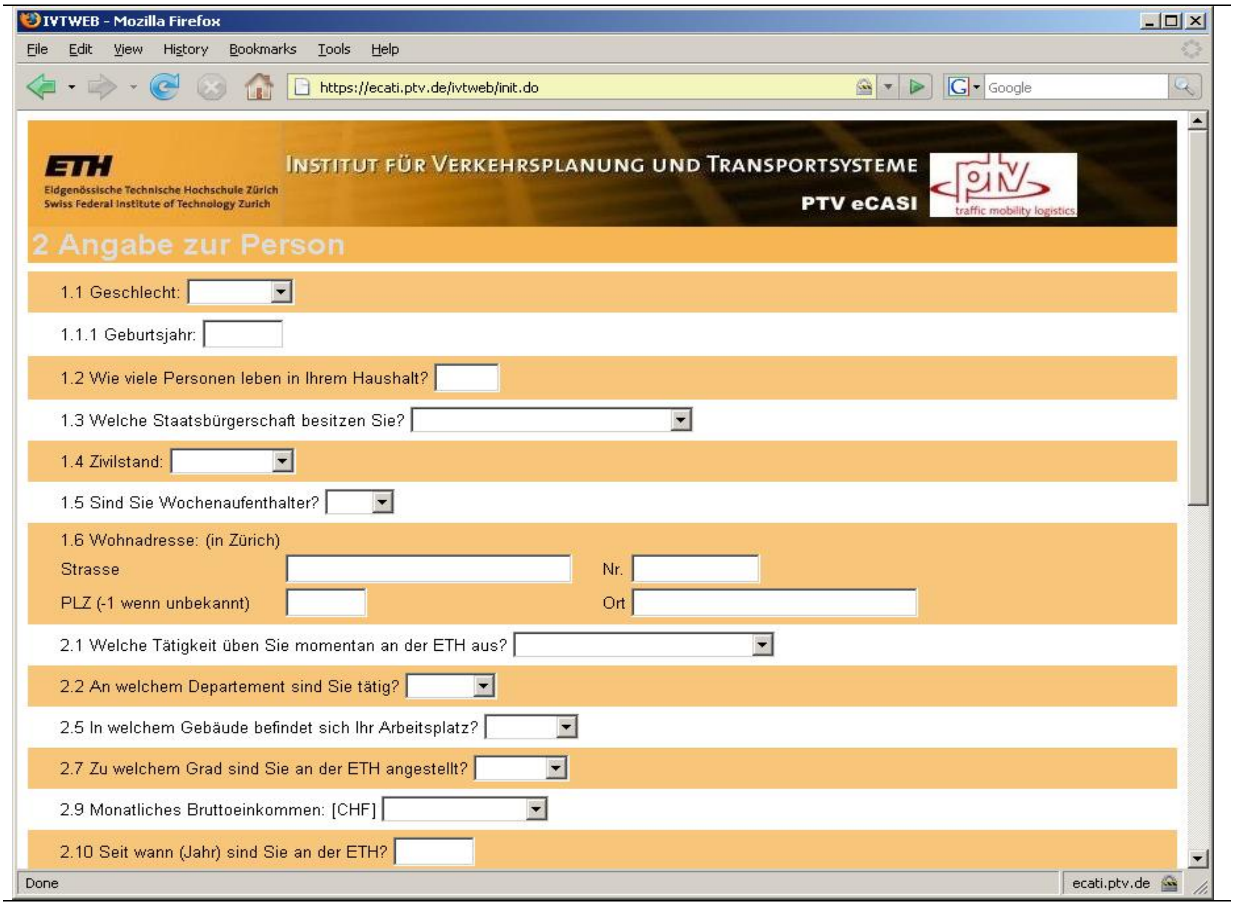

An online travel diary survey among members of ETH Zurich

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Abstract

Within the demand analysis work package of the project "Mobility plan for Zurich's university campus", an online survey on the travel behaviour of ETH's students and employees was carried out. The web based survey spanned over 4 months. Invitations were emailed to all ETH students and employees, i.e. about 18'000 people. Apart from a personal questionnaire covering socio-economic data, the respondents' travel was recorded on two levels. The first part was a week review, covering the 6 days prior to a randomly assigned cutoff date. Here, only trips to and in-between the different ETH sites were recorded. The last part was a detailed diary for the cutoff date. There were three different versions of the diary – stage, trip and activity based. These variants of the questionnaire were randomly assigned to equal parts of the sample. The paper will discuss the response bevhaviour of the interviewees – general response rates; item nonresponse in the socioeconomics questionnaire; premature dropouts of the interview due to a too high response burden, misunderstanding of the questionnaire and/or design issues, and the resulting problems with incomplete diaries. A comparison of the different versions of the questionnaire as well as the impact of technical improvements on data quality will be discussed. Some of the insights gained from the purged and weighted datasets, especially explorative statistics and analyses of trip attraction and mode choice behaviour of the different population groups present in the sample will also be presented.

Keywords

online travel diary survey – data quality – response behaviour – traffic generation – mode choice

1. Introduction

ETH, the University of Zurich and the University Hospital are planning to expand their premises in the city centre of Zurich with new buildings covering a total gross floor area of roughly 150’000 m^2. As of today, 54’000 people work or study in this area. The planned future use of the new buildings will generate an estimated 10’000 additional users.

The City of Zurich demanded the 3 major institutions to carry out a Mobility Plan in order to assert the compatibility of the new facilities with the the adjacent transportation system’s capacities, and to assess possible measures to cope with the additional demand. The Institute for Transport Planning and Systems (IVT) was contracted to conduct the study jointly for all 3 institutions.

The paper describes some of the analyses performed for the working package “demand analysis”. It focuses on an online survey, in which students and employees of ETH Zurich were asked to describe their mobility behaviour by means of travel diaries.

Section 2 shortly presents the survey structure and the different variants of the diary form.

Section 3 deals with the general response rates and the various technical issues that led to problems with data quality. It also describes the various improvements carried out to address those issues, and the methods used to weight the sample.

Sections 4 through 7 provide an overview of the data analyses: spatial properties, explorative statistics of mobility tool ownership rates, transport demand generated by the current usages of the considered area, and mode choice analyses.

The last section summarizes the paper and features an outlook to the upcoming work in the project.

2. Survey structure

The travel diary survey among members of ETH was conducted as follows. Each interviewee was randomly assigned a cutoff date during a period of 4 months starting mid-November 2006. 3 days in advance, they were emailed an invitation letter, informing them that, come their cutoff date, they would be sent a URL under which they would be able to access their questionnaire. The questionnaires were programmed by and hosted on the servers of PTV AG, Karlsruhe.

The questionnaire consisted of several parts:

- An initial question, inquiring if the respondent had undertaken any trips in or to Zurich on their cutoff date;
- a personal questionnaire, covering sociodemographic data, with special attention to mobility tool ownership;
- a weekreview, in which respondents were asked to give a quick overview about their trips to ETH for the 6 days prior to their cutoff date;
- a travel diary for the cutoff date itself, which was only assigned to those who had answered the initial question affirmatively. Each respondent was randomly assigned one of three different available versions of the questionnaire: stage, trip, or activity based.

In the trip based diary, the respondents were asked to provide information on their door-to-door trips on the given day, with multiple choice options for the transport modes of a single trip.

The stage based diary went into more detail, dividing each trip into stages, each with a single transport mode option; e.g., access by bicycle, travel by bus and egress by feet ought to be recorded as separate stages.

The activities carried out at the different locations the respondent visited during the day were inquired about as trip purposes at the end of each trip in the stage and trip based questionnaires, whereas they were the central focus in the activity based diary. Respondents were asked whether their activities were activities at home, at ETH, at some other location, or whether the activity was a trip. This formulation unfortunately led to some confusion, as will be pointed out in section 3.

3. Response behaviour

3.1 General response rates

The general response rate for the ETH sample (i.e., the portion of the population which have answered the initial question) is at a rather moderate 22%.

There are different reasons for this relatively low participation level. First, there may be a general weariness of filling in online surveys among the targeted population. The database containing the email addresses is available to all ETH students and employees, and the system is therefore intensively used for sending out requests of the sort.

