



## AN INSIGHT INTO TRAFFIC ANALYSIS WITH COMPUTER VISION

### Leveraging Smart Infrastructure for Urban Traffic Flow Analysis

ANDRÉ GLÓRIA<sup>1</sup><sup>1</sup> MSC, Instituto Superior Técnico, Portugal**KEYWORDS***Urbanisation  
Cities  
Public Space  
Management  
Traffic Flow  
Urban Lighting  
Edge Computing  
Vision Sensors***ABSTRACT**

*Urbanisation is accelerating, with the UN predicting 68% of the world population will live in cities by 2050, creating new challenges for public space management. Efficient traffic flow is essential in such environments. This project leveraged urban lighting infrastructure to deploy AI-powered edge computing devices with vision sensors on public light poles to monitor traffic at intersections. Three pilot sites in Cascais, Loures, and Oeiras featured nine intersections under real-world conditions. These smart devices not only provided valuable, continuous data for traffic analysis but also demonstrated the potential for resilient, cyber-safe, and connected infrastructures supporting the transition to smarter cities.*

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## 1. Introduction

The United Nations predicts that by 2050, urban areas will be home to 68% of the global population (United Nations, Department of Economic and Social Affairs, Population Division, 2019). This affects how cities will have to organize and manage public spaces, as they accommodate distinct traits of human behavior, such as play, social interaction, creativity, economic activities, and entertainment. When planning new areas, many principles of sustainable development can be readily implemented given information is available to allow for informed decisions. However, this is more challenging in historic and consolidated areas.

Within urban contexts, public space plays a key role in making cities livable. Public space is not easy to define and has very different features and elements, depending on the cultural and geographical contexts. Public space is any place accessible to bring people together on a public basis. This includes public squares, marketplaces, monuments, parks, public beaches, riversides as well as pavements and streets.

It is not enough for a city to allocate ample space for public use, it also needs to ensure that the space is well-maintained and managed so that it can serve its purpose effectively. This raises further questions about the quality of the public space, such as how to make it safe and accessible to all users, and how to finance the costs of creating and maintaining such spaces.

Cities will use new technologies and innovation to deal with current and future problems in areas like transport and mobility or citizen engagement, making them become digital (or "smart"). Cities will also need to become more connected to timely use high-quality data to improve urban management and take quick corrective actions to mitigate any conflicts within the urban spaces (Department for Business, Innovation & Skills, 2013).

One of the main challenges that smart cities face is how to manage traffic congestion and improve mobility for their citizens. Traffic affects not only the efficiency and productivity of urban life, but also the environment, health, and safety of people. Therefore, it is crucial for smart cities to monitor and optimize traffic flow using innovative solutions based on data and technology.

In this work, we developed a prototype specifically designed for smart cities applications. This prototype, hosted in the public lighting infrastructure, measured traffic flow on key intersections of three municipalities in the Lisbon metropolitan area.

## 2. Methods

The traffic solution was tested in three different municipalities: Cascais, Loures, and Oeiras. Nine (9) locations were identified (L1-L9) with a total of seventeen (17) vision sensors deployed in the public light infrastructure (see Figure S1 in the Supporting Information section). With the objective of measuring the total traffic flow, three locations have energy available 24 hours per day (L1-3) and correspond to key intersections, where high traffic flow and conflicts are expected, particularly during rush hours. The other locations, L4-9, only have energy available during night (powered by switched grids) and correspond to single roads. These locations correspond to residential areas – or to accesses to residential areas – where the goal was to identify moments of potential excess of noise pollution.

Data was collected for two months (April and May) with random interruptions due to unexpected down time of the devices. Nevertheless, approximately 30 days of data was collected per device.

The vision sensors were connected to Jetson Xavier NX devices running jetpack 5.0.2 GA with all software deployed and managed via docker containers. Inferencing is done by a modified version of the YOLO-v7 model (Goulão et al., 2024; Novo et al., 2024) that was adapted for improved performance when feed with the top-down video streams, typical when sensors are deployed on lighting poles. The Deep SORT algorithm (Wojke et al., 2017) was used to track objects detected by the vision model. These objects are then counted when they cross a barrier that is configured for each camera perspective. For this purpose, we consider the sum of all vehicles (cars, buses, trucks, motorbikes, and bicycles).

## 2.1. Data analysis

All data analysis were performed using Python 3, processing blocks of one (1) hour and, since we have sparse data in some cases, median values were used.

Rush hours were defined using Tuesday, Wednesday, and Thursday data, as:

- Morning period: from 7 am to 9 am
- Afternoon period: from 4 pm to 7 pm

For the devices powered only at night:

- Early night period: from 9 pm to 11 pm
- Night period: from 2 am to 4 am
- Early morning period: from 5 am to 6 am.

## 3. Results and Discussion

With the solution deployed in the field, in the aforementioned locations, anonymized detections data were collected whenever the devices were powered. This meant full days for devices in locations L1 to L3 since they are on a permanent grid, and around 10 h per day for devices in locations L4 to L9, since they are on a switched grid tied to the public lighting schedule.

Our approach to evaluate traffic counting was done by calculating median values per hour per weekday (Figure 1 and S2).

## 4. Observations

Regarding image quality, one initial observation is that the lower visibility at night did not compromise the feasibility of the solution. It did degrade the camera's video stream quality, producing video frames with much more noise than during daytime, but still allowing for detections to take place. This image degradation was better or worse depending on the lighting conditions on each location, being that locations with High-Intensity Discharge (HID) lamps, especially sodium-based ones (both HPS and LPS) produced the most degraded streams.

Before diving into the details of the results, we observed some general trends that, although expected, should be mentioned.

1. There is a significant reduction in traffic volume during nighttime hours, a trend that aligns with expectations for residential zones and their access routes, such as those under study.
2. There is less traffic during weekends and holidays. This difference is smaller than the one observed between daytime and nighttime, but the trend is clear.
3. Rush hour traffic is very common in cities and their suburbs and quite noticeable from the gathered data across all locations. Data shows a peak in traffic volume for a period in the morning (from 7 am to 9 am) and in the afternoon (from 4 pm to 7 pm).

## 5. Comparing Locations

The comparison between traffic flow on different locations is a good source of information to understand the quality of our results and to highlight the diverse behaviours of traffic on different scenarios. Considering locations L1 to L3, we have:

- L1 is a national road that connects to the main accesses to and from the Lisbon metropolitan area, and as such is expected to have the highest traffic volume.
- L2 is a national/large road expected to have high volume of traffic, although less than in L1.
- L3 is a residential area and therefore should have the lowest traffic volume values.

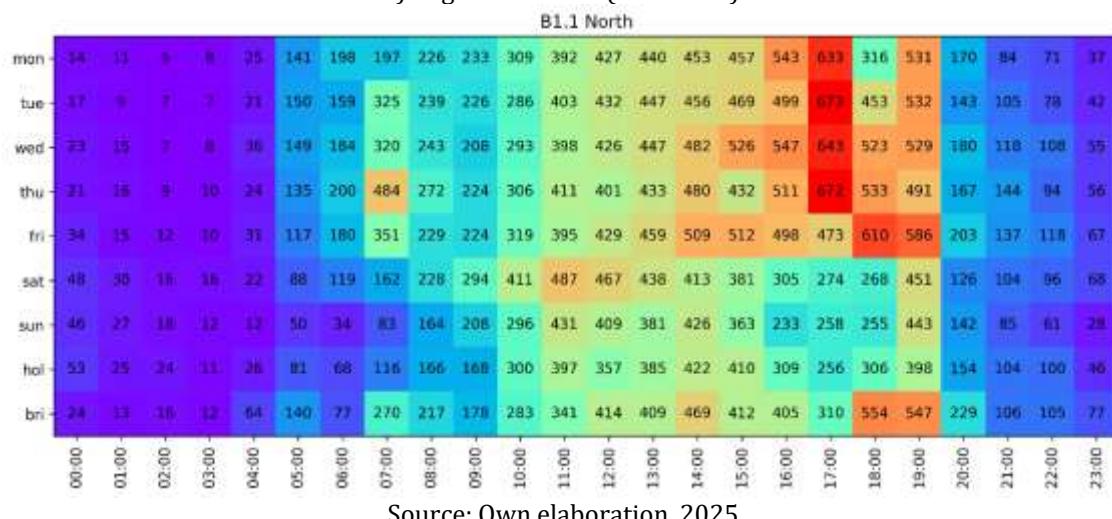
This difference in the scenarios is observed from our results, also validating the expectations as follows:

- L1 and L2 show peaks of traffic volume in the order of 600 to 1000 cars per hour, while in L3, the traffic volume values go beyond 500 only for barrier B3.3, being around 200 to 300 for all the others.

- Between, L1 and L2, the difference between high and low volume of traffic is also observed: barriers in L1, and barriers B2.1 and B2.3 show much larger traffic volumes than barrier B2.2, since this last one is already a tertiary road inside a residential area.
- The overall higher volumes are observed for L1.

Detailing further the residential area (L3) which includes a roundabout with four exits and a small intersection. The patterns observed here are heterogeneous between the barriers since we are monitoring several relatively small streets with high traffic. In addition, the camera perspectives are also heterogeneous for this location which might affect the obtained results (the evaluation of this effect is beyond the scope of this work). There are, however, some interesting details, that further support the quality of this solution. For example, on barrier B3.2 an abnormal peak is observed going North on Saturdays. This peak is similar to the values observed for the rush hour, although a bit later (the peak goes until 11am) which probably corresponds to cars going to the shopping centre that is located a few meters North from the roundabout.

