extent people were actually paying for the resulting travel costs by themselves. In the case of using a rental car, car sharing, car pooling or even a car from the household, it is unclear how the costs of travel are – if at all – shared among all the persons in the car. Similarly, in case of business trips or other work-related travel by PT, the person usually does not pay for the trip. In both cases, we do not know a-priori (when constructing the SP-questionnaire) if a third party contributes (fully or to some extent) to the travel costs presented in the SP task.

For this reason, respondents are asked to what degree they contributed (or would contribute) to the variable travel costs of the RP reference trip by themselves and if other parties (such as the employer or other people from the household, friends, etc.) contributed as well.

As a result of these additional questions, in the later modelling stage, a value between

[7] https://www.allianceswisspass.ch/de/?section=Downloads&download=16350

0 and 1 will be pre-multiplied with the corresponding travel costs to "correct" for the actual cost contribution of the respondent.[8] By asking these questions before the actual SP questions, the respondent should also be reminded by which amount he/she usually – at least approximately – contributes to the costs of travel.

4 Procedure for the selection of RP reference trips

This section briefly discusses the procedure to select a reference trip for each respondent. As an input, we use an extract of the MTMC data, including all trips made by the respondents during one reference day. The description of each trip is given via a set of variables (departure time, origin and destination, mode, purpose, etc.). Some of these trips are excluded due to undesired characteristics (e.g. distance too small, trips abroad, modes not investigated such as plane or funicular, etc.). For the remaining trips the modal alternatives are generated using the routing tool. An algorithm is then used to choose a reference trip for each respondent based on a scoring function, assigning different weights to characteristics such as trip purpose, distance, available alternatives, etc. The choice is driven by two main considerations:

- the SP survey, that is subsequently addressed to the respondent, is based on the selected trip, that should therefore be as "interesting" as possible (distance high enough to allow for variation; at least two available alternatives; a trip purpose that is relevant for the current survey, etc.).
- the final set of all selected trips should be balanced regarding the main trip characteristics (purpose, mode and distance distributions).

5 SP experimental designs and layout

In this section, each SP experiment is presented in terms of attributes, layout and value ranges tested according to the experimental designs.

[8]Given that the SP survey also involves paper-and-pencil questionnaires (the share of these respondents in the final dataset is not yet known), the values cannot be adjusted in real time for the subsequent choice situations.

5.1 SP1 experiment: Mode choice

The same four modes as in the SP survey 2021 are taken into account: **Walk**, **Bike**, **public transport (PT)** and the **car as a driver (Car)**. As in the previous survey, not all of these modes are always presented to each respondent.

The modes presented depend on their availability to the respondents and the distance of the trip. In some cases, respondents will not be asked about their mode choice because they do not have realistically at least two modes available (see also Table 5).

SP1 (mode choice) is not presented to the respondent if:

- the respondent does not have a car and an (E-)bike available[9] and the trip distance is larger than 5 km,
- the respondent has a bike, but does not have a car and the trip distance is larger than the distance limit for the different types of bike (see below),
- no public transport is available for the respondent's reference trip, the respondent does not have a bike and the trip distance is larger than 5 km,
- the respondent has a bike, but no public transport is available for the respondent's reference trip and the trip distance is larger than the distance limit for the bike.

In the SP survey 2021, all trips without a PT alternative were excluded from the survey. In the 2025 survey, given the conditions above, we keep these trips and ask respondents about their mode choice without a public transport alternative. If the respondent has no other mode available (walk or bike) compared to car, we do not include SP1, but we still ask questions on the route choice by car (SP2), such that these respondents are no longer excluded from the SP survey.

Another difference compared to the 2021 survey is that we present the bike alternative only if the respondent has indicated that he/she has a bike available and if the trip distance is below the distance limit for the bike. The distance limit depends on the type of bike:

- 15 km for regular bike (average speed = 12.8 km/h);
- 17 km for slow E-bike (average speed = 14.6 km/h);
- 25 km for fast E-bike (average speed = 20.9 km/h).