Also, the addresses that were available at the time the mailing lists were generated dated from September 2006. A certain portion of those receiving the invitation may not have been at ETH anymore at the time they received it, thus simply ignoring it, not feeling concerned with the issue of the study and not being able to answer the specific questions related to their work at the institution. On the other hand, first term students that matriculated after the time the lists were retrieved did not receive the invitation, so that part of them is missing from the sample.

Predominant among the various issues were technical problems in filling in the questionnaire. Namely, users whose browsers had an active pop-up blocker had to switch it off before being able to access the questionnaire. This may have led a good part of the users to resign to participate, for security concerns or simply because they were frustrated with the barriers with which they were confronted and/or technically unapt to change their security settings. The log files confirmed that about 35% of the invited people attempted to log in, and that a large portion of them were unable to continue from the start page.

Table 1 displays the response rates for the different parts of the survey.

Table 1

Questionnaire	assigned to	filled in by	response rate
initialization	16’289	3’656	22%
personal	3’656	3’079	84%
week review	3’079	2’936	95%
diary	2’745	2’003	73%

The initialization question was assigned to all 16’289 interviewees, i.e. all those in the address list that were found to have a valid email address. The issues described above led to a poor response rate of only 22%.

The remaining 3’656 users were then asked to fill the personal questionnaire. 16% dropped out at this stage, indicating that the questions might have been to intimate to them, e.g. they didn’t want to specify their home addresses or their monthly income.

Of the 3’079 users that finished the personal questionnaire, 95% also filled in the week review. The relatively low drop-out rate indicates that this part of the questionnaire has been well accepted and that the respondents were willing to provide informtaion about their trips to and from work.

After the elimination of those who had negated the initial question, 2’745 users remained and were assigned the different versions of the travel diary. Here again, we observed a high drop-out rate. Possibly the response burden for filling in the detailed diary was percieved as unnecessarily high after the completion of the week review, and some of the respondents saw the inquired information as redundant.

3.2 Comparison of the different diary variants

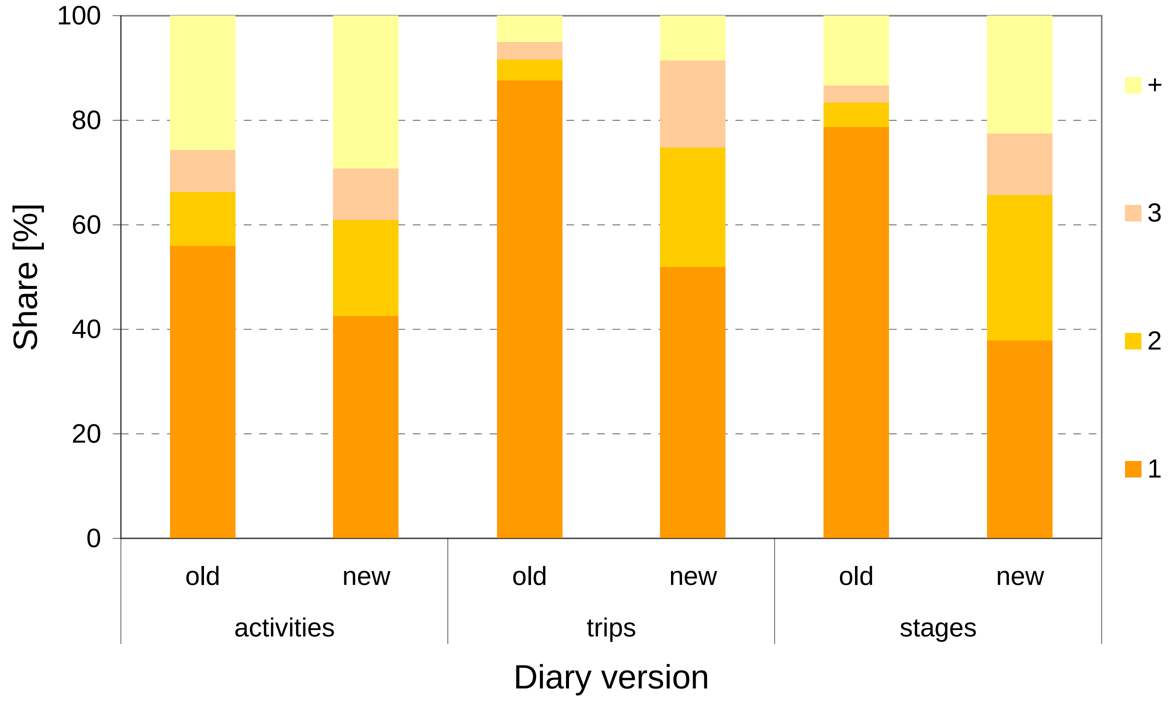
In the diary data there was the intriquingly high portion of datasets with only one stage, trip or activity.

The resulting unplausibly low average number of trips per day was mainly due to design and user guidance issues in the questionnaire. The labelling of the bottom-page buttons was misleading, not making it all clear to the respondent how to enter an additional stage/trip/activity and how to proceed to the end of the survey. This led a good portion of the respondents to inadvertently ending the survey before having entered all the information they might have intended to.

This issue was quickly diagnosed, and a remedy contrived: At the end of each stage/trip/activity, the respondent ought to be explicitly asked if they conducted any further movement during their cutoff date, and, according to their answer, and clicking on the same button, be automatically forwarded to the next data entry page, or to the end of the interview. However, the technical implementation of this improvement took longer than forseen. About 75% of the respondents were confronted with the old version of the questionnaire, leading to an accordingly high rate of incomplete datasets.

Figure 1 below shows the comparison of the different travel diary versions in terms of number of stages/trips/activities entered.

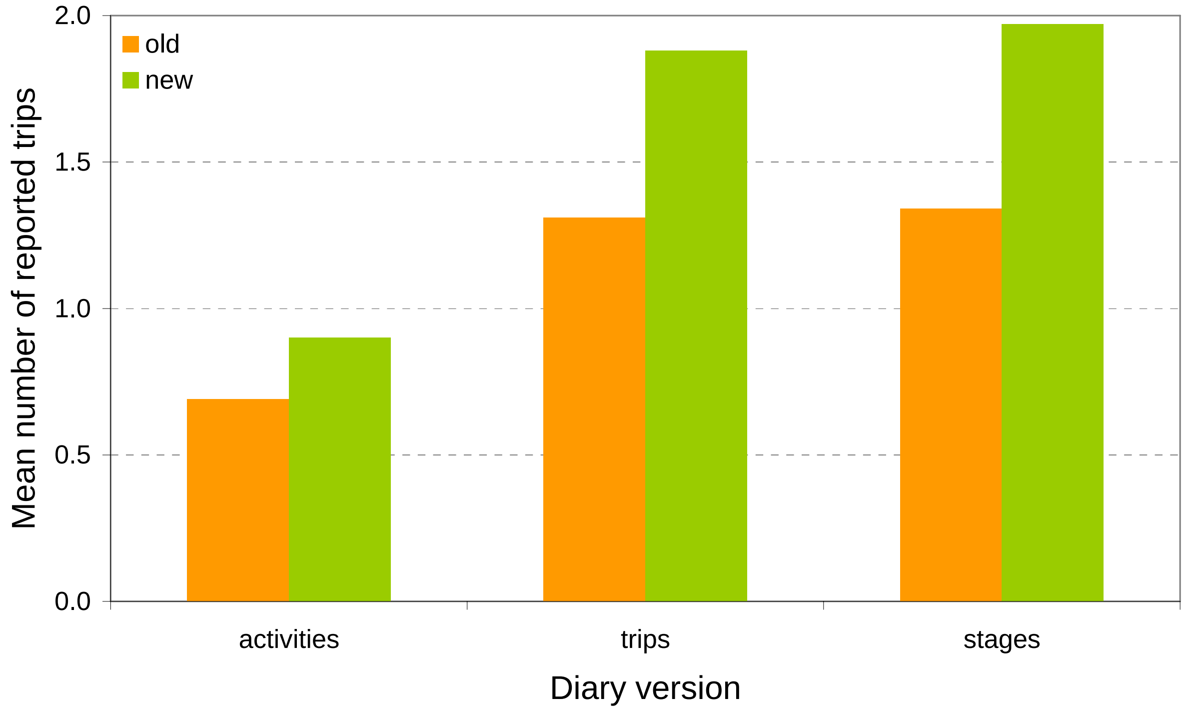
Figure 1 Distribution of number of reported activities/trips/stages by diary version



Even with the new diary versions, there was still a relatively high rate of respondents who reported only one stage/trip/activity. This again suggests that the response burden of filling in the detailed diary form might have been a little too high.