**Figure 1.** Colour code representation of median values of traffic per hour for all weekdays ('hol' stands for national holidays and 'bri' for days between holidays and weekends). Colour code goes from blue (less cars) to green and red (more cars).



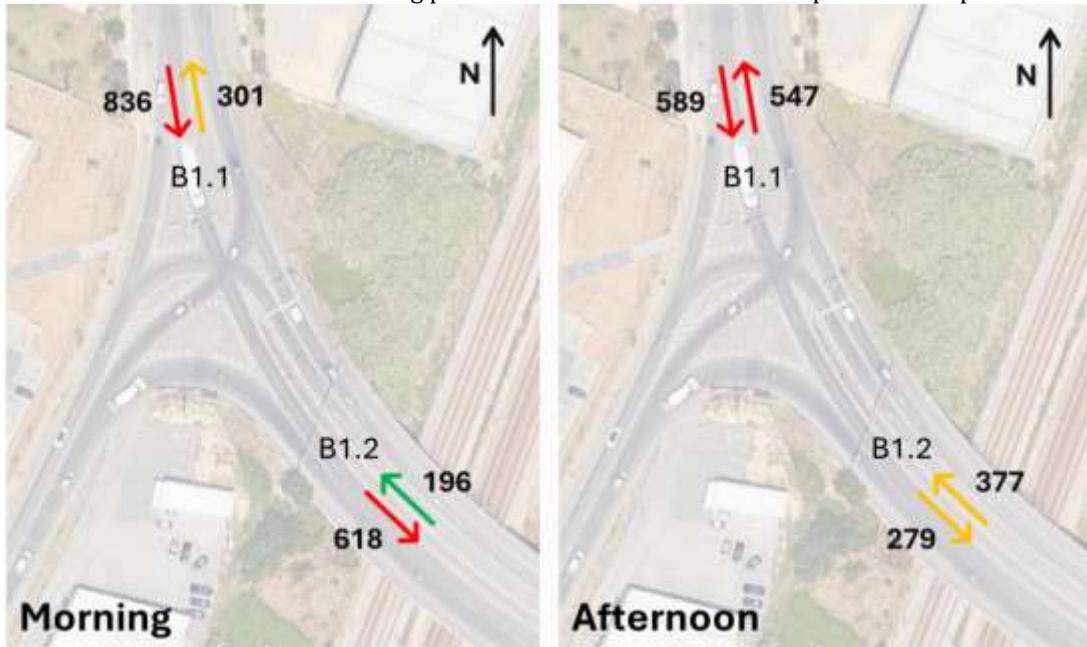
Source: Own elaboration, 2025.

## 6. Rush hour

Rush hour traffic is visible, in the morning and afternoon of weekdays, for all the barriers as indicated by the red zones in the heatmaps (example on Figure 1, more on Figure S2). This effect is more evident on Tuesdays, Wednesdays, and Thursdays probably because people commute from their homes nearer to their workplaces as opposed to Mondays and Fridays that, being closer to the weekends, allow people to travel to/from different places and/or at different times (for example, beach/country house).

The heatmaps data also shows that rush hour traffic typically changes from morning to the afternoon in the same place, but opposite direction. For example, for B1.1 North the red heatmap cells are in the afternoon whereas for South these are observed in the morning. From these results, the specific traffic observed during rush hour was computed by calculating the median values of cars per hour for both morning (7 am to 9 am) and afternoon (4 pm to 7 pm) periods (Figure 2- Figure 4).

**Figure 1.** Comparison between morning and afternoon traffic during rush hours for location L1. Barrier names and median traffic counting per hour for each direction are depicted in the pictures.



Source: own elaboration, 2025.

As mentioned, L1 is a large road with a lot of traffic with significant differences between morning and afternoon (Figure 2). In the morning, most vehicles are going south in both barriers. This tendency is partially inverted in the afternoon. For B1.2 there are more vehicles going North, whereas, for B1.1, this is not observed, but there is a decrease in the vehicles going South and an increase in the other direction. These observations confirm that we captured the effect of the rush hour, and that this is an area with high traffic volumes that are maintained beyond 7 pm.

**Figure 2.** Comparison between morning and afternoon traffic during rush hours for location L2. Barrier names and median traffic counting per hour for each direction are depicted in the pictures.

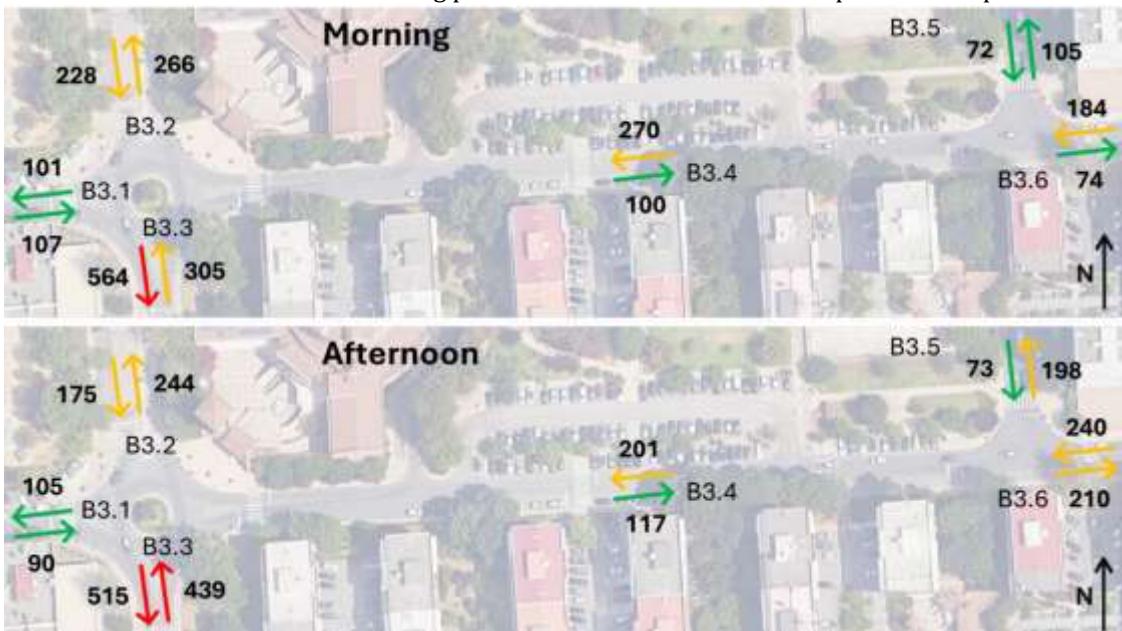


Source: Own elaboration, 2025.

L2 is also a location with high traffic volume, but adjacent to a residential area. For these reasons, the rush hour tendency (Figure 3) is similar to the observed for L1 (the trend is inverted between the morning and the afternoon). However, being already inside a residential area, B2.2 show much less traffic than the two others and the inversion is not evident in this case, hinting

that mainly residents use this route. Interestingly, there is a very large difference between the counting going North on B2.3 and B2.1 (587 -> 316 in the morning and 998 -> 281 in the afternoon), indicating that most cars are turning West on this intersection. The same being true in the counting going South, which are much bigger for B2.3 than B2.1 suggesting that some of these cars may come from West.

**Figure 3.** Comparison between morning and afternoon traffic during rush hours for location L3. Barrier names and median traffic counting per hour for each direction are depicted in the pictures.



Source: Own elaboration, 2025.

The residential area (L3) also shows the same inversion related with the rush hours for most barriers (Figure 4). However, this effect is not so evident as in the first two locations probably for the same reasons mentioned above (heterogeneous type of intersections and camera angles). In these areas, particularly during rush hours, people tend to try different (and unexpected) routes to avoid traffic jams most likely taking different options in the morning and in the afternoon. Despite the higher complexity of this location, there are some observations that match the expected behaviour such as: B3.3 in the morning shows much more traffic going South (going away from the residential area), and B3.5 in the afternoon shows much more traffic going North (coming back from work).

## 7. Noise pollution during the night

According to the Environmental Noise Directive, environmental noise is described as unwanted or harmful sound derived from human activities, including noise emitted by means of transport — road traffic, rail traffic, air traffic, and from sites of industrial activity (Directive 2002/49/EC 2002). This directive points to road traffic noise as the predominant source of day-evening-night noise (Arregi et al., 2024). For locations L4 to L9, where devices were only powered during the night (in agreement with the public lighting schedules) the volume of traffic was compared (see Table 1) between three defined periods:

- Early night period: from 9 pm to 11 pm
- Night period: from 2 am to 4 am
- Early morning period: from 5 am to 6 am.

The number of cars follows the expected trend, of more cars being observed for the early night hours when compared to night and early morning periods. The values obtained for early morning periods are smaller than during the night, suggesting that larger traffic volumes start after 7 am.

The only location where this is not observed is L9, however the numbers are too small, and the difference is not significant (2 -> 5). The magnitude of the computed values is also as expected; locations L4 to L6 have more traffic volume since they are all close to entry points in the city. On the other hand, the numbers are much smaller for locations L7 to L9 since these are closer to residential areas. This allows us to infer that, inside residential areas, traffic generated noise pollution is not a concern, and residents are able to enjoy a peaceful and quiet night.