[9] If not mentioned explicitly, bike refers to all different bicycle/bike types (i.e., regular bike, slow E-bike up to 25 km/h and fast E-bike up to 45 km/h).

Furthermore, we are not limiting SP1 to three modes. For short trips, we present all four modes if they are available.

5.1.1 Attributes

The attributes covered in the SP1 experiment are listed below.

- Walk: Walking time
- Bike:
  - Cycling time
  - Access/egress time (walking)
- Car:
  - Travel time
  - Access/egress time (walking)
  - Time to search for a parking space
  - Variable travel cost (incl. fuel, electricity, wear-and-tear)
  - Peak charge
  - Parking cost
- PT:
  - In-vehicle time
  - Access/egress time (walking)
  - Total transfer time (incl. waiting time)
  - Variable travel cost (ticket price)
  - Peak charge
  - Number of transfers
  - Headway (service interval)
  - Level of crowding

Travel-related costs (fuel/electricity, wear-and-tear in case of car; ticket price in case of PT), parking costs in case of car and the peak charge are presented separately in the choice sets. This will allow us to assign them separate parameters in the modelling phase, and therefore estimate the corresponding effects separately in order to determine whether these three coefficients are significantly different. In the long term, the three coefficients should converge towards a common value, but we would expect the cost sensitivity to be higher for a "new" and/or "avoidable" cost (such as the peak charge and parking costs), which might be less accepted (e.g. Small and Rosen, 1981).

For walk and bike, travel times do not vary according to the SP1 experimental designs. However, the cycling time depends on the respondent's type of bike (regular bike, slow E-bike up to 25 km/h and fast E-bike up to 45 km/h). Separate modelling of the three bike types is possible (if the sample is sufficently large), since the MTMC 2025 provides information on whether or not the respondent has access to each bike type.

Changes in the attributes compared to the SP survey 2021

The first major change compared to 2021 is the removal of the "risk" and "duration" of the delay by car and PT. In the previous study, these variables often were misunderstood. They should have addressed the additional variation (uncertainty) in travel times, but that is not the way they were presented. In the 2021 survey, these variables are expressed in terms of default delays, although these are already included in the travel times. Another argument for removing these attributes is that they are not used in the National Passenger Transport Model (NPTM). Moreover, the literature review also led us to conclude that in order to introduce these attributes into an SP experiment, it was necessary to use a very sophisticated way of presenting them (including a graph of the travel time distribution). To summarize, the proper use of these attributes based on the previous SP surveys is very limited and the estimation of related effects not robust. It was therefor, also in sake of simplicity, decided to remove these variables.

The second major change is the inclusion of the attribute "access/egress time" for the bike and car alternatives. The access/egress time is set to one minute for bike (fixed) and varies between 1, 3 or 5 minutes (according to the factorial design) for car. This change was made after the internal pre-test following feedback from the accompanying group and other respondents that tested the survey. The goal is to make both modes more realistic and also more consistent with the PT alternative.

The third major difference is that the total cost and time (sum over all cost and time components) of the trip are no longer presented in the SP questions (see also Section 5.1.2). This makes the design neater. In addition, in the internal pre-test, many respondents indicated that they were only looking at the total cost and time and did not look at the individual attributes. This was also observed in the first model results using the internal pre-test data, only showing marginal differences between the different time and cost coefficients.

In the 2021 survey, the bike alternative was available also for respondents without having a bike available, and two travel times were presented: the travel time with a regular bike and with an E-bike. In 2025, bike alternatives were only presented to persons who have a bike available and only one travel time is shown. The attribute is calculated according to the type of bike available to the respondent.

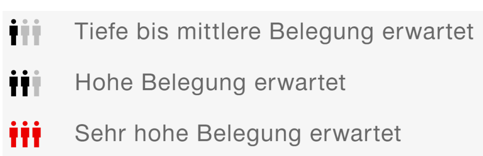
By reducing the number of attributes and simplifying the layout, it was no longer necessary to separate the attributes into two groups as in the 2021 survey. In the mode choice task of the SP survey 2025, all SP1 attributes are shown to all respondents (given that they have the specific mode available).