Figure 2 displays the average number of trips reported by diary version. As can be seen, another problem arises with the activity version of the diary. Here, the type of the conducted activity was asked for, one of the available options being “the activity was a trip”. However, the formulation seems to have led a good portion of the respondents to skipping the trips and only reporting “actual” activities at the places they went to. Hence, the average number of reported trips resulting from this version of the questionnaire is even lower than in the other versions. The activity diary should have been structured differently in order to prevent the respoindents from overseeing that the actual purpose was to record trips and trip purposes rather than just the conducted activities.

Figure 2 Mean number of reported trips by diary version



Another issue was the respondents' understanding of the terms "trip" and "stage". For example, a public transport trip should normally consist of at least 3 stages: access (by feet), in vehicle travel, and egress. However, the respondents often interpreted such a trip as a sole stage and indicated only the main means of transport used, leaving the access and egress stages out. This is reflected by the low average number of 1.35 trips per stage in both the old and new version of the stage diary.

Nevertheless, the stage diary appeared to the best option due to the fact that the average number of reported trips was slightly higher than that of the trip version. Furthermore, it still has a higher level of detail than the trip version, and was thus found to be the most appropriate version for the use in the follow-up survey conducted among students and employees of the other high school in the study perimeter, the University of Zurich.

3.3 Item nonresponse

Among the respondents that filled in the personal questionnaire, trends could be discerned as far as nonresponse to certain questions is concerned. Table 2 displays an overview of the shares of non-respondents for each socioeconomic characteristic. As can be seen, the items most likely to be left out are monthly income and details about the place of residence. The rest of the characteristics have nonresponse rates of about 3%, which result from respondents choosing to leave out the whole questionnaire and continuing to the travel questionnaires right away.

Table 2 Shares of item nonresponse for different socioeconomic characteristics

item		nonresponse [%]
personal data	Gender	2.6
	Year of birth	2.4
	Marital status	3.4
	Household size	2.3
	Nationality	3.1
	Place of residence: city	11.9
	Place of residence: ZIP code	18.1
	Place of residence: street address	28.3
employment data	occupation	3.8
	monthly gross income (non-students)	18.2
mobility tool ownership	driving licence	2.7
	own car	3.3
	public transport season ticket	3.5

For the upcoming analyses, only the respondents who provided sufficient information about their place of residence in order to be assigned to a traffic zone in Zurich's cantonal traffic model (Amt für Verkehr des Kantons Zürich, 2005) were taken into account. This resulted in a sample of 2208 respondents, which were then submitted to the weighting process described in the next paragraph.

3.4 Weighting scheme

In order to compensate for imbalances between the proportions of certain population groups in the real population and the sample of respondents answering the survey, the latter was weighted according to the following criteria:

- gender (male / female)
- status group (student / other)
- ETH department (one out of 16, e.g. Architecture, Civil Engineering…)
- place of residence (ZIP codes in the city of Zurich, cantonal level outside)

After the weighting process, the sample characteristics match those of the true population, which should help the subsequent analyses to be a better fit to the real behavior of the target groups. In detail, the spatial distribution of trip origins resulting from the weighting process and the corresponding estimated network load for the different modes of transport should be quite plausible after the weighting procedure.

The weighting scheme is displayed in Table 3.

Table 3 Weighting scheme

Dept.	place of residence	status group	gender	n_{survey}	n_{real}	weight
Architecture	8001	students	m	3	22	7.33
Civil Engineering	canton AG	PhD students	f	…	…	…
…	…	...	…	…	…	…

According to this scheme, the individuals in the sample were assigned weights spanning from 1.00 up to 125.42. 75% of the respondents are assigned weights less than or equal to 10. The larger the weight, the more underrepresented the corresponding group is in the sample, potentially leading to a greater uncertainty as far as the representativeness of the corresponding data is concerned. This could lead to a slight overestimation of trips from the traffic zones that these weights were assigned to.

For trips originating in the city of Zurich, whose traffic system is the main concern of the study, the weights are slightly smaller. They span from 1.00 to 62.71, the 75% percentile being approximatively 8. Overall, the weighting is expected to provide a relatively good overview of the sample properties and the patterns of trip origins and distribution.

The distributions of the weights for the whole sample and the subsample of Zurich residents are displayed in Figure 3.

Figure 3 Weight distributions

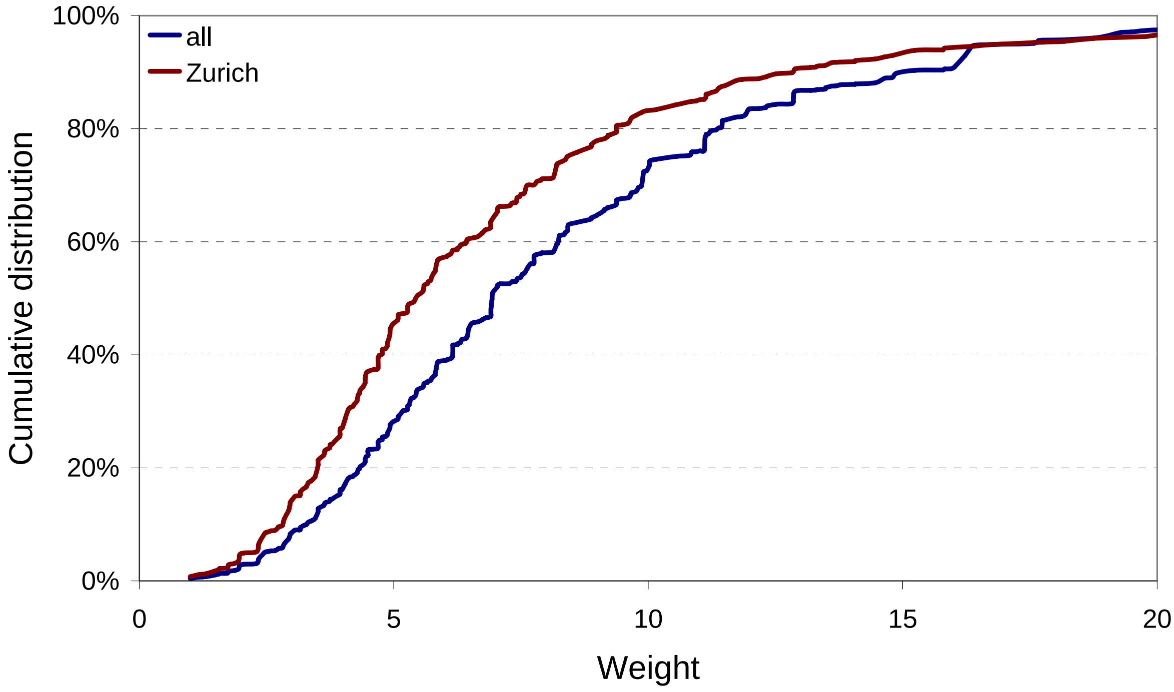


Table 4 provides key figures of the weight distributions.

Table 4 Comparison of weight distributions

	all	Zurich residents
mean	8.39	7.09
25% quartile	4.69	3.91
median	6.93	5.43
75% quartile	8.37	10.16
95% percentile	16.35	16.41

