

TRANSPORT FINDINGS

Tracking Parking Search and Occupancy in Zurich

Laurin Maurer¹, Flurin Roca¹, Noel Treffinger¹, Ludwig Henke¹, Vitus Hofmann¹, Oliver Leonhartsberger¹

¹ Institute for Transport Planning and Systems (IVT), ETH Zurich

Keywords: parking, zurich, switzerland, tracking, occupancy, search

<https://doi.org/10.32866/001c.72793>

Findings

This article describes how parking search times and occupancy in a highly attractive area in central Zurich (Switzerland) develop on a weekday morning when a farmer's market takes place on Bürkliplatz, a central market place inside the study area. Individual vehicles were tracked by bike, drivers were interviewed about their parking behaviour and their route was tracked using GPS. Additionally, the parking occupancy was registered every fifteen minutes during a five-hour time period. A connection between market opening hours and parking dynamics within the perimeter was observed. Drivers usually overestimate their parking search duration.

1. Questions

The city of Zurich (Switzerland) pursues an active parking policy which is aimed at promoting living with a low number of cars (Stadt Zürich 2022c). Changes in parking space availability can influence many parameters in the transportation system such as mode choice, route choice and car ownership rate (Christiansen et al. 2017). This paper gives insights into the parking occupancy and search dynamics in the area between Bürkliplatz and Münsterhof in central Zurich where around 300 on-street parking spots are accessible to the public. The location is close to the historical center and Bahnhofstrasse shopping district and therefore highly attractive for parking. [Fig. 1](#) shows the perimeter (yellow polygon) in central Zurich and parking spaces (red) as a heat map. Parking is charged between 9:00 a.m. and 8:00 p.m., the maximum parking duration is generally two hours with the exception of a short street section with a 30 minute limit. The fee increases with time: 1 Swiss Franc for up to 30 minutes, 3 Swiss Francs for one hour and 7.50 Swiss Francs for two hours.

The parking situation was tracked during a sunny spring morning from 6:30 a.m. to 11:30 a.m. when the farmer's market takes place on Bürkliplatz. The following questions are addressed:

- How does the parking occupancy develop on a market morning?
- How does the parking behaviour and its perception by the drivers change on a market morning?
- What influence does the farmer's market have on parking behaviour in the area between Bürkliplatz and Münsterhof?

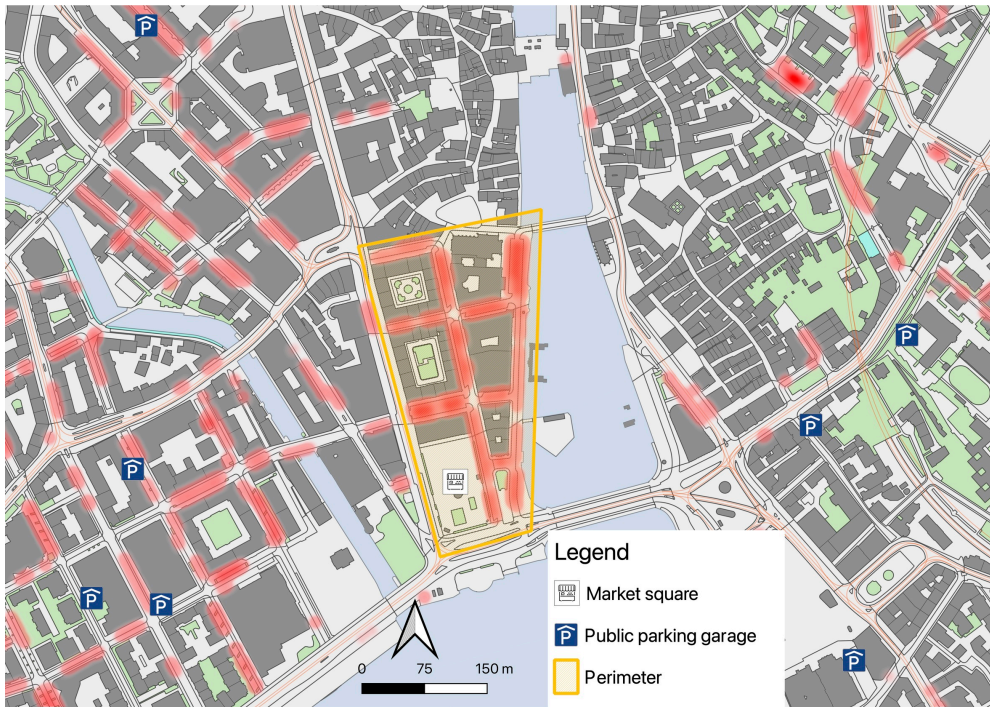


Figure 1. Perimeter (yellow polygon) and heat map of on-street parking spots (red) in central Zurich, heat driven by number of on-street parking spots per area