5.1.2 Improved layout

The formatting and layout of the questionnaire have been improved. Instead of having one box for each mode as in the 2021 survey, we now have one table with the attribute names in the first column and the values for these attributes in the columns one of each mode, with an empty cell when the attribute does not concern the corresponding mode. Moreover, as explained in the previous section, the total cost and the total time are no longer presented.

Another improvement is the visualisation of the level of crowding attribute. The words used in the previous survey have now been replaced by the figures used by the Swiss Federal Railways (SBB), as shown in Fig. 2. It ranges between a low/medium, high and very high level of crowding. To compare the 2025 with the 2021 data (which exhibit the four levels low, medium, high and overloaded), we recommend to combine the first two levels in the 2021 data (low and medium).

Figure 2: Level of crowding according to the Swiss Federal Railways (SBB).



The new SP1 layout in the 2025 survey is shown in Fig. 3.

Figure 3: Example of SP1 choice situation in the 2025 survey.

	E-Bike (bis 25 km/h)	Auto	öV
Reisedauer			
Fahrtzeit:	33 min	16 min	26 min
+ Zu- und Abgangszeit:	1 min	5 min	11 min
+ Parkplatzsuchzeit:	-	2 min	-
+ gesamte Umsteigezeit:	-	-	-
Reisekosten			
Fahrtkosten:	-	3.10 CHF	7.50 CHF
+ Zuschlag zu Stosszeiten:	-	1.10 CHF	1.60 CHF
+ Parkplatzkosten:	-	2.00 CHF	-
Umsteigevorgänge	-	-	0
Takt: Verbindung alle ...	-	-	90 min
Auslastung	-	-	

If the trip is not subject to congestion (e.g., the start and destination of the trip are in rural areas, or the trip is made outside peak time), the "peak charge" attribute is not displayed.

The order of the alternatives is randomised between respondents, but identical for the six choice situations of the same respondent.

5.2 SP2 experiment: Car route choice

5.2.1 Attributes

The SP2 experiment is not presented to a respondent if:

- the respondent does not have a car available;
- the respondent's reference mode is public transport;
- the respondent's reference mode is walk or bike and the trip distance is less than 2 km.

If the respondent's reference mode is walk or bike, the respondent has a car and public transport is available for the reference trip, there will be a random choice between SP2 and SP3.

For this experiment SP2, respondents are presented with two alternative routes. For each alternative, the attributes presented correspond to the following subset of the attributes used in the mode choice experiment:

- travel time
- travel cost (incl. fuel/electricity, wear-and-tear)
- peak charge

In this experiment, access/egress time, time to search for a parking space and parking costs do not vary between alternatives and between the questions, but are mentioned in a sentence above the attribute table: "Please assume that the time to find a parking space, the parking costs and the access/egress time to/from the parked car are identical for both routes." The time to find a parking space varies according to whether the respondent's reference trip is to return home or not, according to the zone of the destination and to the availability of a parking space at the destination. This attribute will not vary in the SP2 experiments. The parking cost is set to 2 CHF, except for trips to return home, in which case the cost is set to 0 CHF.

5.2.2 Improved layout

The layout of these questions (seeFig. 4) has also been improved in the same way as in SP1. In addition, the mode name is now included in the column title. As in SP1, the totals for cost and time are no longer presented.

Figure 4: Example of SP2 choice situation in the 2025 survey.

	Auto-Route 1	Auto-Route 2
Reisedauer		
Fahrtzeit:	32 min	16 min
Reisekosten		
Fahrtkosten:	3.70 CHF	3.10 CHF
+ Zuschlag zu Stosszeiten:	0.70 CHF	3.00 CHF
	○	○

5.3 SP3 experiment: Public transport (PT) route choice

5.3.1 Attributes

SP3 is automatically presented to all respondents who do not have a car available. If a respondent's reference mode is walk or bike, SP3 is presented only if the trip distance is larger than 2 km.