It is worth noting that, for L7, the poor lighting conditions (old sodium-based luminaires) affect the results and may explain the very small numbers observed for this location).

**Table 1.** Median traffic counting per hour for locations L4-L9 for early night, night, and early morning.

Location	Early night	Night	Early morning
<b>L4</b>	436	48	15
<b>L5</b>	254	14	4
<b>L6</b>	178	11	3
<b>L7</b>	20	2	2
<b>L8</b>	6	4	2
<b>L9</b>	34	2	5

Source: Own elaboration, 2025.

## 8. Conclusion

In conclusion, this work presents a successful implementation of an AI-powered edge computing device for measuring traffic flow in key intersections based on vision sensors. The solution was tested in three municipalities, covering nine (9) intersections, and the results show that it is suitable for traffic monitoring. The data collected can be used as a source of information for future projects in the locations studied. The solution was able to capture the effect of rush hour traffic and provide valuable insights into traffic flow patterns. Additionally, the solution was able to retrieve meaningful data during both day and night, demonstrating its feasibility.

Overall, this project represents a step towards the development of a new paradigm of connected urban infrastructure for the implementation of smart city technologies.

## 9. Acknowledgements

The present text arises within the framework of Project Magellan, financed through the PT2020 framework, managed by the POR Lisbon management board, supported by the European Regional Development Funds, that ran from July 1, 2020 to September 30, 2023. We would like to thank all the contributors and institutions involved in this project, especially the municipalities of Loures, Oeiras and Cascais for their support and collaboration.

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## 10. Supporting Information

### 10.1. Locations

**Fig S1:** Satellite (google maps) view of location L1. Magenta bars represent the places where the traffic flow was measured.



Source: Own elaboration, 2025.

**Fig S1 (cont.):** Location L2.



Source: Own elaboration, 2025.

**Fig S1 (cont.): Location L3.**



Source: Own elaboration, 2025.

**Fig S1 (cont.): Location L4**



Source: Own elaboration, 2025.

**Fig S1 (cont.): Location L5.**



Source: Own elaboration, 2025.

**Fig S1 (cont.):** Location L6.



Source: Own elaboration, 2025.

**Fig S1 (cont.):** Location L7.



Source: Own elaboration, 2025.

**Fig S1 (cont.):** Location L8.



Source: Own elaboration, 2025.

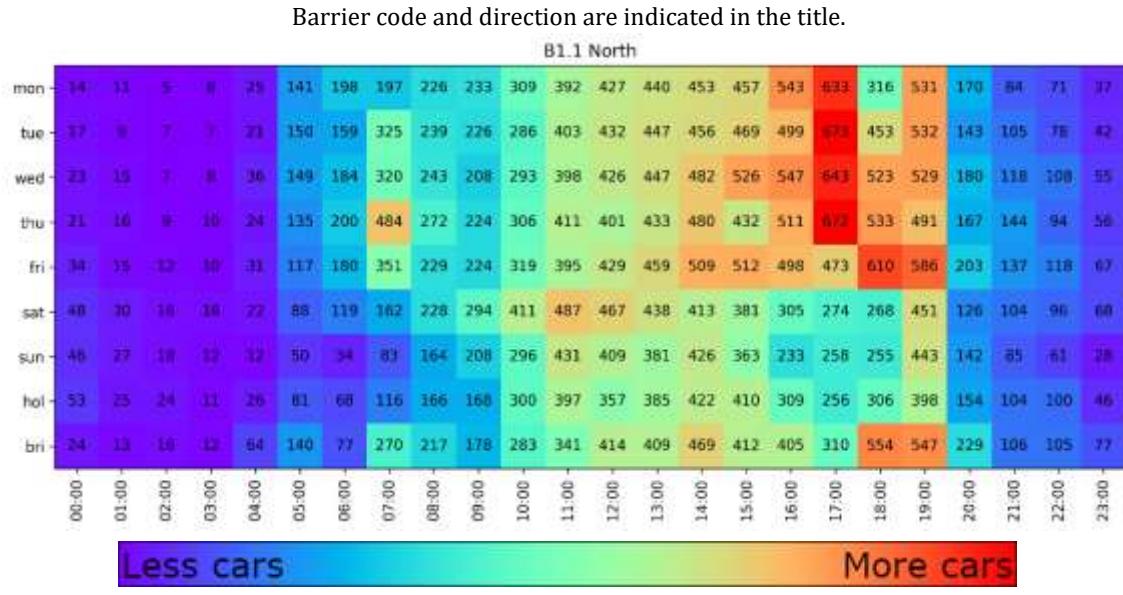
**Fig S1 (cont.): Location L9.**



Source: Own elaboration, 2025.

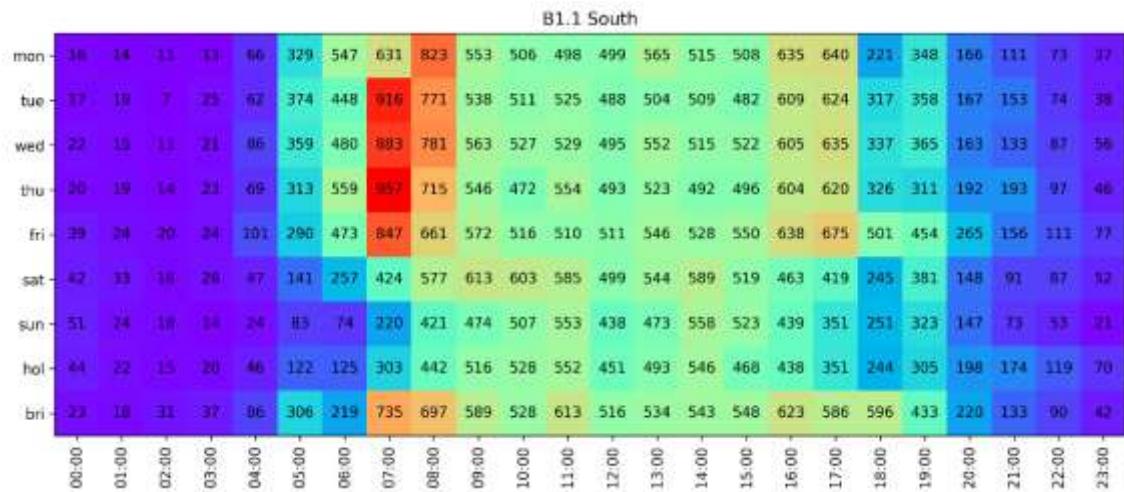
### 10.2. Traffic Charts Per Barrier

**Figure S2:** Colour code representation of median values of traffic per hour for all weekdays (“hol” stands for national holidays and “bri” for days between holidays and weekends). Colour code goes from blue (less cars) to green and red (more cars). The colour scale changes for each location (since the counting change as well). Barrier code and direction are indicated in the title.



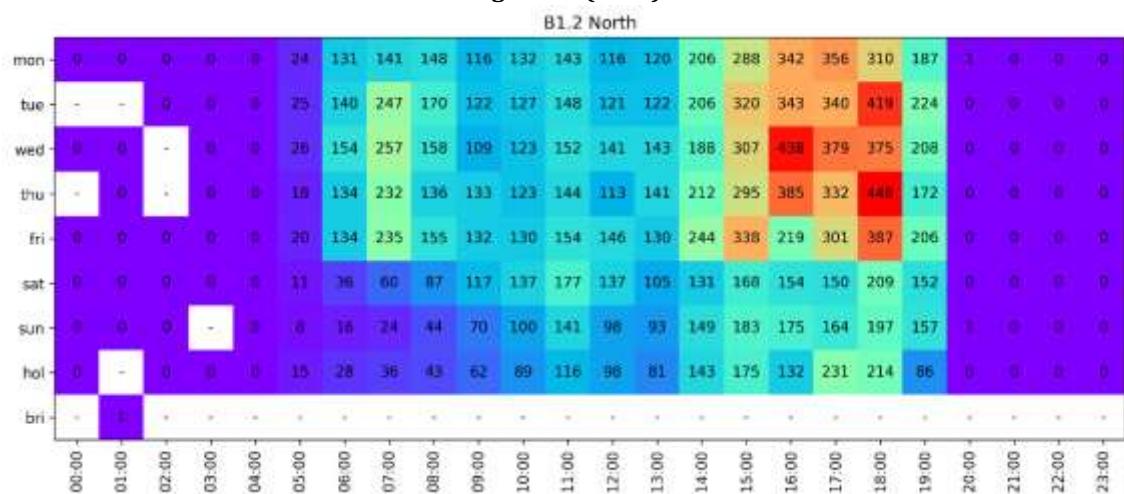
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



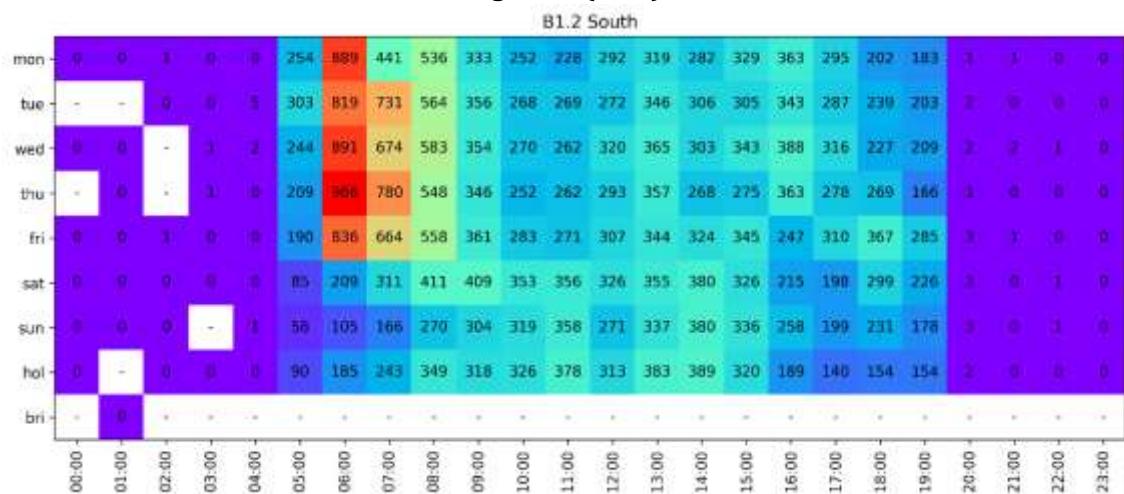
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.

