NomadCurb — LiDAR-based loading area & traffic analysis

Location: Fredikinkatu 61, Fabianinkatu 29 and Aleksanterinkatu
Target users: Users of the loading zones
Company: Flow Analytics by AGC
Partners: Local partners for installation

- **The main objective was to** measure the usage of loading zones
- We used LiDAR to measure the usage of loading zones. At the same time, we also monitored the surrounding traffic, including cars, two-wheelers, and pedestrians.
- We received detailed data on the usage of the loading area, including the types of vehicles that were parked there. In addition, we obtained information on nearby traffic — pedestrians, two-wheelers, and vehicles — including counts and origin-destination data. The results are presented at the end of the presentation.

NomadCurb

LiDAR-Based Loading & Traffic Analysis

Funded by
the European Union

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1. Goal(s) of the pilot

- **Use of loading zones:** Information on how loading zones are used at different times of day and on different days of the week. Includes usage rate, average parking duration, number of stops during a selected time period, and the distribution of vehicle types.
- **Validation of technical implementation:** Ensures that the new battery-powered measurement unit operates reliably in field conditions. The device is designed for installation without a lift, using an integrated mast (~4 meters high). This easier and faster installation method reduces costs without compromising measurement accuracy.
- **Testing LiDAR suitability:** Verifies the applicability of LiDAR-based solutions for measuring loading zones and surrounding traffic. Data collected during the pilot will show whether the system provided sufficiently accurate information for vehicle identification and usage rate analysis in various urban environments.

2. Description of the solution

Flow Analytics Mobile Unit is a battery-powered LiDAR measurement station that is locked onto a lamppost or traffic sign pole. Installation requires no lift, power connection, or data cabling. The unit's built-in telescopic mast raises the LiDAR sensor to approximately four meters.

Key features:

- **Weather-resistant design:** Equipped with a 360° 3D LiDAR sensor and an edge computing unit that processes and transmits data directly to the cloud. Tested in both the winter conditions of Oulu and the heat of Dubai.
- **Mobile and quick to deploy:** Lightweight and easy to relocate. No external power or cabling required.
- **Accurate 3D data:** Enables vehicle identification, precise position tracking, and real-time monitoring of loading zone usage.
- **Cloud integration:** Anonymous traffic data is securely transmitted to the AWS cloud via mobile connection and made available through the Flow Analytics dashboard. Data can also be downloaded for city-specific analysis.
- **Comprehensive traffic view:** The dashboard provides insights not only into loading zone usage, but also surrounding traffic volumes, vehicle types, and behavior.

3. Implementation

Installation:

- Obtaining the installation permits went smoothly. The installation itself was a quick operation, even though it was still a prototype.

Locations:

- We installed the Mobile Unit at two locations: Fredrikinkatu 61 and Fabianinkatu 29. From the second location, we were able to monitor two loading zones — another of them is notably large, approximately 20 meters in length.

Sharing of results:

1. Dashboard, described in the following slides.
2. Dataset compiled from the collected data according to FVH's guidelines
3. Analytics from the result

In the photo, the Mobile Unit is mounted on a traffic sign. This setup allows us to measure not only the loading zone but also traffic on the street and at the nearby intersection area (origin-destination, counts, vehicle types, etc.).

3. Implementation

We piloted the Mobile Unit for the first time in this project. Measurements began immediately after the first prototype was completed. We learned a lot from this trial and now know how to improve the solution. We identified some issues, but we also know how to solve them. This was a highly valuable project for our product development.

A major positive was that the control electronics, computer, software, battery management, battery pack, cabling, and LiDAR all worked flawlessly — which was crucial, as they form the core of the solution. However, we encountered three main issues, detailed on the next slide:

1. Battery life
2. Physical design and mounting of the battery case
3. Installation locations in central Helsinki

The testing was very useful — it's always important to see how solutions work in practice, not just on paper. The measurement itself was also successful. The next step would be to discuss with end users what kind of result reporting would be most useful for them.

The LiDAR is elevated using the Mobile Unit's mast, eliminating the need for a personnel lift.

3. Implementation / challenges

1. Battery life – The calculated battery life was ten days, but during the first two measurement periods, the batteries lasted only half that time. On the third attempt, performance matched expectations. We discovered that the installer had charged the batteries incorrectly. The charging instructions will be clarified.

2. Battery case and mounting – The size and mounting mechanism of the battery case did not meet our quality standards. While the solution worked for the first pilot, it needs improvement. A next-generation version of the Mobile Unit is already in development.