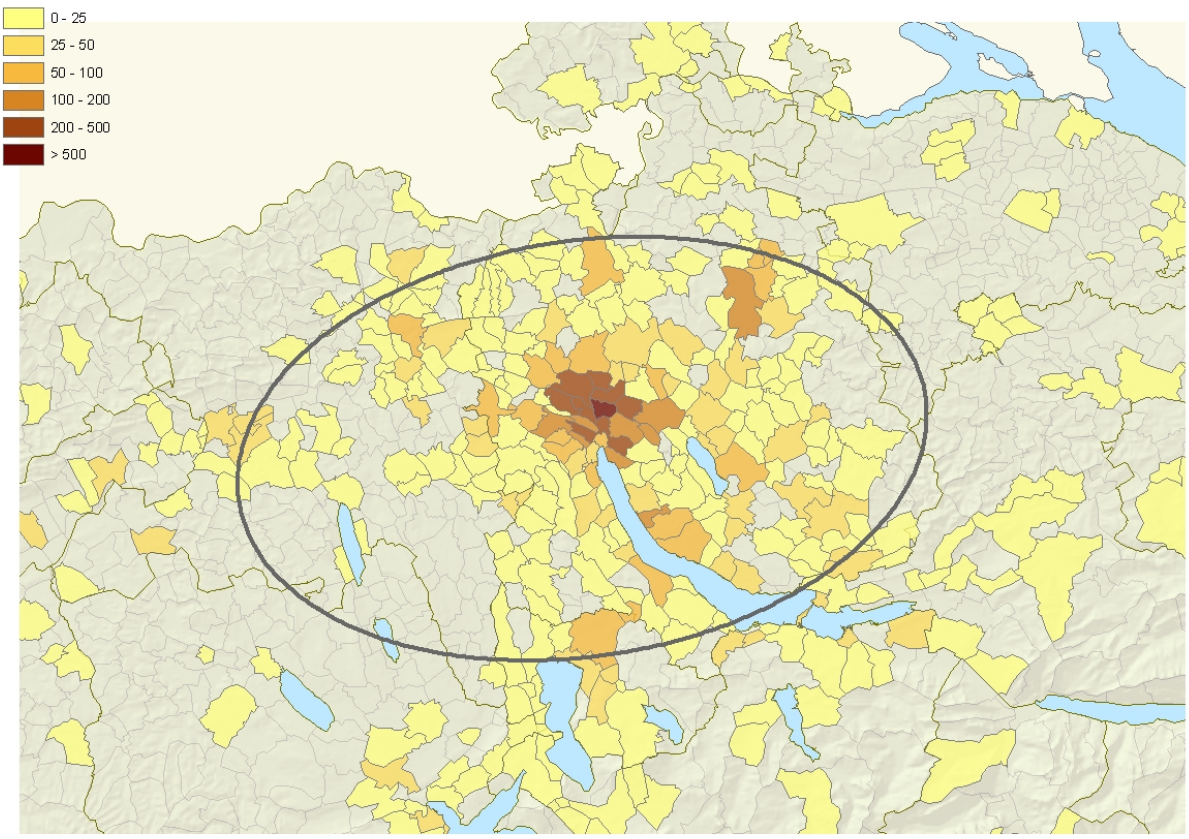
4. Spatial distribution

This section shall provide an insight into the spatial distribution of the different population groups in the sample at hand, and try to determine by which socioeconomic factors the residential location choices are determined.

Furthermore, the data analysed in this section allow a rough assessment of the transport axes on which most of the traffic to and from ETH are expected to be handled.

The spatial distribution of students' residential locations, as well as the corresponding confidence ellipse, is displayed in Figure 4. The confidence ellipse (defined analogously to the ellipse for human activity locations in Schönfelder and Axhausen, 2002) is given by the geographical barycenter of the population distribution and a longer axis corresponding to the regression line (i.e., the line for which the sum of squared distances to the individual residential locations is minimal). The axis lenghts are here set to reflect the standard deviation of the points along the respective axes.

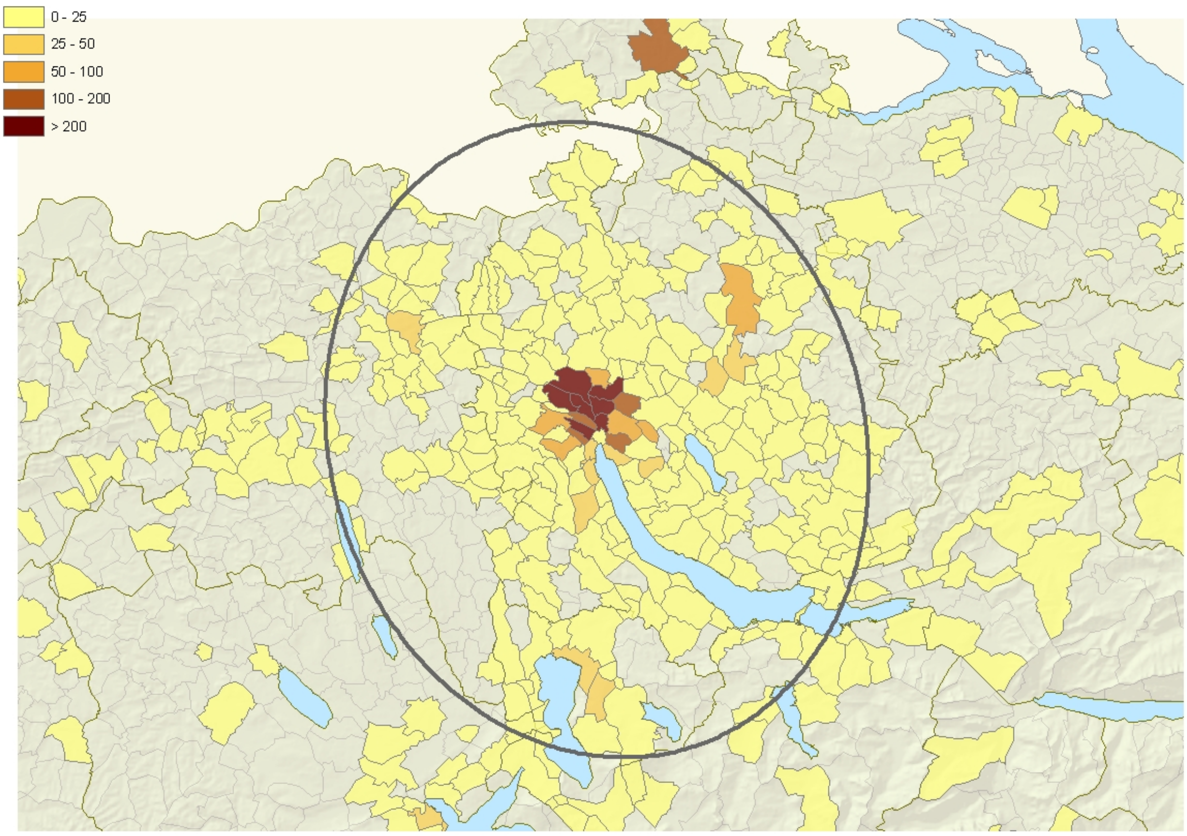
Figure 4 Spatial distribution of students' residential locations



It can be seen that the residential location space for students is quite disperse. It centers on the outskirts of Zurich’s city center, especially on the neighborhoods of Oerlikon, Schwamendingen and Langstrasse, where there are relatively many low rent flats and student residences (for a labeled map of Zurich’s neighborhoods, see Figure 14 in the appendix). The ellipse’s main axis is directed towards the neighbor cantons of Aargau and, further away, Berne. This indicates that students originating from those regions stay at their homes for the duration of their studies, and commute everyday, accepting the travel times of up to an hour in exchange for saving the rent for an appartment in Zurich.

The location space for PhD students’ residences, as shown in Figure 5, is quite different from the one discussed above.