**Figure S2 (cont.).**

B2.1 North

mon	17	10	14	33	46	254	324	142	308	345	325	304	291	296	290	226	253	294	262	220	120	78	52	29
tue	17	6	13	37	53	265	315	298	337	388	318	290	288	284	289	260	312	297	244	256	177	93	74	34
wed	36	9	18	21	44	257	342	299	331	393	335	309	335	330	298	266	315	321	226	231	137	110	72	54
thu	17	11	13	28	50	269	317	303	333	414	362	326	326	294	282	194	273	315	245	218	131	114	75	31
fri	26	14	16	17	42	225	329	311	349	404	369	306	307	314	275	281	318	324	276	286	153	128	94	72
sat	44	33	29	38	39	131	262	347	454	479	463	398	355	408	384	301	305	305	302	249	123	135	101	71
sun	41	30	21	17	26	183	129	193	284	322	341	387	308	314	351	233	258	231	228	202	124	115	65	27
hol	45	31	20	38	59	130	205	246	304	316	304	300	315	372	406	108	211	208	229	196	110	101	60	42
bri	36	14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

B2.1 South

mon	38	17	12	39	28	101	228	104	170	209	220	234	261	241	254	220	253	302	340	309	192	159	128	88
tue	31	17	18	33	27	115	207	241	209	186	196	224	232	234	247	280	260	312	356	386	236	190	162	101
wed	38	16	9	33	28	112	191	236	201	227	235	269	252	245	239	257	286	324	361	383	240	180	181	139
thu	44	30	10	14	21	95	205	230	204	214	209	241	226	206	230	229	296	343	372	368	253	207	171	94
fri	49	21	14	17	30	108	235	258	200	228	240	263	244	243	259	237	276	326	342	325	236	193	208	151
sat	85	58	31	30	34	85	122	185	215	239	246	310	281	238	255	252	308	359	344	309	221	206	194	138
sun	83	46	37	23	25	39	58	97	130	185	210	253	237	178	254	184	323	342	327	320	220	151	119	63
hol	124	55	45	40	64	69	130	139	133	135	184	240	214	188	265	120	274	296	324	277	184	166	166	114
bri	36	22	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

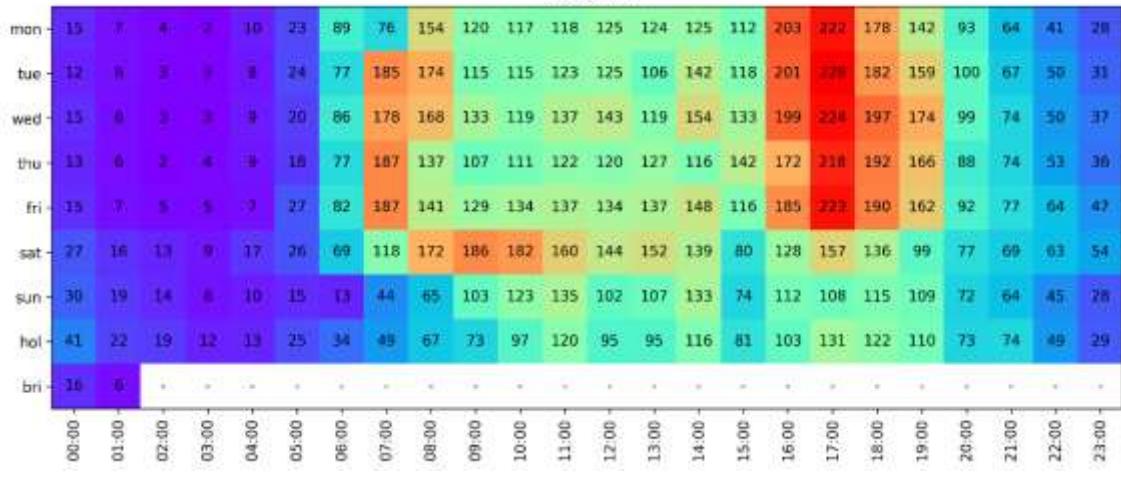
B2.2 East

mon	2	0	2	3	5	28	119	89	113	73	67	71	88	82	78	91	153	186	131	88	32	20	6	7
tue	11	1	3	0	4	30	122	196	127	78	72	82	82	77	94	76	170	179	135	102	32	21	8	4
wed	4	0	1	3	3	23	125	188	117	77	73	83	96	82	94	75	160	186	156	97	36	21	11	7
thu	1	2	1	2	8	30	117	175	82	78	66	78	90	76	75	91	173	169	135	82	38	28	14	5
fri	1	0	1	1	5	34	138	171	112	89	82	84	92	85	95	76	156	185	143	109	36	20	9	7
sat	6	4	7	0	2	19	45	79	109	136	132	110	85	93	96	51	88	77	70	68	24	15	12	13
sun	8	2	2	3	3	13	23	30	50	69	74	84	66	62	71	50	66	61	70	61	23	16	9	5
hol	22	7	6	2	3	33	34	42	66	65	78	92	60	54	61	44	58	50	73	67	26	10	13	8
bri	1	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

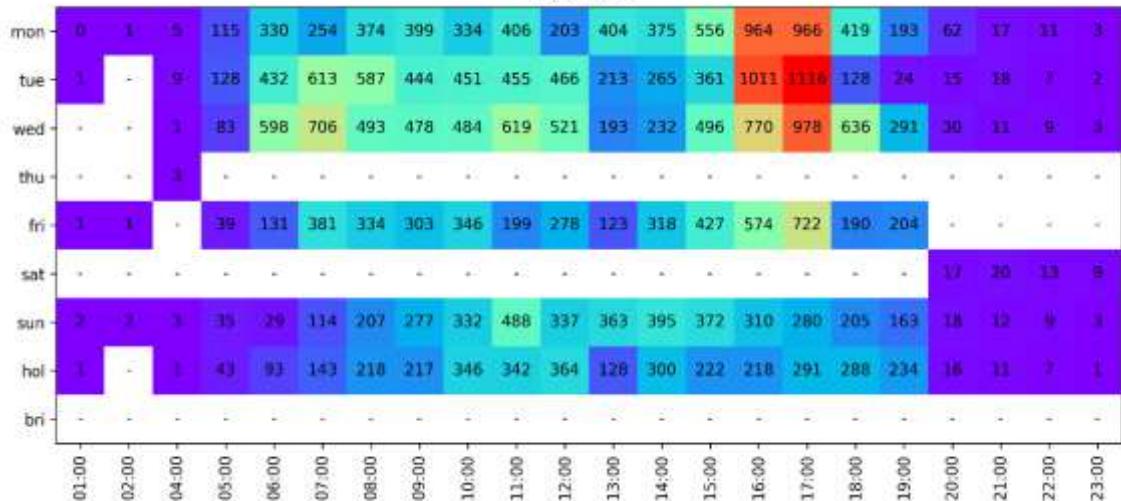
B2.2 West



Source: Own elaboration, 2025.