3. Installation challenges in Helsinki city center – Street lighting in central Helsinki is elegantly implemented with cables between buildings, keeping the streets clear of poles. However, this limits available mounting locations for the Mobile Unit. We tested attaching it to a traffic sign, which worked but is not ideal — traffic signs are quite flimsy.

There are parking spots along the streets that can be rented from the city for measurement purposes. A setup like the one shown in the image could be a good solution, with or without a solar panel. The unit stands firmly on its own and can be placed in any parking space, allowing us to measure virtually any location in Helsinki in a cost-effective way.

A small trailer with sturdy support legs remains stable and can be parked in any parking space for the duration of the measurement period. The number of batteries can also be increased, allowing for measurement durations of several weeks if needed. This setup is well suited for central Helsinki, where there are not usually poles available.

User interface

Information about loading zone activity is delivered to users in three ways:

1. Web-based interface

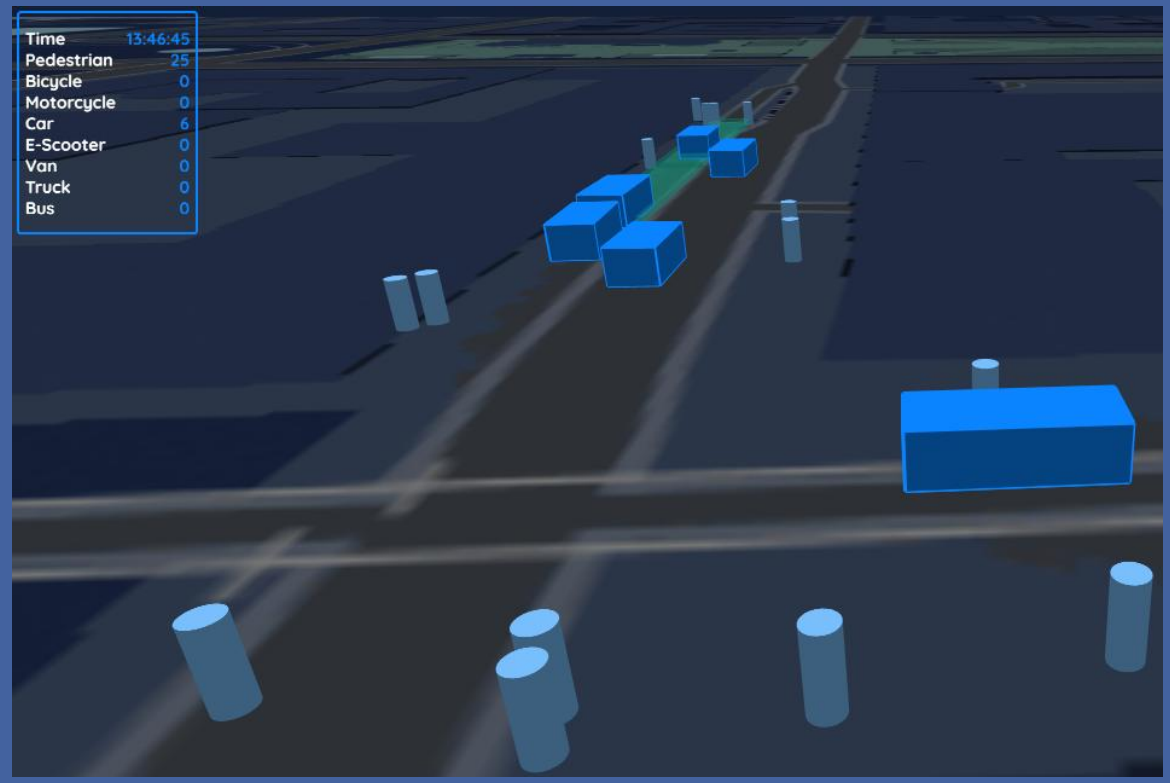
The interface provides an easy way to view the parking status of loading zones. It also includes a replay feature that shows recorded events as images on the right side of the screen.