Figure 5 Spatial distribution of PhD students’ residential locations

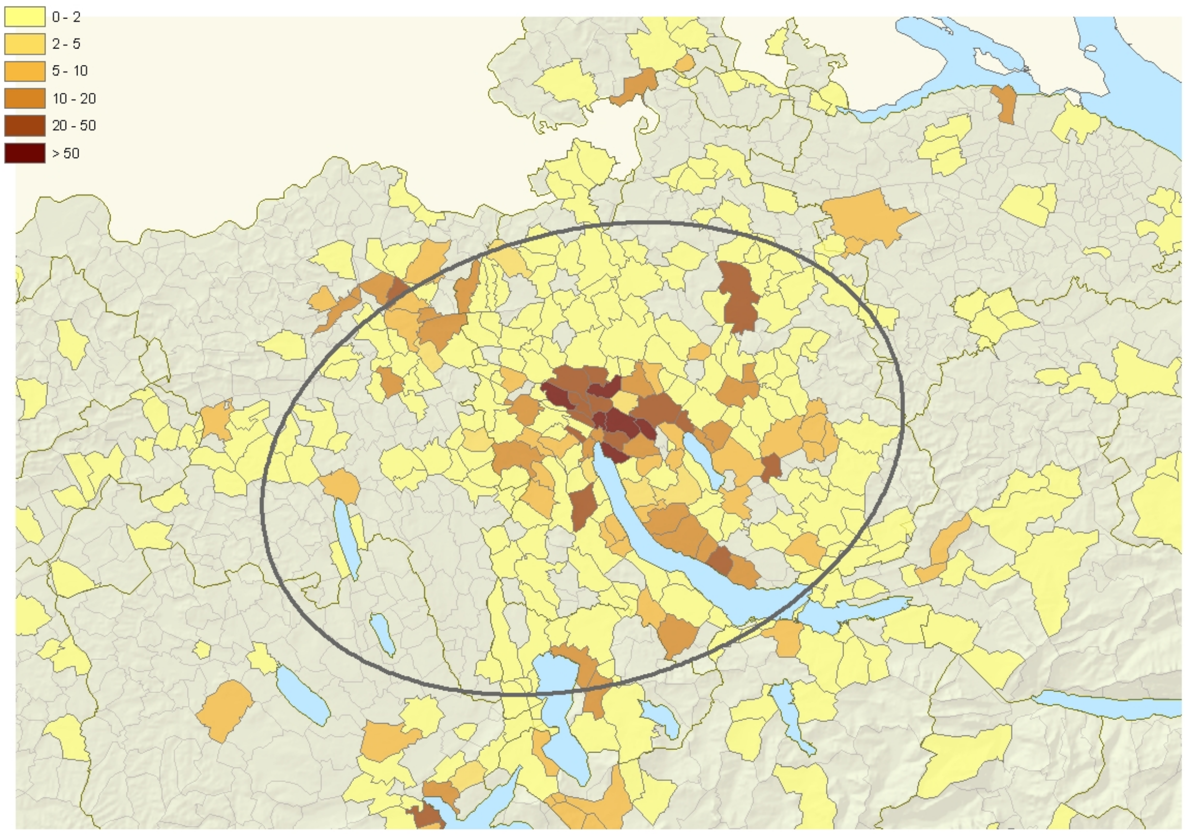


It is centered on the same neighborhoods as that of the students. However, it is more strongly focused on that area, as can be seen from the high density of residential locations there.

Furthermore, the directional distribution is pointing northwards, as shown by the ellipse and the relatively high densities in Winterthur and Schaffhausen. These cities are connected to Zurich via suburban railway, which provides a good accessibility of the ETH campuses from there. Thus, the choice of parts of the medium income population of PhD students and research assistans to live in these areas, where rents are lower than in Zurich, is not surprising.

The distribution of residential locations for professors and docents, i.e. the higher income group, is displayed in Figure 6.

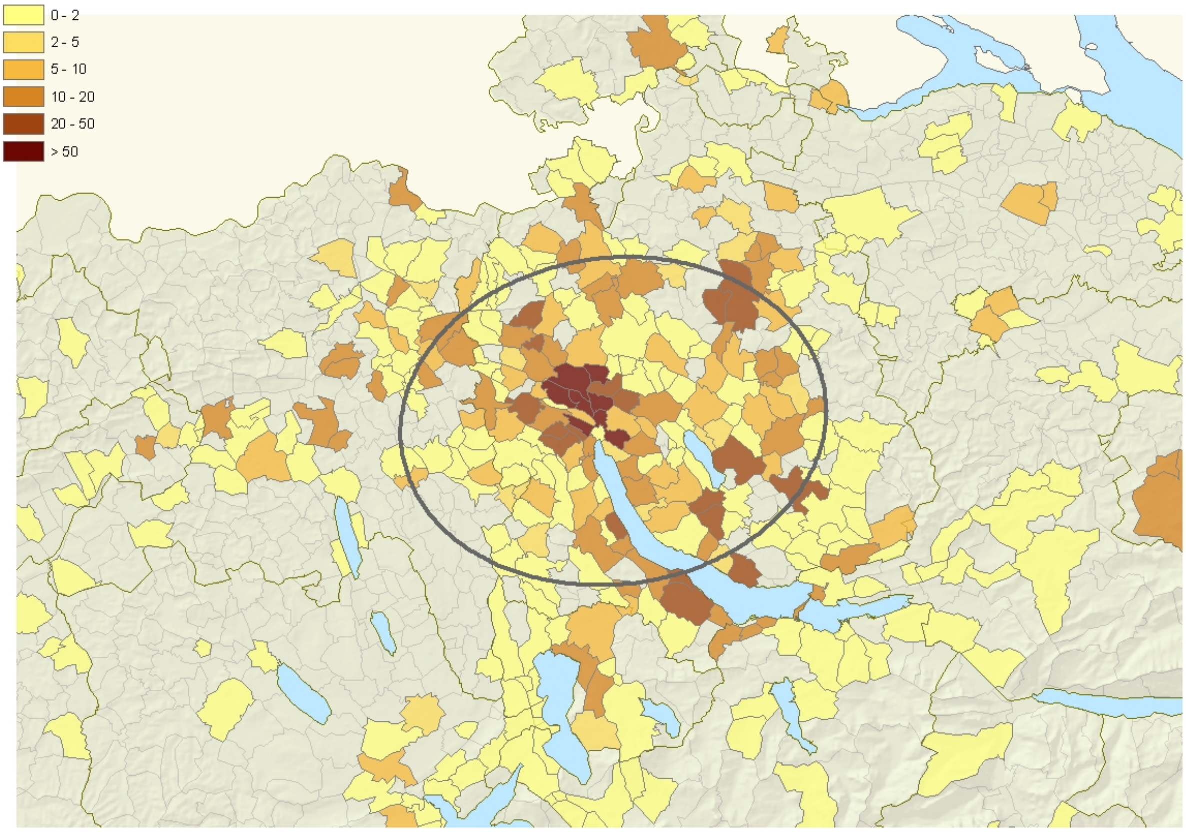
Figure 6 Spatial distribution of professors' residential locations



The higher spending capacity is reflected in the home location choices of the group. In Zurich, they are centered on the more sophisticated neighborhoods, like Seefeld and Zürichberg. Outside of the city, there is a noticeable concentration on the Goldküste, the area on the northeastern shore of Lake Zurich, around the suburbs of Küsnacht and Herrliberg.

The spatial distribution for the employees categorized as "other", is much more disperse than that of the groups considered so far. The salaries in this group are less narrowly ditributed and span over the whole bandwith of values between 2000.- and 14000.- CHF. This again affects buying power and thus the ability to pick a residential location in a more or less expensive area.

Figure 7 Spatial distribution of other employees' residential locations



As students and PhD students account for large parts of the population under study, one can expect the most heavily loaded traffic routes to be those leading from their home locations to ETH and vice versa. A detailed analysis of traffic generation and distribution will be provided in section 7.

5. Mobility tool ownership

This section will give an overview of mobility tool ownership among the different population groups in the sample and compare the data to the Swiss population data from the 2005 Microcensus (Bundesamt für Statistik, 2005). Table 5 is an overview of the ownership rates of various mobility tools for the different population groups in the sample compared to data from Zurich and Switzerland as a whole.

Table 5 Mobility tool ownership [%]

	sample					MZ2005	
	all	students	PhD students	professors / docents	other employees	ZH	CH
car driving license	89.6	88.4	89.6	94.3	92.8	65.6	68.8
own car	27.7	15.3	28.7	67.5	55.5	39.3	54.4
parking spot at work	4.7	1.3	4.4	15.3	14.0	18.6	32.5
own motorcycle	9.2	10.6	5.9	9.3	9.1	5.5	5.8
own bicycle	84.1	86.1	83.5	79.6	79.5	60.8	68.6
general abonnement (GA)	38.7	48.2	28.6	23.2	25.0	13.2	6.3
half fare card (Halbtax)	53.3	40.1	69.0	73.3	70.0	35.0	26.6
monthly local pt season ticket (Regenbogen)	11.3	11.8	13.4	5.4	9.0	12.8	4.8
yearly local pt season ticket (Regenbogen)	28.1	28.5	26.1	26.0	32.3	17.3	6.2

This reveals that, even compared to the standards of Zurich, where public transport has a relatively high modal share, the share of season ticket owners among members of ETH Zurich is very high. More than 90% have either a general abonnement (GA) or a half-fare card (Halbtax), indicating that public transport is their main means of travelling. The GA ownership rates are especially high among students and PhD students, these groups often not owning a car and thus not having an alternative to public transport when it comes to covering longer distances.

Besides, roughly 90% of the population own a car driving license, indicating a high general mobility in the population. Over 80% own a bicycle, and the rate of motorcycle is above the average level as well. Most respondents thus own a means of transport allowing them to cover small to medium distances at reasonable speed and without having to be on the lookout for a car parking spot at the destination.