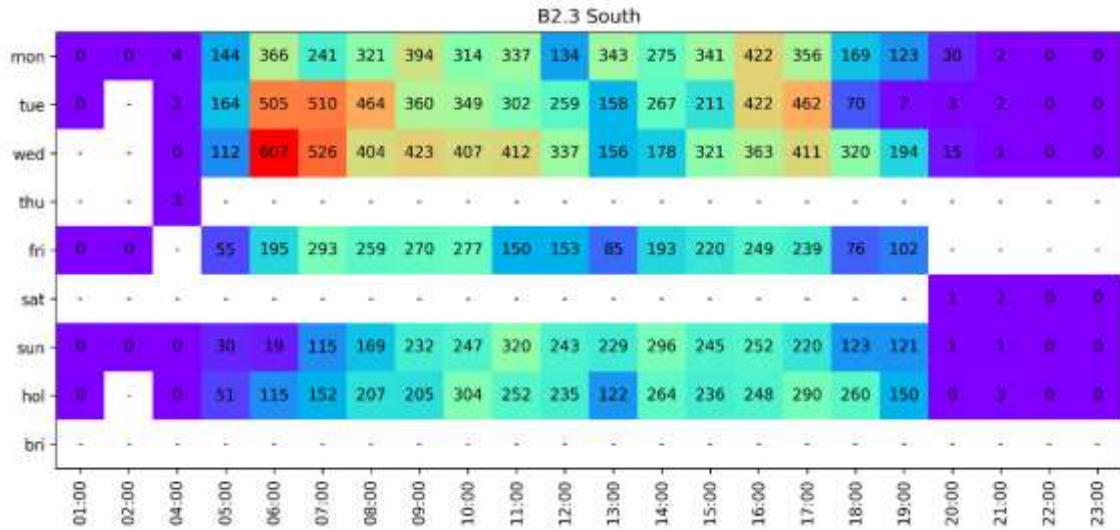
**Figure S2 (cont.).**

B2.3 North



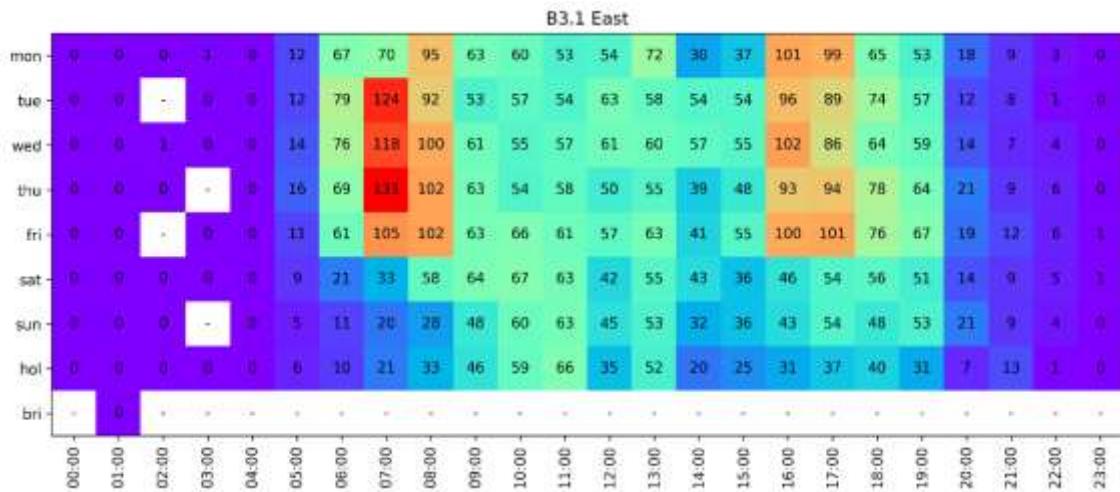
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



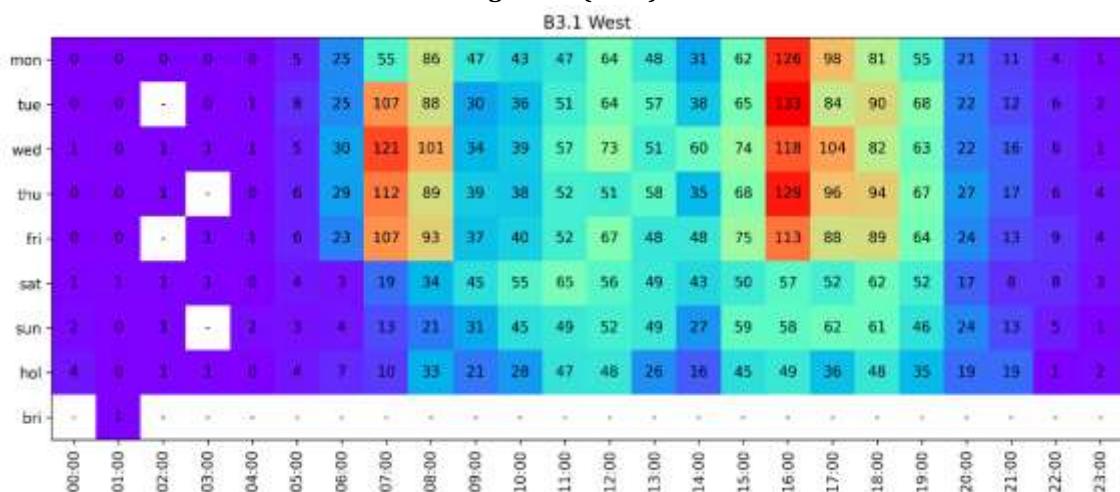
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.

**Figure S2 (cont.).**

		B3.2 North																							
		00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
mon	3	2	3	3	3	20	93	179	246	156	104	97	153	151	131	181	241	281	164	183	101	61	31	15	
tue	3	2	3	3	4	22	121	259	255	144	81	119	151	168	163	219	246	285	172	195	90	65	36	19	
wed	3	3	2	3	3	15	122	269	269	145	119	149	191	150	156	181	239	221	244	189	67	55	43	27	
thu	3	1	4	3	5	22	133	239	260	179	102	129	134	123	180	153	273	270	264	174	90	74	41	22	
fri	0	3	3	2	6	19	70	270	278	152	157	194	202	193	170	199	231	241	177	194	102	77	54	31	
sat	14	0	3	3	9	25	47	109	233	267	202	147	134	162	119	128	140	125	113	139	66	49	46	26	
sun	13	10	4	3	7	14	28	62	126	148	114	106	102	112	113	104	99	117	102	117	74	57	31	12	
hol	18	2	5	3	8	27	36	72	133	107	98	133	116	121	116	132	87	118	117	116	73	53	24	9	
bri	0	0	3	0	14	38	75	247	248	159	113	122	191	159	134	183	204	205	137	177	98	80	54	38	

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

		B3.2 South																							
		00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
mon	3	2	3	2	4	13	140	178	153	130	113	118	129	112	105	111	205	182	96	115	64	46	17	11	
tue	3	1	9	3	4	20	146	252	175	116	128	125	146	119	118	148	206	183	107	125	55	38	21	8	
wed	4	3	1	3	3	13	124	247	193	125	122	143	141	119	123	139	189	162	130	113	60	42	28	15	
thu	8	2	1	2	5	14	152	267	181	128	127	142	135	119	103	128	204	154	171	124	76	47	29	10	
fri	5	3	1	3	3	12	91	211	171	118	127	153	129	140	102	153	200	154	134	146	76	46	28	21	
sat	14	0	4	4	7	10	28	64	102	152	166	149	124	94	103	118	128	86	80	87	50	45	28	18	
sun	11	3	5	5	3	8	14	38	64	106	112	134	84	77	79	83	90	76	65	69	56	41	25	10	
hol	13	6	4	3	8	11	22	47	86	115	132	116	103	98	76	79	95	82	68	62	49	35	21	8	
bri	3	1	2	3	4	10	104	173	161	110	128	118	151	132	86	99	171	135	107	99	79	64	38	24	

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

		B3.3 North																							
		00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
mon	8	7	2	3	4	39	134	215	261	214	192	198	254	222	123	271	474	488	395	252	96	65	34	9	
tue	7	2	3	2	5	36	131	315	275	206	206	212	241	218	176	335	453	464	406	287	109	76	46	32	
wed	3	1	4	3	3	33	147	323	287	214	216	239	284	248	228	340	447	488	422	260	98	63	43	22	
thu	4	3	2	3	4	37	149	325	283	205	215	231	269	209	189	337	453	460	417	268	114	83	44	18	
fri	5	4	3	3	5	41	135	332	275	229	217	265	299	270	212	341	447	439	386	275	135	97	69	33	
sat	13	13	6	5	8	31	50	115	201	254	267	251	222	205	164	253	266	247	229	214	89	73	54	30	
sun	16	9	8	4	6	27	34	65	126	178	203	198	195	172	154	202	232	262	216	174	79	59	33	12	
hol	21	6	5	3	3	45	65	72	123	170	181	223	159	163	93	179	214	192	185	161	77	74	35	12	
bri	7	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

	B3.3 South																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
mon	0	1	0	3	4	89	387	497	439	301	296	309	273	224	127	356	560	550	454	326	56	29	14	4
tue	2	1	9	0	3	87	432	699	432	304	295	240	264	220	201	428	545	583	474	318	59	32	18	4
wed	0	0	0	0	1	66	449	710	447	292	296	312	302	250	267	414	512	526	477	349	67	38	20	6
thu	3	2	1	3	1	69	429	664	445	345	301	312	273	234	216	457	572	534	492	357	69	44	14	6
fri	1	2	3	3	3	59	389	648	393	288	293	330	327	263	197	481	525	538	471	446	77	42	29	11
sat	4	1	2	0	4	35	95	195	270	331	331	345	273	201	209	319	338	323	337	283	57	39	19	9
sun	5	1	2	3	3	28	62	100	176	254	282	306	224	179	174	280	300	309	329	259	68	33	18	5
hol	3	2	0	1	4	36	85	113	180	218	287	290	229	222	111	210	229	288	295	173	35	26	16	5
bri	2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Own elaboration, 2025.