2. Ready-made analysis

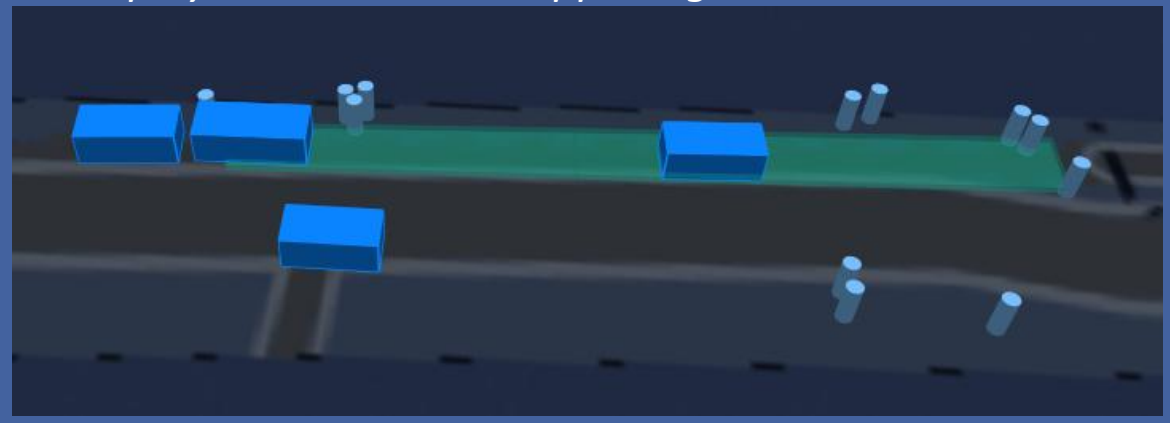
Our data scientists analyze events occurring in the loading zones. It’s important to engage with end users to tailor the analysis to their needs. This allows us to enhance the dashboard with features that highlight the most relevant insights for each location.

3. Raw data

Raw data on moving objects in the area is available for download in CSV format and can be easily imported into tools like the city’s digital twin or Excel for further use.



The replay shows what is happening in the area.



The loading area is marked in green, with passenger cars parked in it.

4. Results / Measurement locations and time periods:

FVH zone IDs	Place	Acquisition period
15059	Fredrikinkatu 61 /Kampintori	March 27, 2025 – April 10, 2025
15025	Fabianinkatu 29, the officicial (south of Aleksanterinkatu)	April 10, 2025 – April 29, 2025
15025_N	Fabianinkatu, un-official EXTRA (north of Aleksanterinkatu)	April 10, 2025 – April 29, 2025

Object stopping more than 10s are only considered

Flow Vehicle classes	
0: unknown,	5: escooter
1: pedestrian	6: van
2: bicycle	7: truck
3: motorcycle	8: bus
4: car	

RESULTS: Fredikinkatu 61

March 27, 2025 – April 10, 2025

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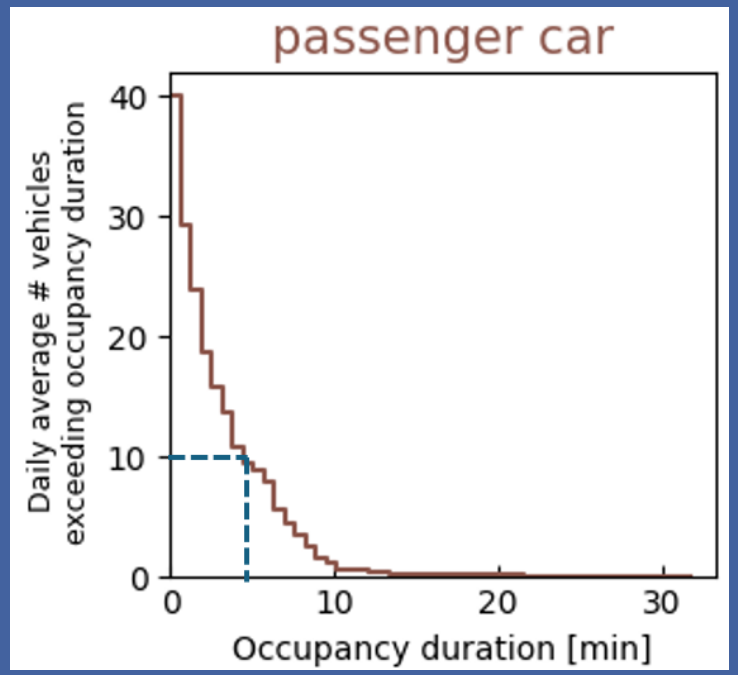
4. Results / Fredrikinkatu 61, Kampintori (March 27, 2025 – April 10, 2025)