In SP3, the respondent has the choice between two public transport routes. The attributes presented in these two alternatives are the same as in SP1 for the PT alternative:

- in-vehicle time
- total transfer time (incl. waiting time)

- access and egress time (walking)
- variable travel cost (ticket price)
- peak charge
- number of transfers
- headway
- level of crowding

In contrast to the 2021 survey, the public transport main mode (bus, metro, tram, train, etc.) is not explicitly specified as an SP attribute anymore. This simplification reduces the number of attributes, making the questionnaire easier for the respondents. Moreover, since this information is not used in the national transport model, its omission does not affect the use of the results. However, the lack of specified interactions in the design means that the available data cannot be used to estimate respondents' preferences for different types of public transport. Nevertheless, it is still possible to estimate different sensitivities, assuming that the main mode corresponds to the current (RP) PT main mode.

5.3.2 Improved layout

The SP3 layout (see Fig. 5) has been improved similarly to SP1 and SP2.

Figure 5: Example of SP3 choice situation in the 2025 survey.

	öV-Route 1	**öV-Route 2**
Reisedauer		
Fahrtzeit:	62 min	32 min
+ Zu- und Abgangszeit:	20 min	10 min
+ gesamte Umsteigezeit:	-	23 min
Reisekosten		
Fahrtkosten:	Abgedeckt durch Abo	Abgedeckt durch Abo
+ Zuschlag zu Stosszeiten:	9.60 CHF	7.20 CHF
Umsteigevorgänge	0	3
Takt: Verbindung alle ...	20 min	15 min
Auslastung		
	○	○

The differences between the the 2025 and 2021 survey have already been highlighted in Section 5.1. To create the factorial designs, 16 SP3 design subgroups were created, based on the distance class, travel period (peak/off-peak) and PT travel costs.

5.4 SP4 experiment: Departure time choice

SP4 is a departure time choice experiment for car and public transport (PT) users who travelled during peak hours. The respondents receive six choice tasks, each with five alternatives of different departure and arrival times. The objective of the design is to generate a set of alternatives where there is no clear dominance. Fig. 6 shows an example of a choice task for a car user with a RP reference trip of 30 minutes departing at 8:30 AM.

Figure 6: Example of SP4 choice situations in the 2025 survey. Top: Car user; bottom: PT user.

	Vor Stosszeiten		Während Stosszeiten		Nach Stosszeiten
Uhrzeit der Abreise:	15:42	16:45	17:00	17:15	18:00
Gesamtdauer:	18 min	18 min	19 min	18 min	18 min
Uhrzeit der Ankunft:	16.00	17.03	17.19	17.33	18.18
Gesamtkosten (inkl. Zuschlag zu Stosszeiten):	6.60 CHF	7.80 CHF	7.80 CHF	7.80 CHF	6.60 CHF

	Vor Stosszeiten		Während Stosszeiten		Nach Stosszeiten
Uhrzeit der Abreise:	15:32	16:23	16:28	16:33	18:00
Gesamtdauer:	28 min	28 min	28 min	28 min	28 min
Uhrzeit der Ankunft:	16.00	16.51	16.56	17.01	18.28
Gesamtkosten (inkl. Zuschlag zu Stosszeiten):	4.30 CHF	5.10 CHF	5.10 CHF	5.10 CHF	4.30 CHF
Auslastung:					

None of the five alternatives is dominant; this is ensured based on the following logic by alternative:

- current departure time, but later arrival than the current trip. A peak charge has to be payed.
- earlier than current departure, with a lower travel time and hence arriving before the current alternative. A peak charge has to be payed.
- later than the current alternative, with smallest travel time overlap with the peak period, later arrival than the current alternative. A peak charge has to be payed.
- arrival before the peak period starts, without peak charge.
- departure after the peak period ends, without peak charge.