**Figure S2 (cont.).**

	B3.4 East																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
mon	0	0	0	0	0	14	37	39	90	63	54	31	30	44	61	81	125	95	115	84	14	11	2	0
tue	0	0	0	0	0	16	43	95	98	69	54	28	54	46	74	93	112	103	141	101	23	12	2	0
wed	0	0	0	0	0	13	43	93	106	63	63	49	58	69	79	91	115	114	142	101	24	12	2	0
thu	0	0	0	0	0	12	47	119	108	69	70	45	41	50	77	88	109	128	159	96	27	13	3	0
fri	0	0	0	0	0	16	43	79	93	75	63	61	37	75	91	95	126	119	124	96	27	16	3	1
sat	0	0	0	0	0	9	20	33	64	81	79	66	59	57	68	72	80	71	85	68	16	10	3	0
sun	0	0	0	0	0	6	9	17	37	52	64	65	61	56	66	61	63	62	80	78	17	13	2	0
hol	0	0	0	0	0	14	17	23	34	57	61	68	37	62	51	47	44	67	74	22	8	2	0	0
bri	0	0	0	0	4	15	33	81	74	53	59	74	61	62	69	68	77	58	93	115	41	13	4	1

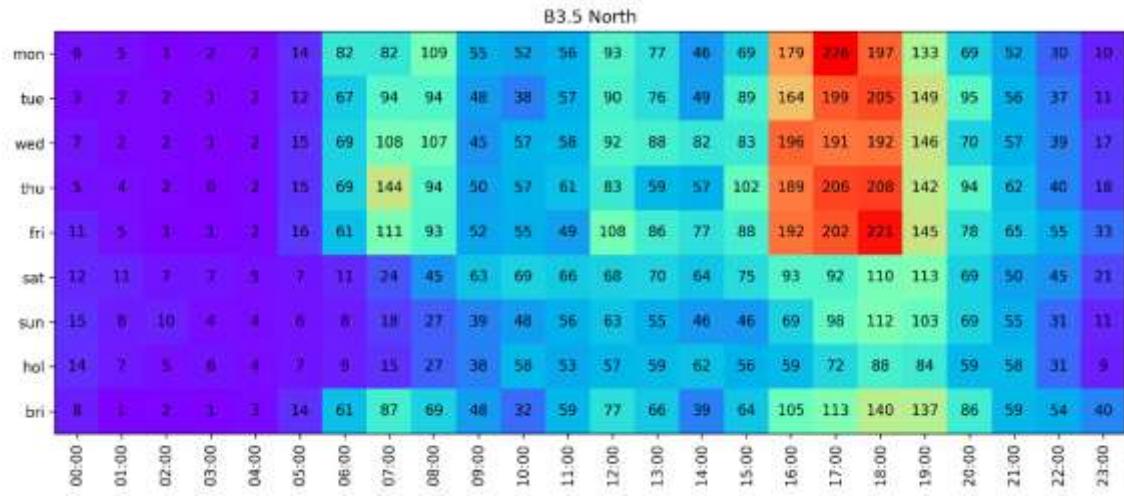
Source: Own elaboration, 2025.

**Figure S2 (cont.).**

	B3.4 West																							
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mon	2	1	3	2	2	23	133	118	247	170	136	127	107	144	158	174	201	136	212	144	69	46	27	3
tue	2	0	0	0	2	26	167	297	241	166	170	149	151	136	156	185	193	124	219	155	73	50	27	7
wed	1	3	0	0	3	26	162	305	263	177	159	173	184	173	152	197	215	125	242	160	79	55	33	12
thu	1	1	0	0	3	29	159	322	245	174	156	149	160	137	150	165	211	131	238	180	81	65	32	9
fri	2	0	3	1	3	24	142	213	245	178	170	161	146	162	191	213	216	159	267	191	88	60	47	19
sat	0	2	2	2	2	15	46	82	152	200	201	202	150	147	151	129	112	87	148	121	80	49	34	14
sun	3	3	3	3	2	12	27	38	79	130	163	177	136	111	124	117	99	56	123	95	61	52	22	6
hol	3	0	3	3	3	18	40	68	107	140	146	170	137	80	124	98	79	55	124	96	62	41	26	11
bri	1	0	1	2	8	25	126	259	229	154	185	152	126	142	135	152	182	80	170	145	96	70	67	33

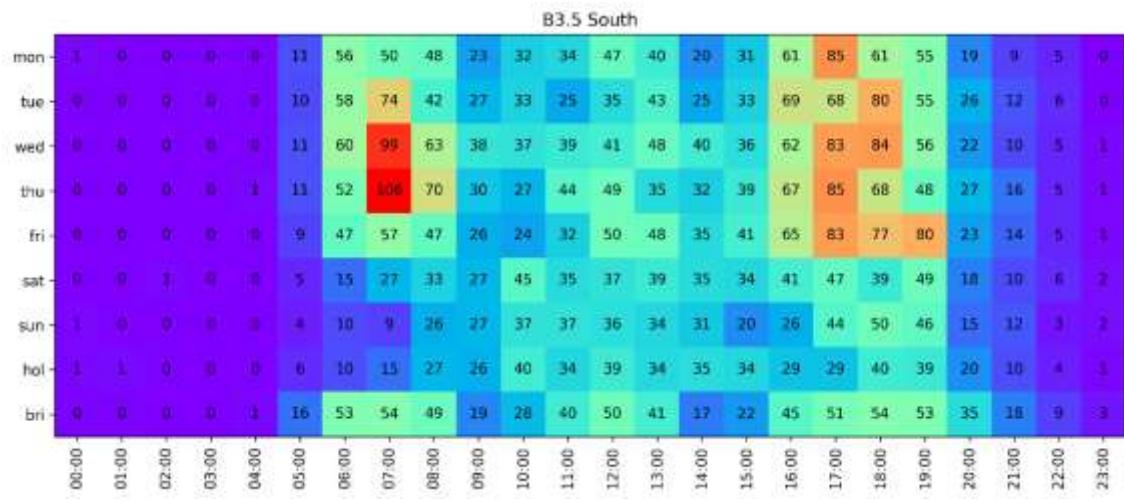
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



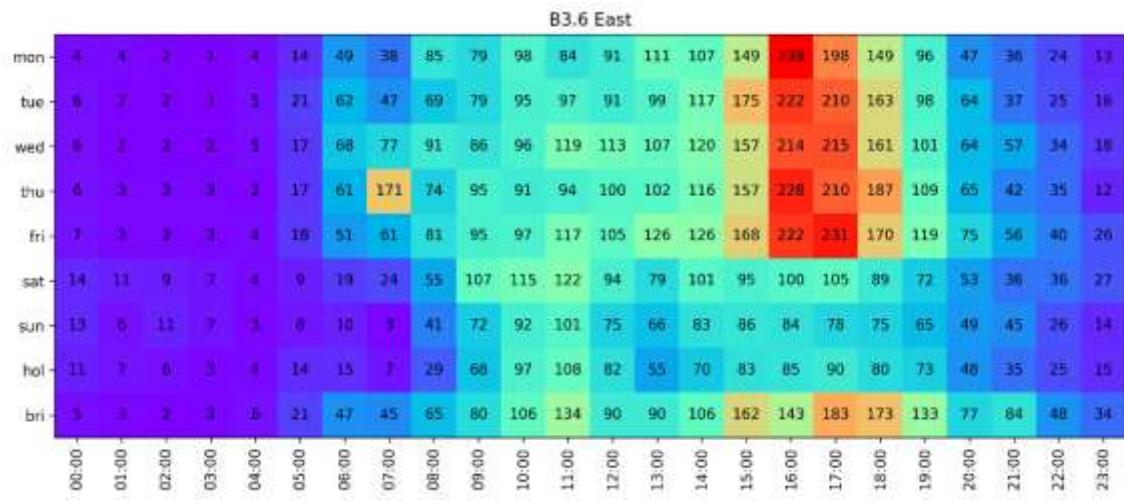
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



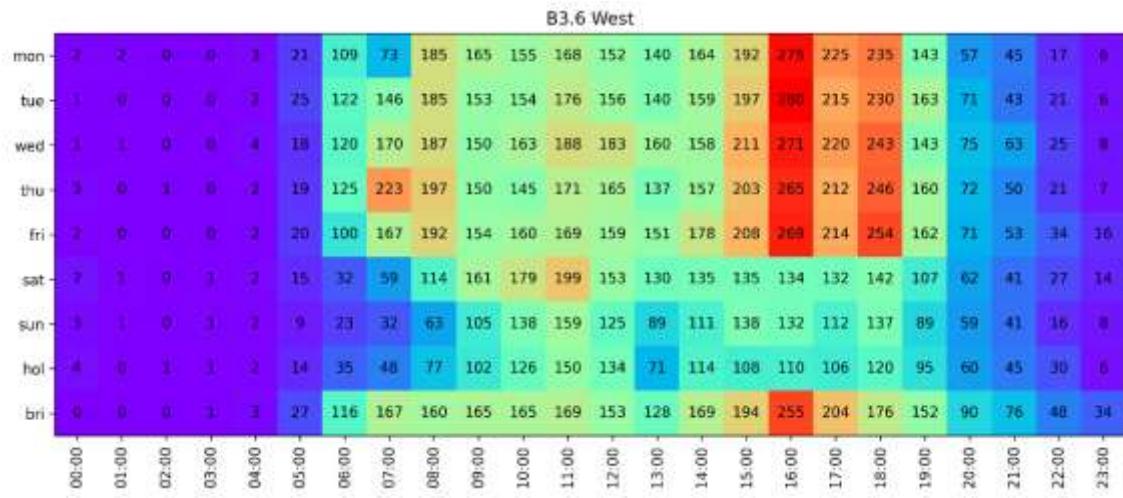
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