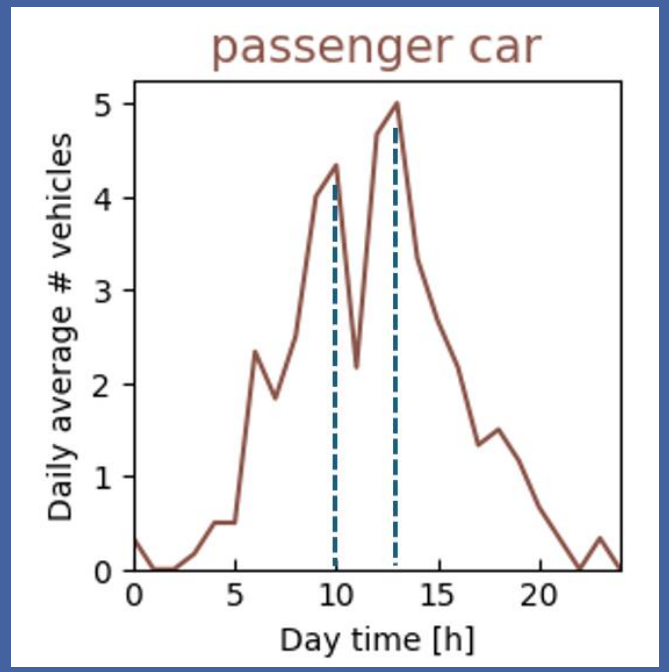
- Max pedestrian occupancy duration was ~ 2 min
- Almost no detected bicycle (only 3) + no detection of motorcycles
- Average of 40 passenger cars per day staying on average ~ 2 min (due to Fredi Pizzeria?)
- Max passenger car occupancy duration was ~ 20 min
- Average of 5 delivery pickups per day staying on average ~ 3-4 min
- Max delivery pickup occupancy duration was ~ 17 min
- Average of 1 short truck per day staying on average ~ 3-8 min
- Max short truck occupancy duration was ~ 30 min
- No detection of long trucks

A no-stopping sign, a free loading zone, and a pizzeria make an interesting combination. There are many short-term parking violations by passenger cars in the area, especially during lunchtime.