In contrast to the designs of SP1, SP2 and SP3, the realism of the experiment lies not only in the characteristics of the alternatives themselves, but also on how they relate to each other. That is, all the alternatives are naturally related to each other because they are related to the same trip which shifts in departure time, which is important for the realism of the experiment.

5.4.1 Attributes and general characteristics

Each respondent sees the following attributes: departure time, total travel time, arrival time and travel cost. For car and PT users, the total travel cost is shown, which includes the actual travel costs and peak charge. For public transport (PT) users, additional information on the level of crowding is provided.

The SP4 experiments are characterised by several key features. There are eight design segments and eight corresponding design blocks. Each block contains six choice tasks and each choice set contains five alternatives. Car users see four attributes, while PT users see five attributes (see Fig. 6).

The SP4 questions are based on information from a reference trip. Specifically, the travel mode, travel time, travel cost, departure time and arrival time according to the RP reference trip are used to tailor the choice tasks to each respondent's situation.

5.4.2 Differences compared to the 2021 design

In the 2021 survey there were two alternatives for the current mode and one from the other (for example, a car user would have two departure times for the car and an alternative to switch to PT). Since the new mode alternative was not chosen often, it was decided to focus on the current mode, which reduces the complexity of the design.

6 Combination of SP experiments and types of questionnaires

38 different types of questionnaires were created in the SP survey 2021. As described in ARE (2022), it was decided which type of questionnaire was assigned to which type of respondent according to i) the current mode used for the reference trip, ii) the distance of the reference trip (short or long), iii) the ownership/availability of a car and iv) the (randomly) assigned attribute set (set 1 or set 2) in SP1 and SP3.

When we break down all possible cases, taking into account car availability, distance class, current mode and the verification of SP4 conditions, we end up with 38 different questionnaire types. In the 2021 survey, each respondent was asked a maximum of 18 SP questions.

Table 5 shows the different types of questionnaires in the current SP survey. There are 41 different types of questionnaires. Questionnaire types are assigned to respondents according to i) the current mode used for the reference trip, ii) availability of a car, iii) availability of a public transport alternative and iv) the distance class.

In the SP survey 2025, the logic behind the construction of the questionnaire can be summarised as follows:

- depending on the distance class of the reference trip and the modes available, the modes included in SP1 (Walk, Bike, PT, Car) are different; this leads to ten variants of SP1
- as a general rule, SP3 is presented to respondents whose RP main mode is PT, and SP2 to respondents whose RP main mode is car. If the respondent's main mode is walk or bike, they will receive SP3 if they do not have a car, but there is a PT alternative available. They will receive SP2 if they have a car, but no PT alternative available. If you have a car and a PT alternative available, the choice between assigning SP2 or SP3 is made at random. The presentation of the SP2 or SP3 experiment for respondents whose main mode was walk or bike is conditional on reporting a reference trip larger than 2 km.
- if the trip is made by car or PT, on a working day during the morning (7 AM - 9 AM) or evening (4 PM - 6 PM) peak periods, the SP4 experiment is included in the questionnaire.

Table 5: SP survey 2025: Different types of questionnaires.