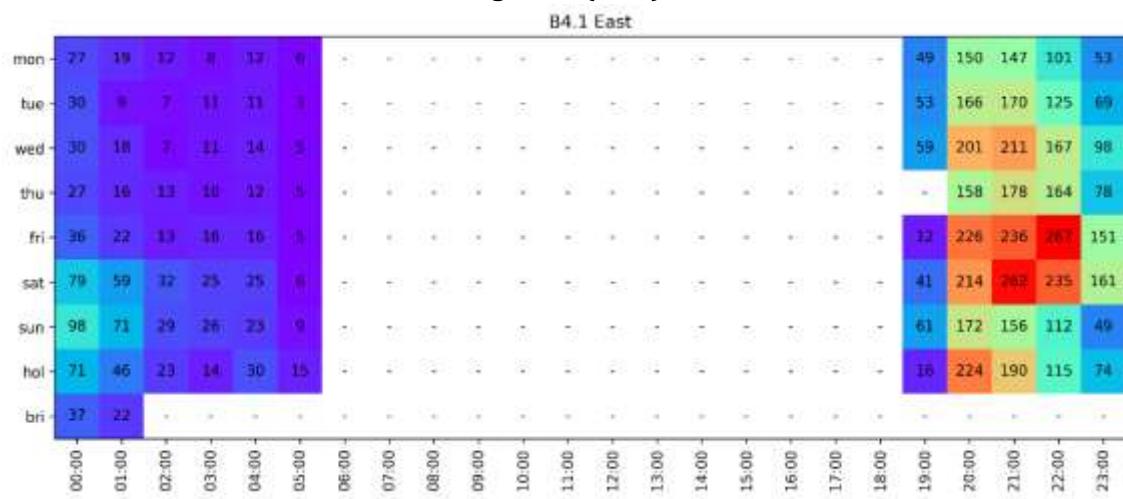
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



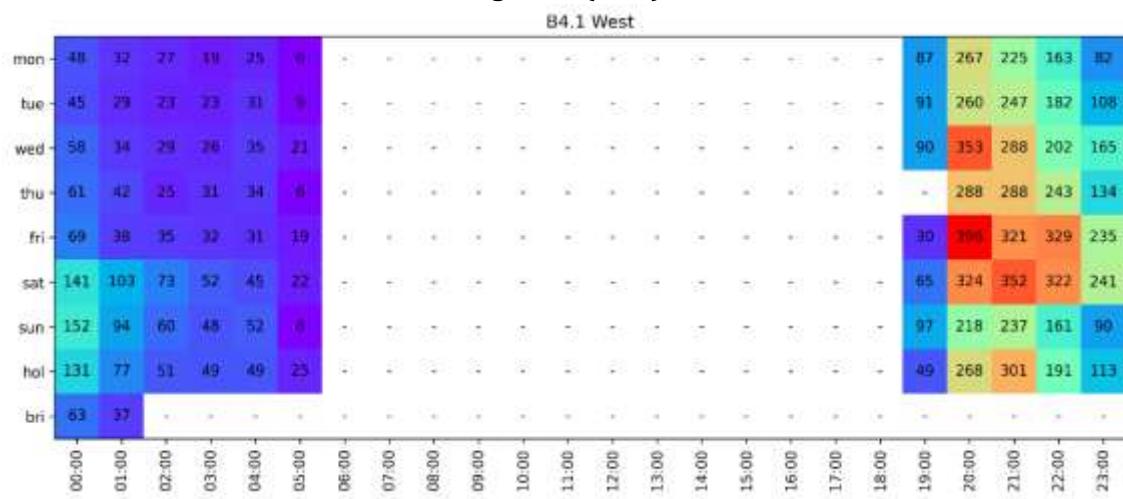
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



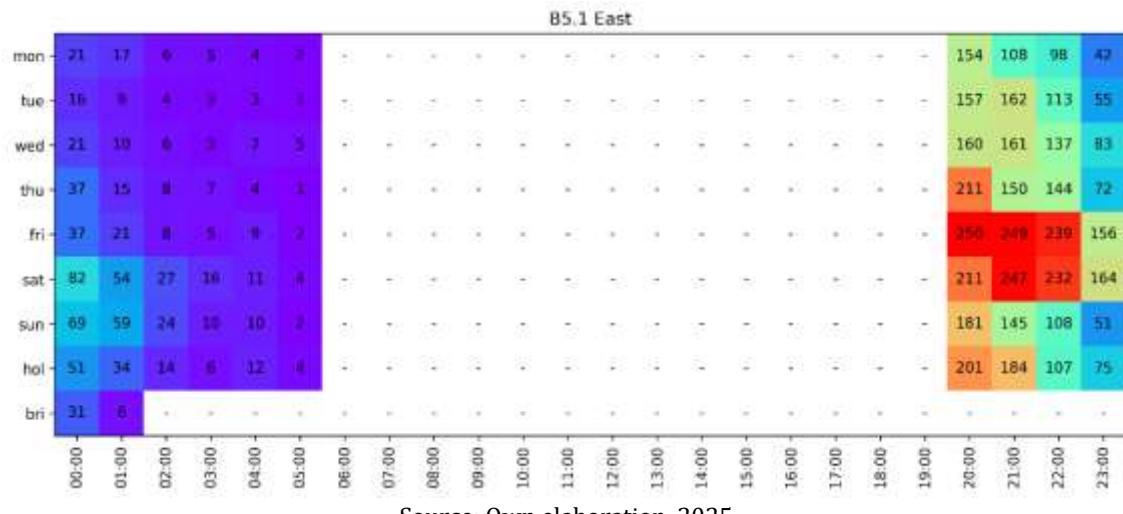
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



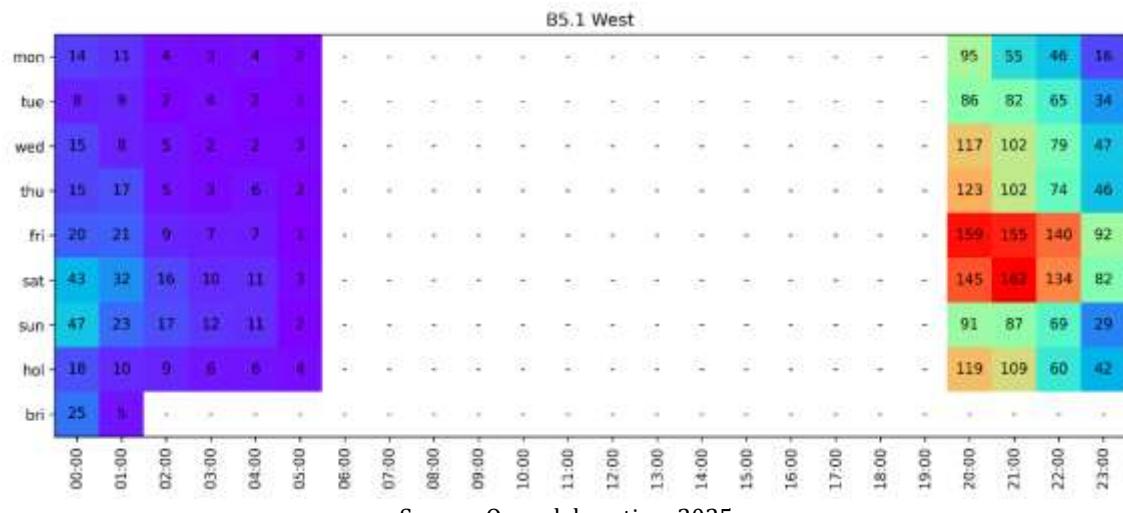
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



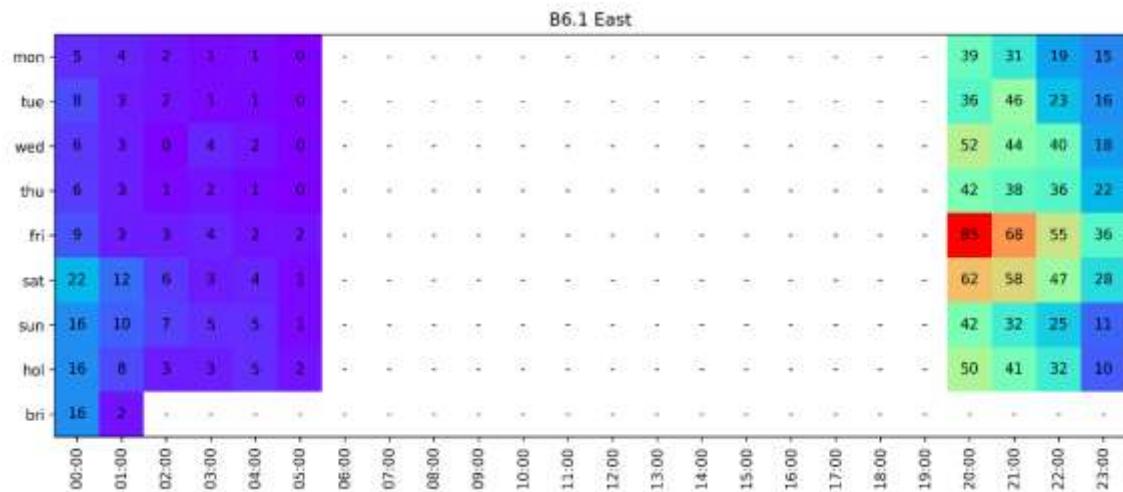
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