4. Results / Fredrikinkatu 61, Kampintori (March 27, 2025 – April 10, 2025)

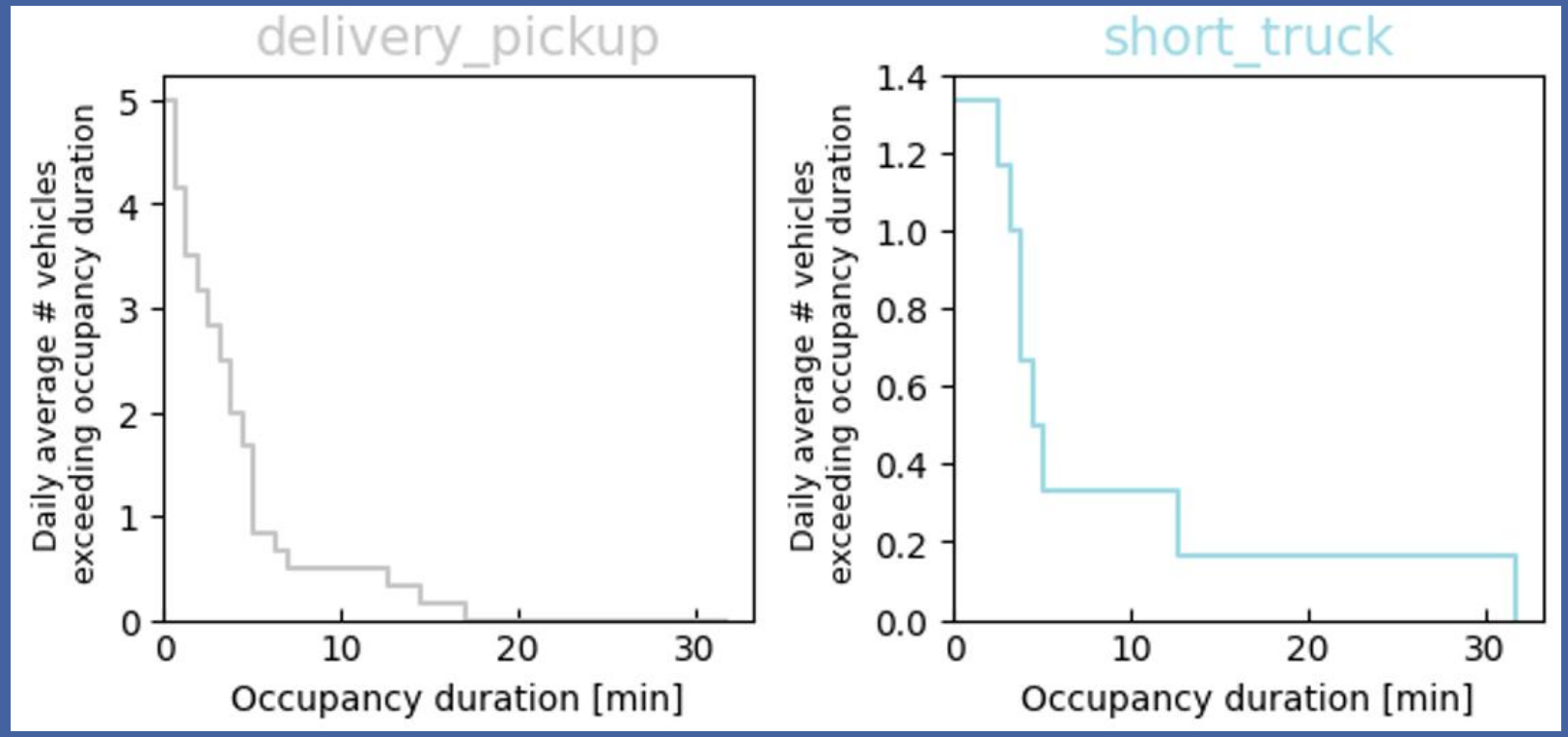


There are on average 10 passenger cars staying more than ~ min per day



Most parking violations occur during lunchtime.

4. Results / Fredrikinkatu 61, Kampintori (March 27, 2025 – April 10, 2025)



Parking times for vans (delivery_pickup) are significantly shorter than those of trucks (short_truck). That's to be expected

RESULTS: Fabianinkatu 29

April 10, 2025 – April 29, 2025

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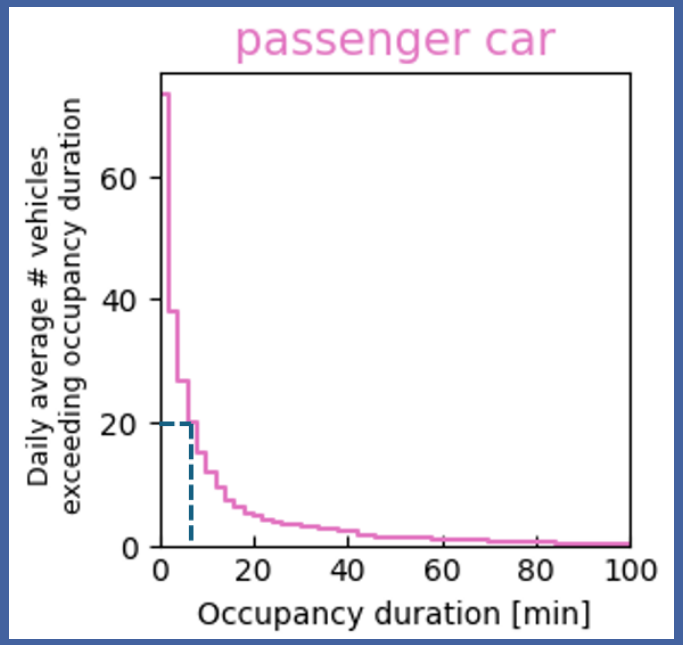
4. Results / Fabianinkatu 29

Despite the long length of the loading zone and the distant position of the LiDAR, the measurement was successfully carried out. At the same time, it was possible to monitor a second loading zone and the intersection area between them.

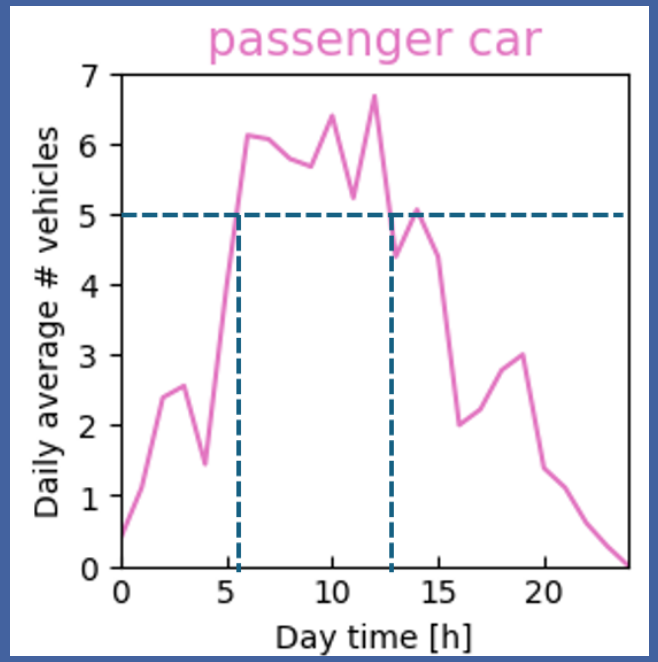
- Average of 73 passenger cars per day staying on average 2-6 min
- Max passenger car occupancy duration was 3h
- Average of 16 delivery pickups per day staying on average 5-9 min
- Max delivery pickup occupancy duration was 6h
- Average of 2-3 short trucks per day staying on average 12-20 min
- Max short truck occupancy duration was 1h
- No detection of long trucks

Opposite the Stock Exchange Building, there is a long loading zone, approximately 20 meters in length. The renovation shown in the image has been completed, and the fence was no longer in place at the time of measurement.