Car available	PT available	Distance	Current mode	(E-)Bike avail.	SP4 condition	Modes in SP1	Route choice	SP4 shown	Quest. type
No	Yes	short (< 5km)	Walk or Bike	Yes	Yes/No	Walk/Bike/PT	SP3**	No	1
No	Yes	short (< 5km)	Walk or Bike	No	Yes/No	Walk/PT	SP3**	No	2
No	Yes	medium (5-BL)	Walk or Bike	Yes	Yes/No	Bike/PT	SP3**	No	2
No	Yes	medium (5-BL)	Walk or Bike	No	Yes/No	-	SP3**	No	Excluded
No	Yes	short (< 5km)	PT	Yes	No	Walk/Bike/PT	SP3	No	3
No	Yes	short (< 5km)	PT	No	No	Walk/PT	SP3	No	3
No	Yes	short (< 5km)	PT	Yes	Yes	Walk/Bike/PT	SP3	Yes	4
No	Yes	short (< 5km)	PT	No	Yes	Walk/PT	SP3	Yes	4
No	Yes	medium (5-BL)	PT	Yes	No	Bike/PT	SP3	No	5
No	Yes	medium (5-BL)	PT	No	No	–	SP3	No	5
No	Yes	medium (5-BL)	PT	Yes	Yes	Bike/PT	SP3	Yes	6
No	Yes	medium (5-BL)	PT	No	Yes	–	SP3	Yes	6
No	Yes	long (> BL)	PT	Yes	No	–	SP3	No	7
No	Yes	long (> BL)	PT	No	No	–	SP3	No	7
No	Yes	long (> BL)	PT	Yes	Yes	–	SP3	Yes	8
No	Yes	long (> BL)	PT	No	Yes	–	SP3	Yes	8
Yes	Yes	short (< 5km)	Walk or Bike	No	Yes/No	Walk/Car/PT	SP2 or SP3**	No	9
Yes	Yes	short (< 5km)	Walk or Bike	Yes	Yes/No	Walk/Bike/Car/PT	SP2 or SP3**	No	10
Yes	Yes	medium (5-BL)	Walk or Bike	No	Yes/No	Car/PT	SP2 or SP3	No	Excluded
Yes	Yes	medium (5-BL)	Walk or Bike	Yes	Yes/No	Bike/Car/PT	SP2 or SP3	No	12
Yes	Yes	short (< 5km)	PT	No	No	Walk/Car/PT	SP3	No	13
Yes	Yes	short (< 5km)	PT	Yes	No	Walk/Bike/Car/PT	SP3	No	14
Yes	Yes	short (< 5km)	PT	No	Yes	Walk/Car/PT	SP3	Yes	15
Yes	Yes	short (< 5km)	PT	Yes	Yes	Walk/Bike/Car/PT	SP3	Yes	16
Yes	Yes	medium (5-BL)	PT	No	No	Car/PT	SP3	No	17
Yes	Yes	medium (5-BL)	PT	Yes	No	Bike/Car/PT	SP3	No	18
Yes	Yes	medium (5-BL)	PT	No	Yes	Car/PT	SP3	Yes	19
Yes	Yes	medium (5-BL)	PT	Yes	Yes	Bike/Car/PT	SP3	Yes	20
Yes	Yes	short (< 5km)	Car	No	No	Walk/Car/PT	SP2	No	21
Yes	Yes	short (< 5km)	Car	Yes	No	Walk/Bike/Car/PT	SP2	No	22
Yes	Yes	short (< 5km)	Car	No	Yes	Walk/Car/PT	SP2	Yes	23
Yes	Yes	short (< 5km)	Car	Yes	Yes	Walk/Bike/Car/PT	SP2	Yes	24
Yes	Yes	medium (5-BL)	Car	No	No	Car/PT	SP2	No	25
Yes	Yes	medium (5-BL)	Car	Yes	No	Bike/Car/PT	SP2	No	26
Yes	Yes	medium (5-BL)	Car	No	Yes	Car/PT	SP2	Yes	27
Yes	Yes	medium (5-BL)	Car	Yes	Yes	Bike/Car/PT	SP2	Yes	28
Yes	Yes	long (> BL)	PT	Yes	No	Car/PT	SP3	No	29
Yes	Yes	long (> BL)	PT	No	No	Car/PT	SP3	No	29
Yes	Yes	long (> BL)	PT	Yes	Yes	Car/PT	SP3	Yes	30
Yes	Yes	long (> BL)	PT	No	Yes	Car/PT	SP3	Yes	30
Yes	Yes	long (> BL)	Car	Yes	No	Car/PT	SP2	No	31
Yes	Yes	long (> BL)	Car	No	No	Car/PT	SP2	No	31
Yes	Yes	long (> BL)	Car	Yes	Yes	Car/PT	SP2	Yes	32
Yes	Yes	long (> BL)	Car	No	Yes	Car/PT	SP2	Yes	32
Yes	No	short (< 5km)	Walk or bike	Yes	Yes/No	Walk/Bike/Car	SP2**	No	33
Yes	No	medium (5-BL)	Walk or Bike	Yes	Yes/No	Bike/Car	SP2	No	34
Yes	No	short (< 5km)	Walk or Bike	No	Yes/No	Walk/Car	SP2**	No	35
Yes	No	medium (5-BL)	Walk or Bike	No	Yes/No	–	SP2	No	Excluded
Yes	No	long (> BL)	Walk or Bike	Yes	Yes/No	–	SP2	No	Excluded
Yes	No	long (> BL)	Walk or Bike	No	Yes/No	–	SP2	No	Excluded
Yes	No	short (< 5km)	Car	Yes	No	Walk/Bike/Car	SP2	No	36
Yes	No	short (< 5km)	Car	No	No	Walk/Car	SP2	No	36
Yes	No	medium (5-BL)	Car	Yes	No	Bike/Car	SP2	No	37
Yes	No	medium (5-BL)	Car	No	No	–	SP2	No	37
Yes	No	long (> BL)	Car	Yes	No	–	SP2	No	38
Yes	No	long (> BL)	Car	No	No	–	SP2	No	38
Yes	No	short (< 5km)	Car	Yes	Yes	Walk/Bike/Car	SP2	Yes	39
Yes	No	short (< 5km)	Car	No	Yes	Walk/Car	SP2	Yes	39
Yes	No	medium (5-BL)	Car	Yes	Yes	Bike/Car	SP2	Yes	40
Yes	No	medium (5-BL)	Car	No	Yes	–	SP2	Yes	40
Yes	No	long (> BL)	Car	Yes	Yes	–	SP2	Yes	41
Yes	No	long (> BL)	Car	No	Yes	–	SP2	Yes	41
No	No	All	All	Yes/No	Yes/No	–	–	–	–