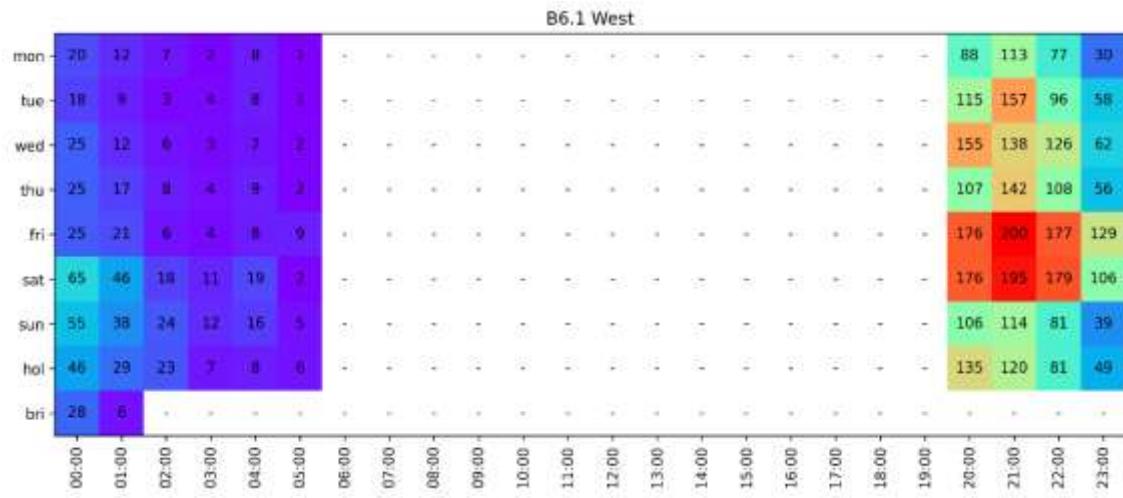
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



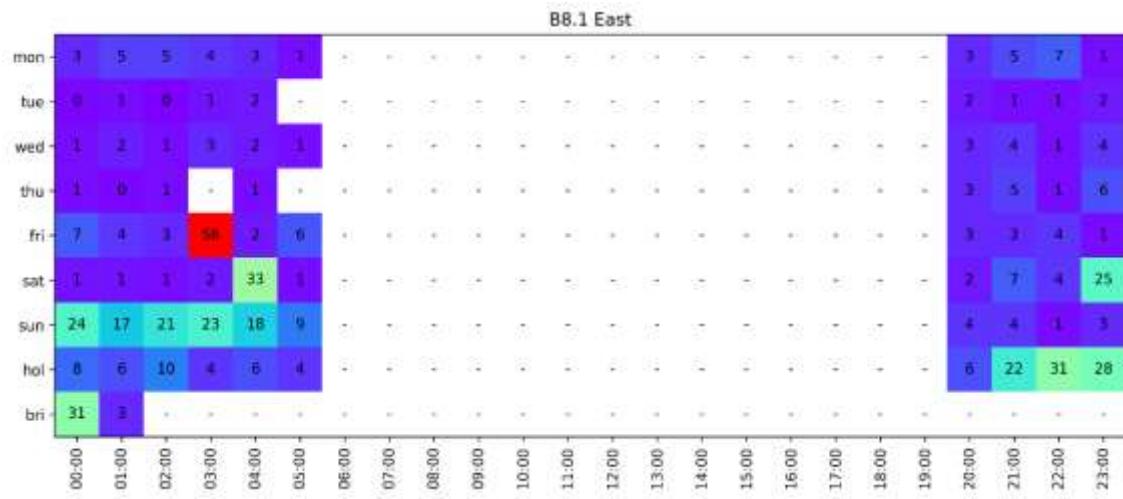
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



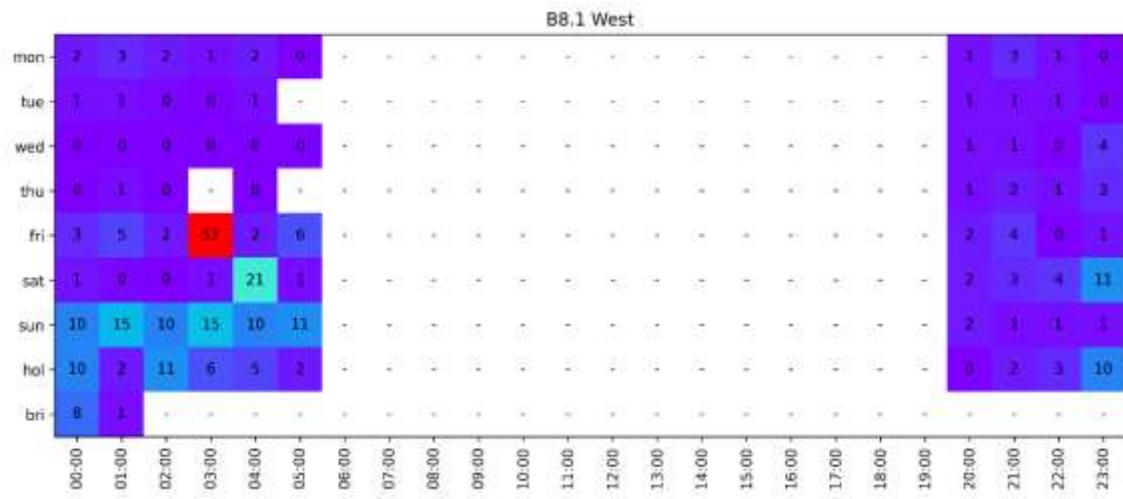
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



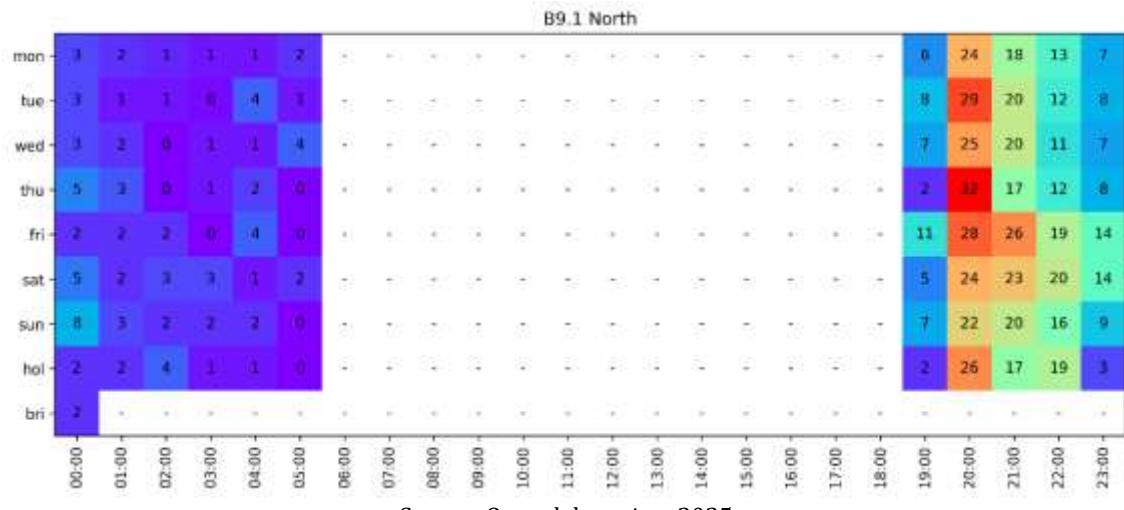
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



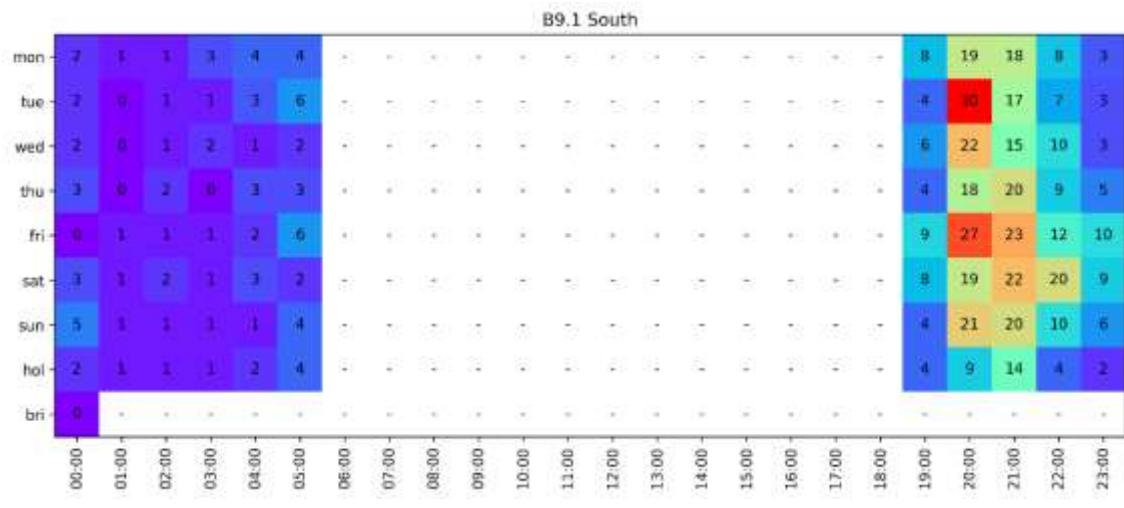
Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.

**Figure S2 (cont.).**



Source: Own elaboration, 2025.