4. Results / Fabianinkatu 29

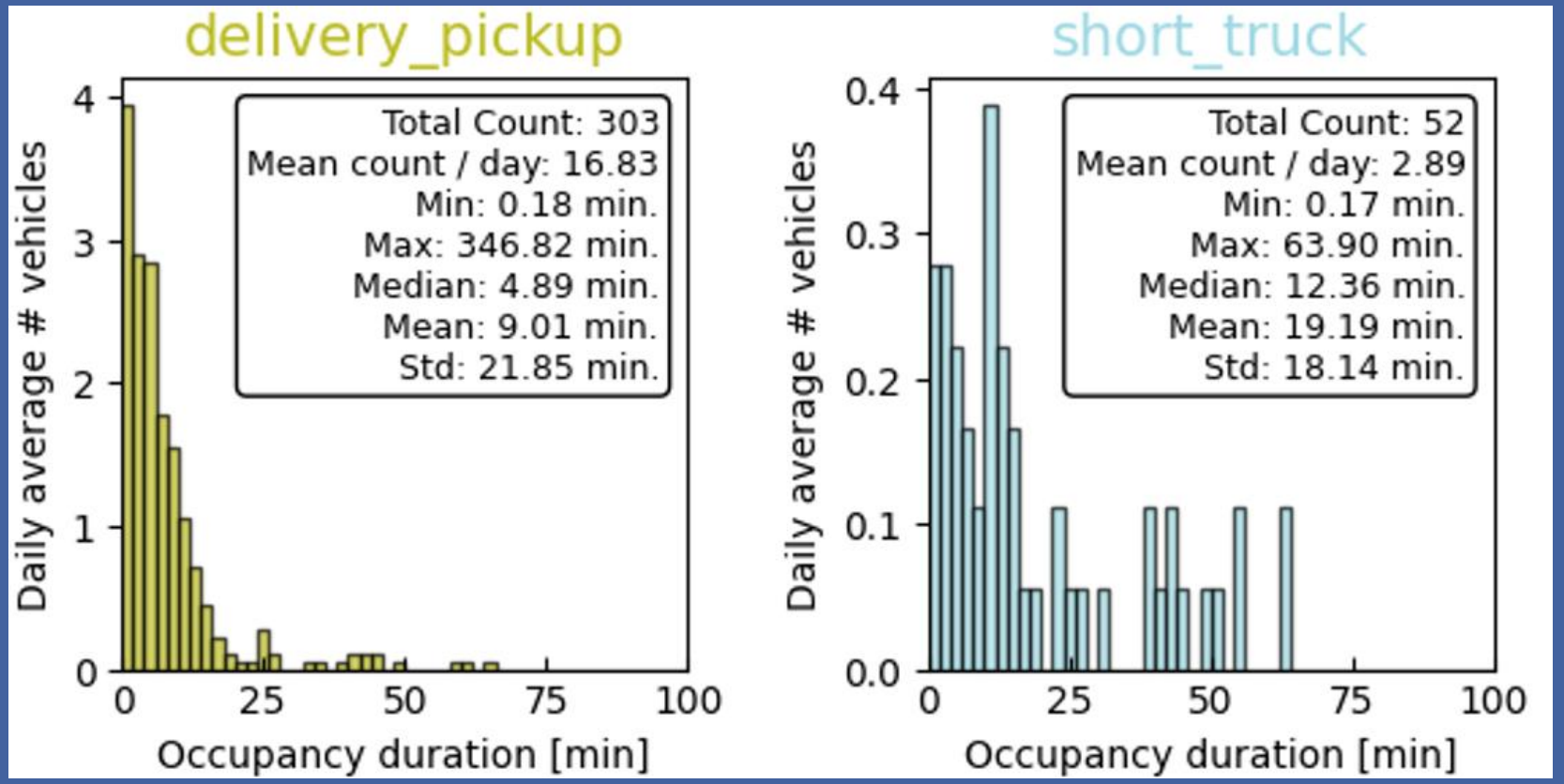


There are on average 20 passenger cars staying more than 5 min per day



More likely to see passenger cars parking on the loading zone between 5am-1pm (at least 5 passenger cars each hour)