Source: Including data from Stadt Zürich (2022b), Stadt Zürich (2022a) and background map from Kanton Zürich (2022)

2. Methods

Two methods were used to track parking search and occupancy. To record the parking occupancy, all parking spaces within the perimeter were inventoried and the perimeter was divided into three subareas, as shown in [Fig. 2](#). The occupancy of individual parking spots was checked every 15 minutes by one person per subarea by noting the parked vehicle's license plate and, when present, if the vehicle had a special parking permit for market staff. The number of times a vehicle is subsequently recorded allows estimating its parking duration. In total, 871 different license plates were noted.

To study the parking search traffic in the perimeter, team members tracked vehicles driving into the perimeter by bike and asked drivers (after they parked and left their vehicle) about their destination, estimated parking search duration and estimated total parking duration. As soon as the car enters the perimeter, they started to record the exact route, distance to parking spot and parking search duration with a GPS application, as well as the vehicle license plate and the parking space number. From 6:30 a.m. to 11:30 a.m., 82 vehicles were tracked by bike and 66 vehicle drivers were interviewed.

At 6:30 a.m., 36% of the total 296 available parking spaces in the perimeter were occupied. Occupancy increased progressively until 9:30 a.m. when it reached its peak with almost all parking spaces being used. At the end of the survey, 82% of the parking spaces were occupied. The occupancy of the parking spaces in the individual streets is shown as a matrix in [Table 1](#). In the streets around the Bürkliplatz farmer's market, three quarters of the parking

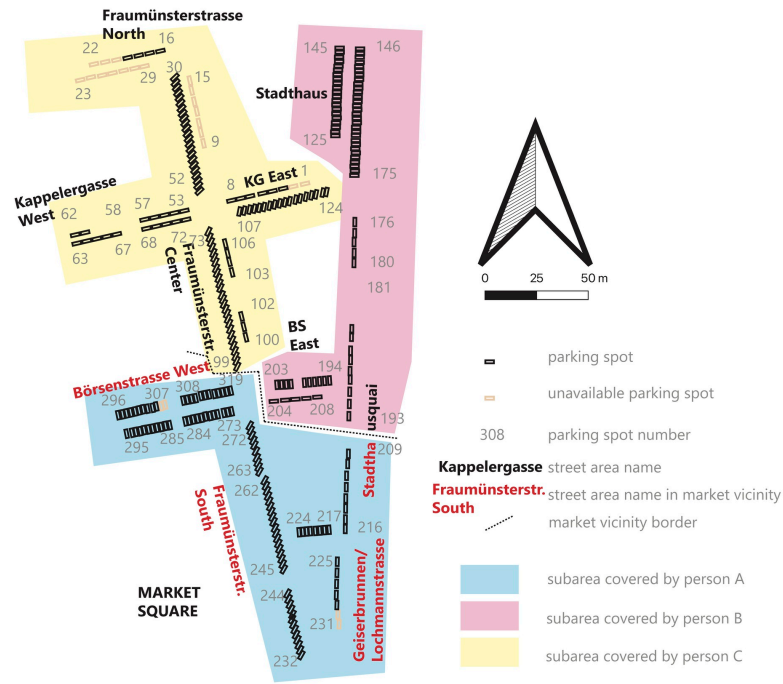


Figure 2. Parking spot inventory and perimeter subareas

Source: Including data from Stadt Zürich (2022b)