Comparing car ownership to the local and national average (where the option “car always available” was taken as an equivalent to “car ownership”), we see that it is relatively high among docents and professors, the group with the highest income and who apparently whish to be flexible as far as their choice of means of transport is concerned. However, the low rate of parking card owners indicates that even these groups tend to use their cars relatively seldom, at least when it comes to trips their workplace. This again points out to the high quality of Zurich’s urban and suburban public transport system.

The next section will provide a more detailed insight into the mode choice behaviour.

6. Mode choice

The previous section suggested that the population sample at hand tends to use public means of transport in an even greater measure than the average Swiss poulation. This is reflected by the modal spilt data, displayed in Table 6. In fact, roughly 80% of the trips to the ETH campuses are conuducted by public transport.

Table 6 Modal split [%]

	sample					MZ2005 (CH)	
main means of transport	all	students	PhD students	professors / docents	other employees	work	education
by feet	4.8	2.9	7.0	15.7	6.4	16.3	49.0
bicycle	7.4	5.6	11.5	7.9	9.0	7.7	14.8
motorized private transport	7.2	3.4	9.8	23.8	17.1	59.9	11.6
public transport	80.6	88.1	71.8	52.6	67.6	16.1	24.5

Students use public transport most intensively; docents and professors have the highest motorized private transport share, which is nevertheless still far below the 60% nationwide share for work trips.

Trips by feet or by bicycle have a relatively low share, indicating that even trips covering low distances are likely to be conducted by public transport. This hypothesis is fueled by a look at Table 7 below. The mean distance for public transport trips in the sample is a litte lower than that of the average Swiss work trip. At the same time though, trips by feet and bicycle are significantly longer than the average. Whether a short distance trip is conducted by public transport thus appears to be highly dependent on the local public transport service quality. If it is insufficient, travel to work is carried out by slow moving transport regardless of the distance.

Table 7 Mean distance by transport mode [km]

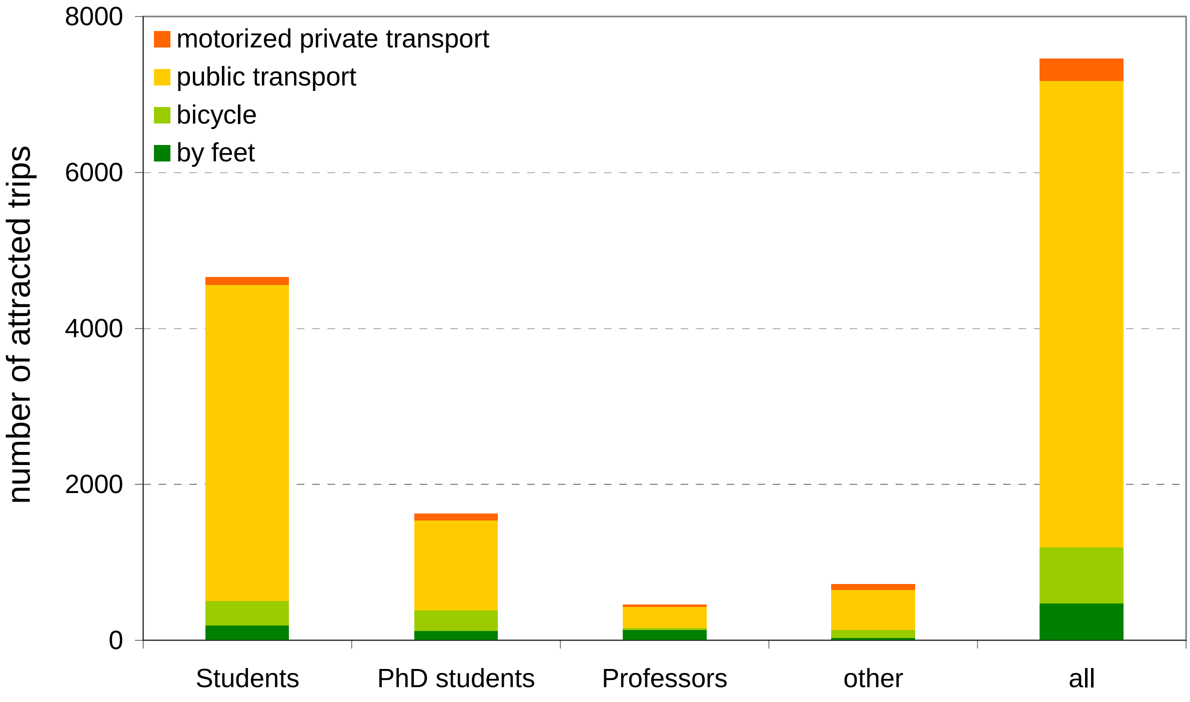
	sample					MZ2005 (CH)	
main means of transport	all	students	PhD students	professors / docents	other employees	work	education
by feet	2.2	2.1	2.1	1.9	3.8	1.0	1.6
bicycle	4.7	4.4	5.0	3.8	5.1	2.4	2.3
motorized private transport	10.9	10.3	9.3	11.8	12.7	9.0	7.2
public transport	11.7	12.3	8.7	11.3	14.6	12.0	9.4

7. Trip attraction

This section will look into trip attraction and generation by ETH Zurich, and the spatial, temporal and modal distribution of these trips. The ETH generated traffic will be assigned to Zurich's private and public transport networks, allowing an assessment of the axes over which most of it flows. It will also allow seeing to what part traffic to and from ETH contributes to the total traffic in the study area. The basis for the following analyses is the information that respondents provided for an average weekday in the week review questionnaire.

The impact of the mode choice figures discussed in the previous section on network loads is displayed in Figure 8. Figure 9 shows trip generation for the different modes, split up for origins in- and outside the city of Zurich. Both figures account only for traffic to the campus located in the city center, as this is the main object of the study. Of the 12'000 people traveling to ETH every day, about 2/3 visit the main campus.

Figure 8 Number of trips to main campus by mode and population group



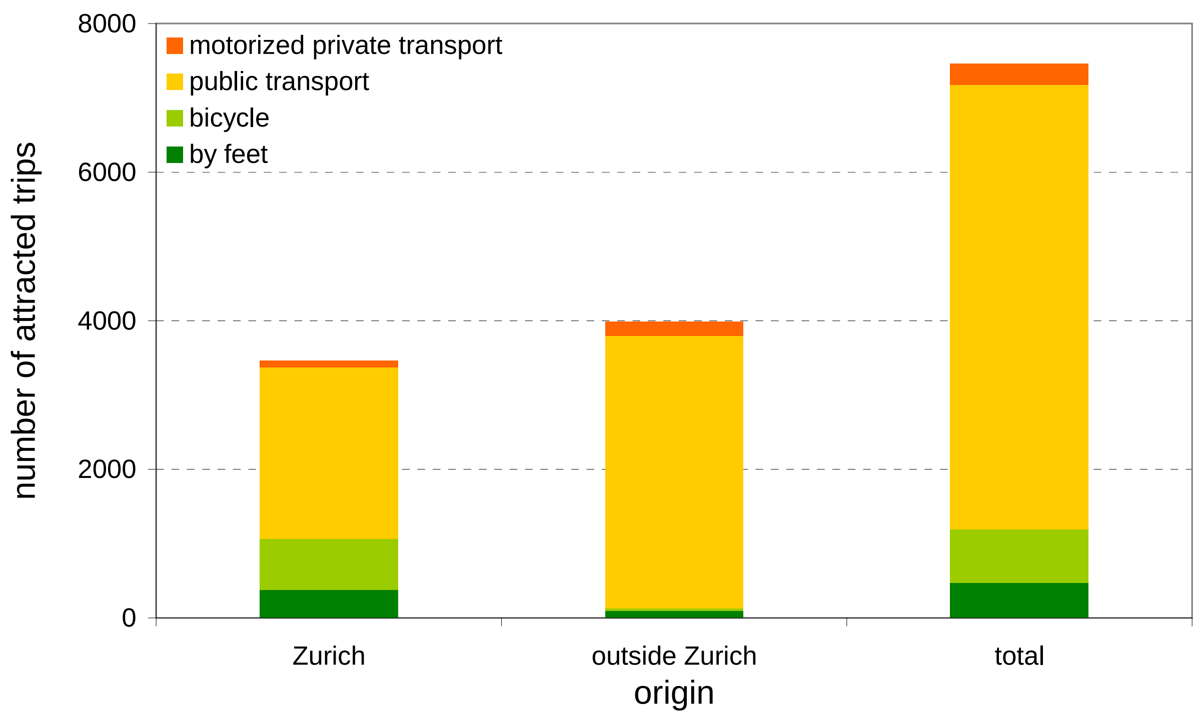
We observe a relatively high number of trips that are conducted by feet or bicycle. This indicates that those modes are attractive in principle, and that there is potential for a further increase of their share by improvements of the according access routes.