BL: Distance limit for the bike/E-bike (depending on the type of bike).
**: Distance min. 2 km

7 Factorial designs

Similar to the 2021 study, the factorial designs for the SP experiments are constructed using the software *Ngene*. Yet, the 2025 survey introduces multiple improvements in the experimental design compared to the 2021 study. First, the design variation will be increased with the addition of a 60+km distance class. Secondly, the variation of the choice tasks has increased from 2 blocks to 8 blocks (without increasing the response burden, as one block is randomly assigned to a respondent), each comprising six choice tasks. For all 28 SP1 designs, 8 SP2 designs and 16 SP3 designs, a set of 48 choice tasks is constructed. And as the design pivots around a respondent's current travel time and cost, this setup guarantees unique and tailored experiments for each respondent. Another improvement is the addition of a 5th attribute level for the travel time and cost attributes. This is a 0% change level so that it renders the reference trip time/cost of the respondent. This addition of a 5th attribute allows for more variation in choice tasks and adds to the realism of the experiment.

Like the 2021 study, the factorial designs are constructed using a D-efficient approach. D-efficient designs aim to optimise information that can be obtained from the experiment by setting the expected values of the model parameters: *the priors*. The data and model estimates from the 2021 study are the foundation for the priors in the current study. The new priors have been retrieved by re-estimating the choice models in the preference space and by retrieving the average values of all attributes for each distance class/design segment separately. Therefore, for each design segment unique priors have been estimated and set to optimise each individual design.

8 New qualitative questions related to RP mode choice

An important, but relatively easy-to-implement innovation compared to previous SP surveys is to ask an additional qualitative question about the reasons for choosing a mode of transport. Numerous studies, including those for Switzerland, have shown that such factors may be as important as the actual level-of-service (LOS) attributes (e.g. FehrAdvice, 2013).

The question relates primarily to the reference trip and is asked once after the SP1 question.