street area name	parking spot number	number of spots in street area	parking spot occupancy [%]																				σ
			6:30 a.m.	6:45 a.m.	7:00 a.m.	7:15 a.m.	7:30 a.m.	7:45 a.m.	8:00 a.m.	8:15 a.m.	8:30 a.m.	8:45 a.m.	9:00 a.m.	9:15 a.m.	9:30 a.m.	9:45 a.m.	10:00 a.m.	10:15 a.m.	10:30 a.m.	10:45 a.m.	11:00 a.m.	11:15 a.m.	
Fraumünsterstrasse North/Poststrasse	9-52	27	37	41	44	56	67	74	78	85	89	93	89	100	93	96	100	85	100	100	96	96	81
Stadthausquai (partially)	176-193, 209-216	26	54	62	54	58	58	58	69	85	92	96	88	96	100	96	100	100	96	96	85	65	80
Fraumünsterstrasse South	232-272	41	56	54	54	51	66	66	71	83	85	93	88	93	90	95	95	100	100	98	93	76	80
Geiserbrunnen/Lochmannstrasse	217-231	13	46	23	38	62	46	62	92	85	100	100	92	100	92	100	100	100	85	92	77	80	
Börsenstrasse West	273-319	45	38	49	51	58	64	76	67	73	71	73	76	89	91	87	98	98	96	93	91	78	76
Stadthaus	125-175	51	37	37	37	39	47	45	49	45	65	71	76	88	76	82	100	94	90	92	90	86	67
Kappelergasse West	53-72	20	35	40	50	40	50	35	40	45	40	45	70	85	95	100	95	90	90	85	100	90	66
Börsenstrasse East	194-208	15	27	27	27	40	60	60	40	40	40	53	67	67	93	93	100	100	100	100	80	73	64
Fraumünsterstrasse Center	73-106	34	15	26	32	24	21	24	26	26	35	56	68	82	97	97	100	100	100	100	88	97	61
Kappelergasse East (30min)	1-8, 107-124	24	8	17	17	17	17	21	42	29	25	25	46	54	63	63	96	100	96	92	92	75	50
average	1-319	296	36	40	42	44	50	53	57	60	65	72	76	86	88	90	98	97	96	95	91	82	71
market vicinity	209-319	107	50	50	53	58	64	71	73	79	81	86	84	93	92	92	97	99	97	93	89	73	79
non-market vicinity	1-208	189	29	34	35	37	42	42	48	49	56	63	72	83	86	89	99	95	96	95	92	87	66

Table 1. Parking spot occupancy per street [%] during study period: red street area names are close to the market

spots were occupied, on average, until 10:00 a.m. In the same period, only half of the spots were occupied, on average, on the remaining streets, which were not in the immediate vicinity of the market. The lowest occupancy rate has been observed in the subarea where the allowed parking time is limited to 30 minutes, with an average occupancy of 50 %.

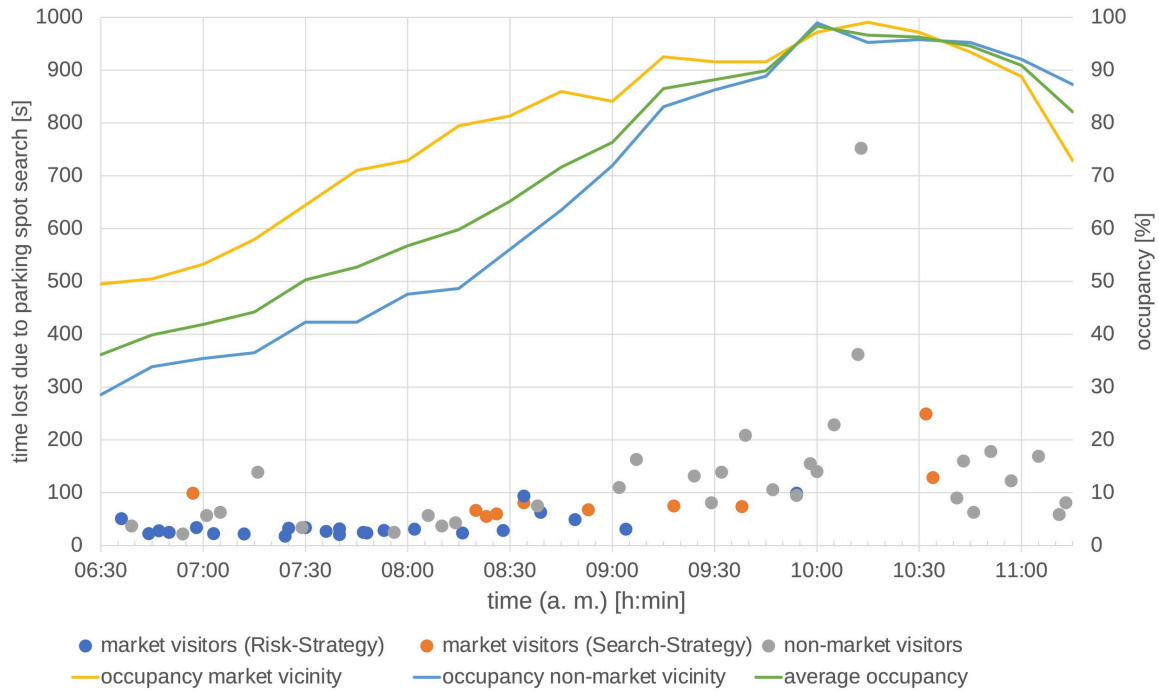


Figure 3. Occupancy, search duration and search strategies over time

Parking search duration increases as parking occupancy increases. The search duration increases until the longest search duration (752 s) for an individual vehicle is recorded at 10:25 a.m. After 10:30 a.m., the search duration decreases slightly until 11:30 a.m. The average search duration was 91 seconds. Other recorded values such as time lost due to parking search, the distance difference between optimal parking spot (directly at stated destination) and final parking spot or unnecessary distance driven behave similarly.