The ETH campus attracts about 6’000 public transport trips per day, which corresponds to a large portion of the total network load, especially during rush hours. The increasing demand will further strain the system’s capacities, which will imply a necessity to increase capacity.

Only 300 of the trips attracted by the main ETH campus are carried out by motorized private transport. This load is negligible compared to the total network load in the area, mainly caused by through traffic. However, in order not to increase this load (as required by the project masterplan), care must be taken to maintain and increase the attractiveness of the other modes.

More than 50% of the users of the perimeter are students. A possible measure to prevent public transport network overloads caused by the increasing demand gererated by this group would be the supply of low rent flats or student housing facilities close to the campus, so that the additional students will resort to slow moving traffic instead of public transport. Figure 9 supports the hypothesis that slow traffic is attractive for those living close to the campus: 30% of the trips coming from inside the city are carried out by feet or bicycle.

Figure 9 Number of trips to main campus by mode and trip origin



For trips from outside town, public transport is predominant, again pointing to the excellent accessibility of the campus by (suburban) rail. Logically, the private transport share is highest for trips from outside the city, especially from regions that are less well connected to the public transport network.

The transport planning software VISUM 9.44 (PTV, 2007) was used to compute the expected assignment of the given demand to the public and private transport networks. The origin-destination matrices were again extracted from the week review data.

As can be seen in Figure 10, the public transport axes most heaviliy loaded by the traffc demand generated by the ETH campuses are those leading from the main residential locations of students (i.e., Oerlikon and Schwamendingen, in the northeast of the map) to both the campuses: the main campus in the south eastern corner of the map, and Science City, which is located in the north western region. Furthermore, the suburban railway axe, accumulating traffic flows from the regions outside of the city and leading towards the main station (near the southern border of the map) are intensely used.

Figure 10 PT network load caused by traffic to and from ETH: absolute

Figure 11 displays the percentages of total public transport network load that are caused by traffic destined to and originating from the ETH campuses, ranging from low percentages in light green, up to very high ones in dark red.

The road sections on which the ETH share accounts for 100% of the total demand are those which are exclusively used by an hourly bus connection linking the main campus to Science City.

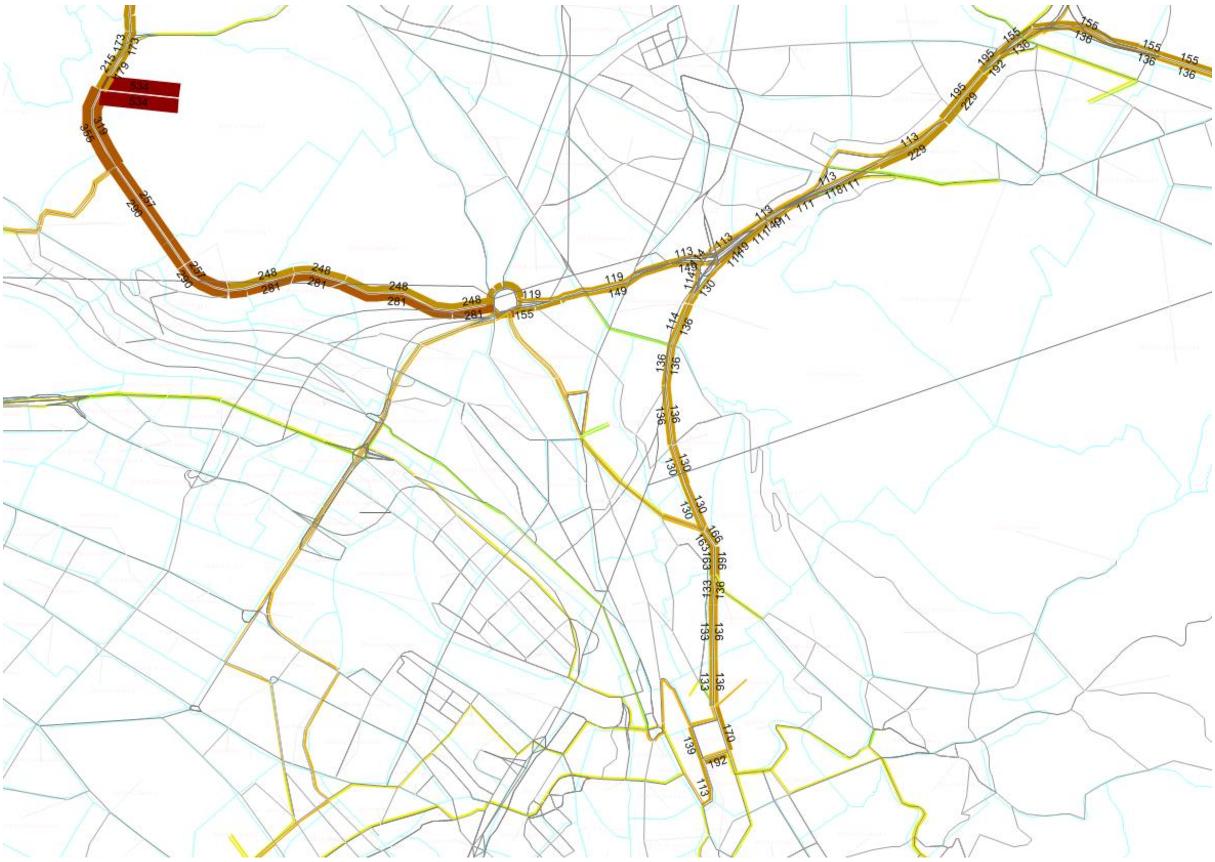
For the corridor leading from Oerlikon to the main campus, ETH generated traffic has a share of about 18% of the total demand. During rush hours, this share is expected to be even higher. 30% of the demand on the heaviliy congested bus line originating from the rail station in Oerlikon, going past Science City and continuing southwards are target traffic flows to the campus.

On the suburban lines, although the absolute load generated by ETH is almost as high as on the urban network, the share of total traffic is negligible due to the very high total load of the corresponding network sections.

Figure 11 PT network load caused by traffic to and from ETH: share of total network load

An illustration analogous to that in Figure 10 is depicted in Figure 12 for private transport. As has been said before, demand generated by the main campus is quite low. More users are travelling to Science City by car, which explains the maximum load on the road section leading to that campus. Still, private transport trip attraction by ETH is reasonably low on the whole network.