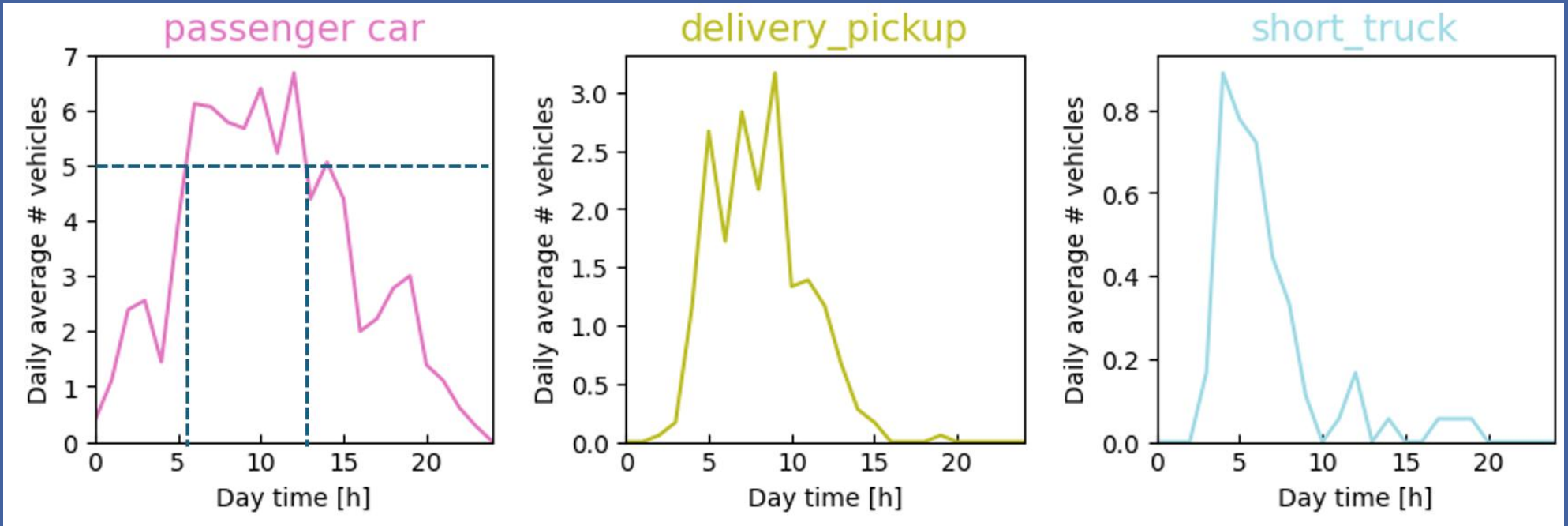
4. Results / Fabianinkatu 29



Some parking times are very long. Vehicles stay longer on Fabianinkatu than on Fredrikinkatu.

Very short stops usually happen when drivers briefly adjust their position and leave the parking for a while. These can be filtered out in data cleaning process if the project continues.

4. Results / Fabianinkatu 29



Trucks mainly park before 10 AM. Passenger cars occupy spots during the busiest loading hours. It would be interesting to study how full the long loading zone gets at peak times — this is fairly easy to analyze from existing data.