3. Findings

The study shows that parking occupancy increases during the morning (see [Fig. 3](#)). Parking spots in the vicinity of the market fill up significantly earlier than those further away from the market. The parking spaces further away from the market function as a kind of buffer as they are used more when occupancy in the area close to the market is high (80 % or more). At 10:00 a.m., only five of the 296 available parking spots are empty. After that, the occupancy decreases slightly, which could be caused by the closing of the Bürkliplatz farmer's market at 11:00 a.m. Up to an occupancy of about 60 %, the parking search time remains at a constant low level. At peak occupancy, drivers sometimes stop the parking search and leave the perimeter. During the market's opening hours (6:00 a.m. to 11:00 a.m.), 20 % of all parking spaces in the perimeter are permanently occupied by market staff, in some cases also in the area close to the market. This leaves only 80% of all parking spaces available for other drivers.

Drivers often overestimate their own parking search time (see [Table 2](#)). The estimated values (expressed by drivers in minutes) usually deviate from the measured value (measured in seconds) by one or up to two minutes. The

Table 2. Average driver estimated and measured parking search time and duration

	driver estimated	measured	difference	standard deviation
parking search time	115 s	91 s	-24 s	69 s
parking duration	55 min	43 min	-12 min	34 min

estimates of parking duration are more scattered. Likewise, most respondents overestimate their expected parking duration even as they are trying to keep their stay short. The deviation from the measured parking duration is usually not higher than one hour. People who underestimate their actual parking duration are in most cases short-term parkers. Some people parked longer than our data collection period (6:30 a.m. to 11:30 a.m.). Without these, the difference between estimated and measured parking duration is lower (-7 min), but it stays negative.

Two parking search strategies of market visitors were observed: Risk-Strategy and Search-Strategy. Applying the Risk-Strategy means waiting at the perimeter entrance until a spot is free or parking directly on a vacant parking place at the Bürkliplatz farmer's market. Using the Search-Strategy, drivers continue north inside the perimeter and search for a parking place. The Risk-Strategy is the preferred parking search strategy among market visitors before 9:00 a.m. After that, the Risk-Strategy is chosen by only two of the six arriving market visitors. When comparing the two parking strategies, the Risk-Strategy proved to be clearly more efficient, but it is only promising if there is sufficient free capacity in the area around Bürkliplatz farmer's market. [Fig. 3](#) illustrates the discussed findings.

Acknowledgements

We express our appreciation to Christopher Tchervakov and Kay W. Axhausen for their advice and sharing their expertise. In addition, we are indebted to three anonymous reviewers for helpful comments on previous versions of the manuscript. All remaining errors are our own.

Submitted: January 02, 2023 AEDT, Accepted: March 06, 2023 AEDT



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-SA-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-sa/4.0> and legal code at <https://creativecommons.org/licenses/by-sa/4.0/legalcode> for more information.

REFERENCES

- Christiansen, Petter, Øystein Engebretsen, Nils Fearnley, and Jan Usterud Hanssen. 2017. “Parking Facilities and the Built Environment: Impacts on Travel Behaviour.” *Transportation Research Part A: Policy and Practice* 95 (January): 198–206. <https://doi.org/10.1016/j.tra.2016.10.025>.
- Kanton Zürich. 2022. “GIS-Browser Kanton Zürich.” <https://maps.zh.ch/>.
- Stadt Zürich. 2022a. “Öffentlich zugängliche Parkhäuser OGD.” https://www.stadt-zuerich.ch/geodaten/download/Oeffentlich_zugaengliche_Parkhaeuser.
- . 2022b. “Öffentlich zugängliche Strassenparkplätze OGD.” https://www.stadt-zuerich.ch/geodaten/download/Oeffentlich_zugaengliche_Strassenparkplaetze_OGD.
- . 2022c. “Parkraumplanung und –bewirtschaftung.” https://www.stadt-zuerich.ch/ted/de/index/stadtverkehr2025/parkraumplanung_bewirtschaftung.html.