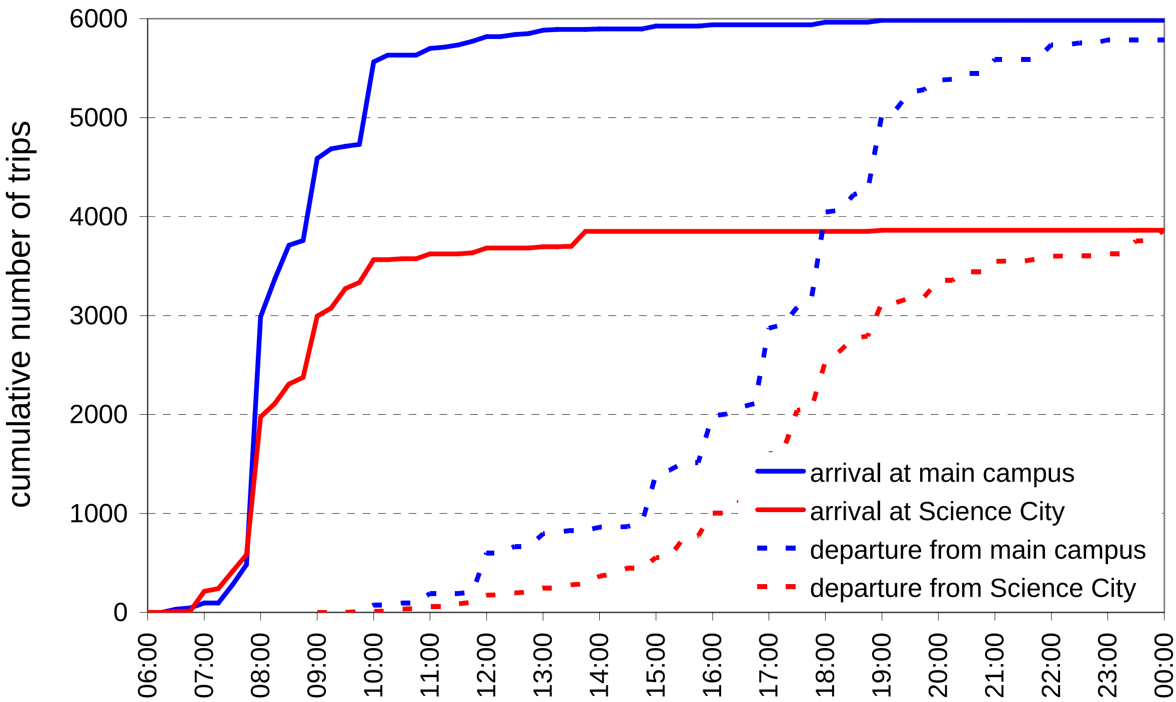
Figure 12 Motorized private transport network load caused by traffic to and from ETH



The following is an analysis of the temporal distribution of attracted public transport trips to and from both ETH campuses, in order to determine the rush hours and their traffic load.

Figure 13 displays the cumulative load curves for arrivals at and departures from both campuses. The resolution is at a 20 minute interval.

Figure 13 Temporal distribution of arrivals and departures by campus



For arrivals, we see rush hours at 08:00, 09:00 and 10:00 at both locations, while there are negligibely few arrivals over the rest of the day. Between 08:00 and 08:15, there are 2500 public transport users arriving at the main campus. Assuming that these are evenly distributed over the 3 tram lines going through the area, each of which has 3 courses from each direction in the given 20 minute interval, this comes down to about 140 people per vehicle disembarking in the area, which is a considerable part of the capacity of the tram lines.

As far as departures are concerned, these are more evenly distributed over the course of the day. The first departures occur around noon, the largest part of the rest in the time span between 15:00 and 19:00. Thus, the source traffic does not strain the area's transport system as intensely as the target traffic.

8. Summary and outlook

As discussed in the first sections of this paper, great care has to be taken of technical implementation and user guidance when using online questionnaires for conductiong travel diary surveys. The week review questionnaire was well accepted, and allowed an assessment of trip generation and mode choice for the different population groups in the sample of ETH students and employees.

80% of the trips to and from ETH are conducted by public transport, which militates in favor of the quality of Zurich's urban and suburban public transport network and of the accessibility of ETH's campuses, as well as for the dependency of the user grous, especially students, on public transport. The goal of the project, not generating additional motorized private transport demand, should thus be possible to meet. However, the additional demand generated by extension of the main campus will make certain measures necessary in order to prevent network congestion during peak hours.

As far as the analysis of existing demand for the project at hand is concerned, the next working steps will be the assessment of demand structures for the University of Zurich and the University Hospital, analogously to the procedures described in this paper.

For the survey conducted at the University, a slighty adapted version of the ETH questionnaire was used. The stage based questionnaire was maintained as the only version in the diary part of the survey. A high number of diaries in the ETH survey was aborted due to the high response burden after completing the week review. Therefore, a part of the interviewees in the new sample received a questionnaire where the order of week review and stage diary was inverted, so that the diary appeared before the week review. For part of the University employees, no e-mail addresses were available, do that they had to be interviewed by means of a pen-and-paper survey. This will allow a comparison of response rates and data quality accross survey modes.

The same online questionnaire will be used for the employees of the University Hospital. In addition, there will be a paper questionnaire sent out to a sample of patients that were hospitalized in a certain span of time. Furthermore, an short on-location oral interview will be conducted among visitors to the hospital, so that all of the user groups of this facility will be covered.

Overall, the resulting analyses will provide a good overview of the preferences of the different user groups that travel to the study area and allow predicting the consequences of changing the structure of the area on traffic demand.

9. References

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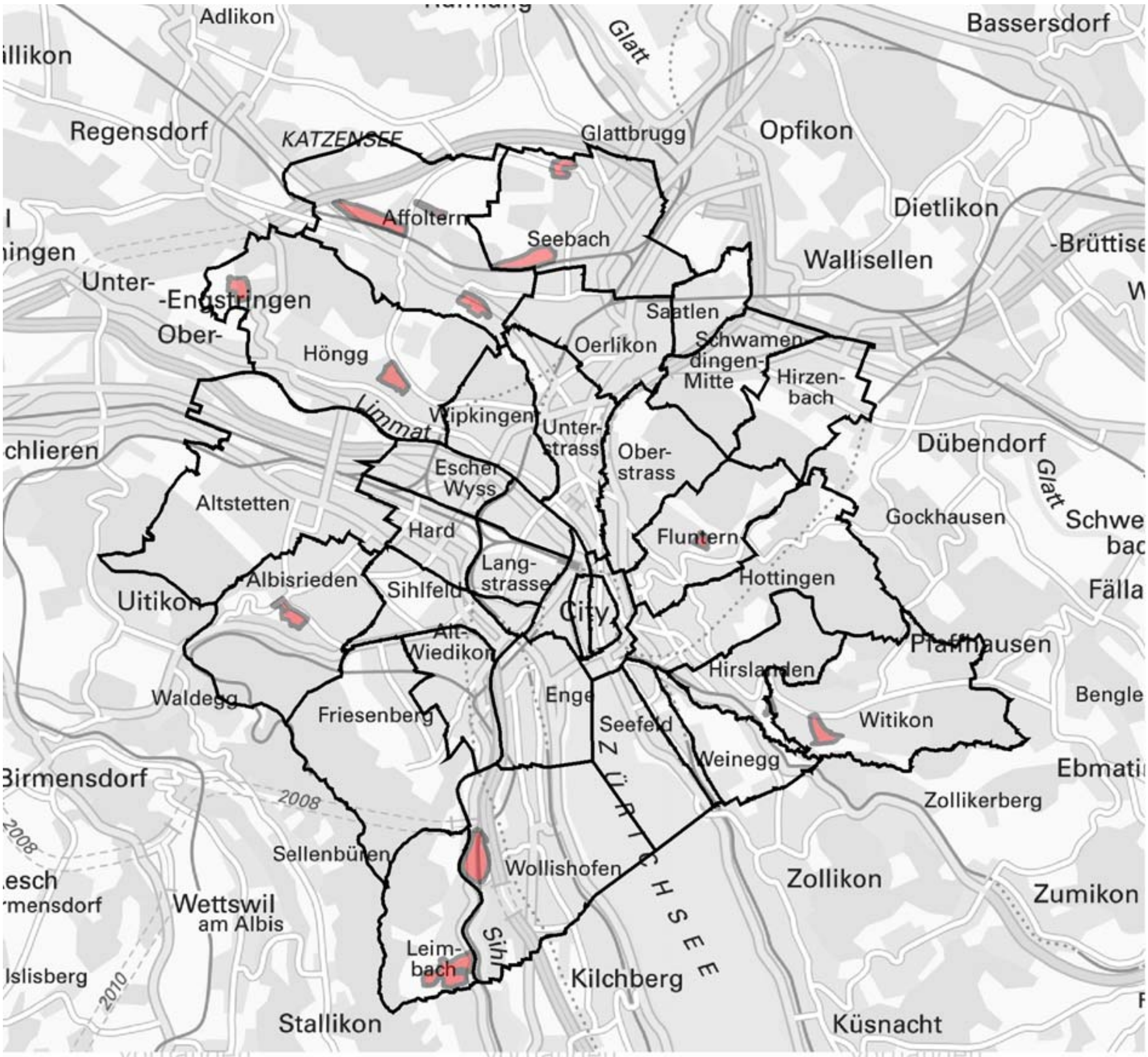
Appendix

Figure 14 Map of Zurich's neighborhoods



Source: Bau- und Zonenordnung der Stadt Zürich, http://www.bzo.stadt-zuerich.ch/zueriplan/bzo.aspx