In addition to the measurable LOS attributes such as travel time and cost, factors that cannot be measured directly such as habits, time flexibility and context variables (e.g. weather, luggage, etc.) are also taken into account. The question relates to the variables *f52100a* to *f52300b* in the MTMC, which also asks for the main reason of using a specific mode. Unfortunately, however, this information is only available for a subsample of the MTMC (roughly 30%), which is why it is asked again for each SP-respondent:

What were the **decision criteria** for you when you chose [**insert RP transport mode**] for this trip? Please add to each statement how important it was for your choice of the transport mode, using a scale from 1 (not at all important) to 5 (very important).

- travel cost
- travel time
- easiest / most convenient choice
- no other option / lack of alternatives
- flexibility / freedom
- luggage transport / bulky items
- weather
- pleasure of travel / travel comfort
- health
- environmental impact
- combination of multiple activities / chain trips (e.g., working, shopping, picking up the children)

The later analysis of the SP survey will examine how important these factors are relative to the directly measurable LOS attributes such as travel time and cost, and whether/to what extent in certain cases (e.g., respondents who state "habit" as very important), the measurable attributes are less/more important in the utility function.

9 Conclusions

Several improvements have been introduced in the SP survey 2025 compared to the 2021 edition, in order to better meet the survey objectives and improve data quality. One major change is the removal of the risk and duration of delay attributes for the car and public transport alternatives. In the previous study, these variables were often misunderstood by respondents and failed to correctly represent the intended additional variability in travel times. Moreover, these attributes are not used in the National Passenger Transport Model (NPTM), and the literature suggests that their correct use in SP experiments would require a far more sophisticated presentation. Consequently, the estimation of related effects was found to be weak and unreliable based on previous SP surveys, leading to the decision to remove these variables.

Another change is the inclusion of the "access/egress time" attribute for bike and car alternatives. For bikes, this value is fixed at one minute, while for cars it varies between one, three, or five minutes according to the experimental design. This adjustment was implemented after internal pre-testing and feedback from the accompanying group, improving the realism and consistency of these alternatives with the public transport alternative.

Additionally, the totals for travel cost and travel time have been removed from information displayed. This change was motivated by the redesign of the questionnaire layout and by findings from the internal pre-test, where many respondents indicated that they focused only on the total cost and time, largely ignoring the breakdown into individual attributes. This behaviour was also reflected in the early model results, where differences between the estimated time and cost coefficients were minimal.

The bike alternative has also been simplified: only one travel time is now presented, based on the type of bike available to the respondent. Unlike in the 2021 survey, where both regular and e-bike times were shown even to respondents without a bike, the new approach ensures greater consistency.

By reducing the number of attributes and simplifying the layout, it is no longer necessary to split the attributes into two separate groups, as it was done previously. In the 2025 SP survey, all attributes are shown to all respondents, provided the respective transport mode is available to them. This increases the clarity of the choice tasks, improves data reliability and ultimately leads to more robust model estimations.

Another important improvement to the SP survey 2025 is the use of more accurate, personalized travel costs. Beyond creating more realistic cost attributes, the main motivation is to increase the variation in travel costs and to reduce correlations with other variables, particularly travel time – a common problem in RP data. In the case of car trips, additional information from the MTMC vehicle questionnaire is used, enabling the assignment of cost factors based on the specific car type used for each trip. In the case of

PT trips, the ownership of season tickets is consequently taken into account. Both for car and PT trips the best available and up to date data been used. The more differentiated approach adopted for 2025 is expected to improve the behavioural realism and statistical efficiency of the data.

Another conceptual change is the focus on respondents' current travel mode in the departure choice experiment. In the 2021 survey, respondents were offered two alternatives for their current mode and one alternative to switch to a different mode (e.g., a car user would choose between two different departure times for car use and an option to switch to public transport). Since the "other" mode alternative was rarely chosen, it was decided to concentrate solely on the current mode.

Overall, the SP survey 2025 reflects a series of targeted refinements aimed at enhancing data quality, realism and respondent understanding. By removing poorly performing attributes, simplifying the attribute structure, using more precise travel cost information, improving the design of the choice experiments and incorporating more realistic access/egress times, the new survey design is better aligned with the modelling needs and the theoretical requirements for robust behavioural data collection.

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