RESULTS: Aleksanterinkatu

April 10, 2025 – April 29, 2025

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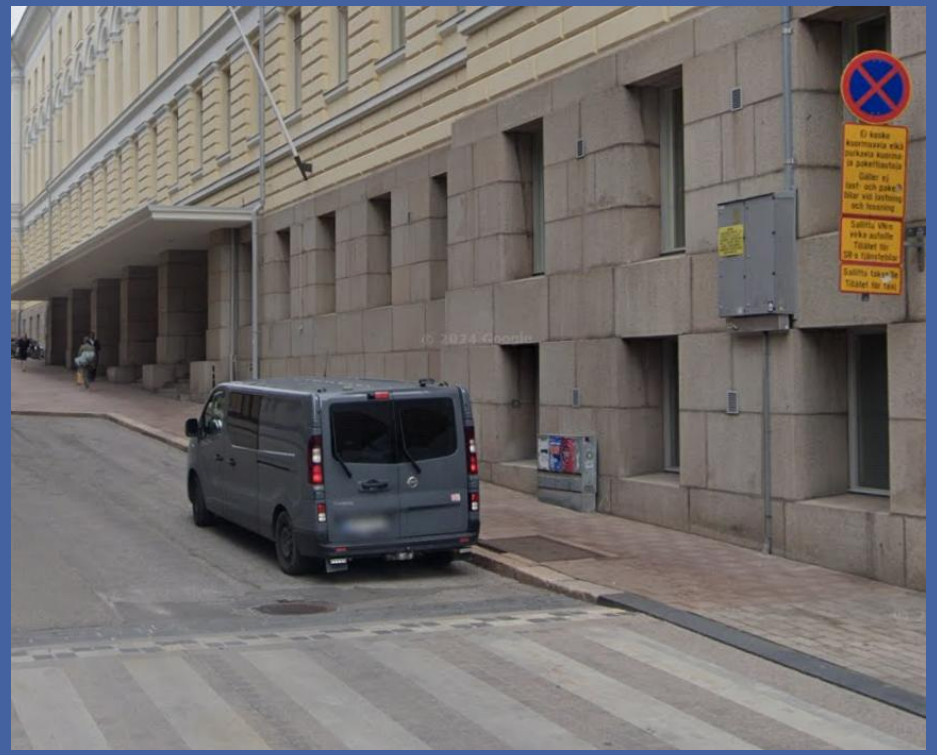
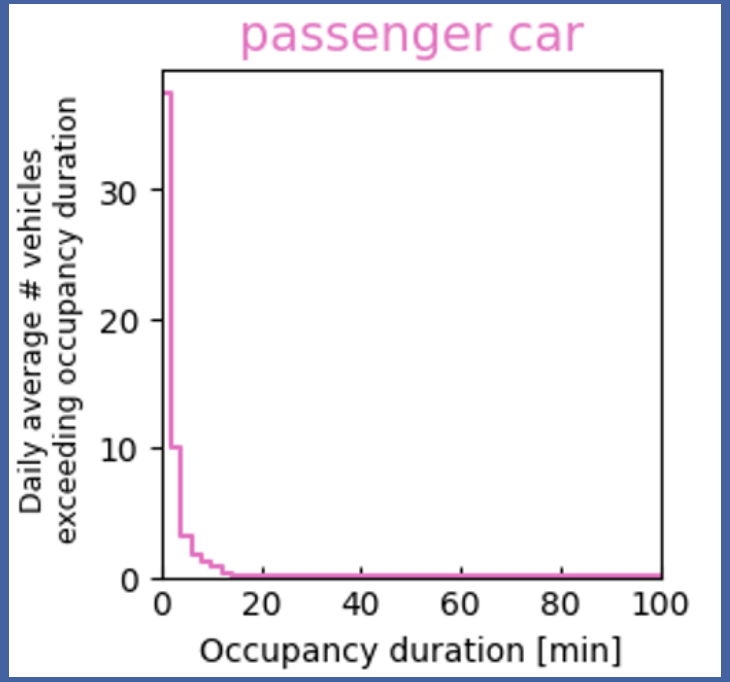
4. Results / Aleksanterinkatu

- Max passenger car occupancy duration was ~ 6h
- Average of 6 delivery pickups per day staying on average 2-4 min
- Max delivery pickup occupancy duration was 20 min
- Average of 1 short truck per day staying on average 5-7 min
- Max short truck occupancy duration was 20 min
- No detection of long trucks

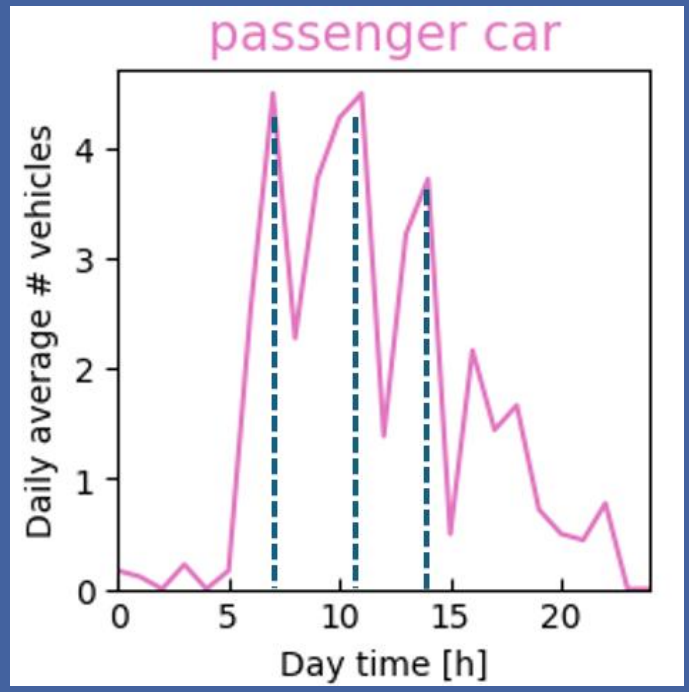


Next to the intersection of Fabianinkatu and Aleksanterinkatu, there is a loading zone we have named Aleksanterinkatu. It is mainly used for short stops.

4. Results / Aleksanterinkatu

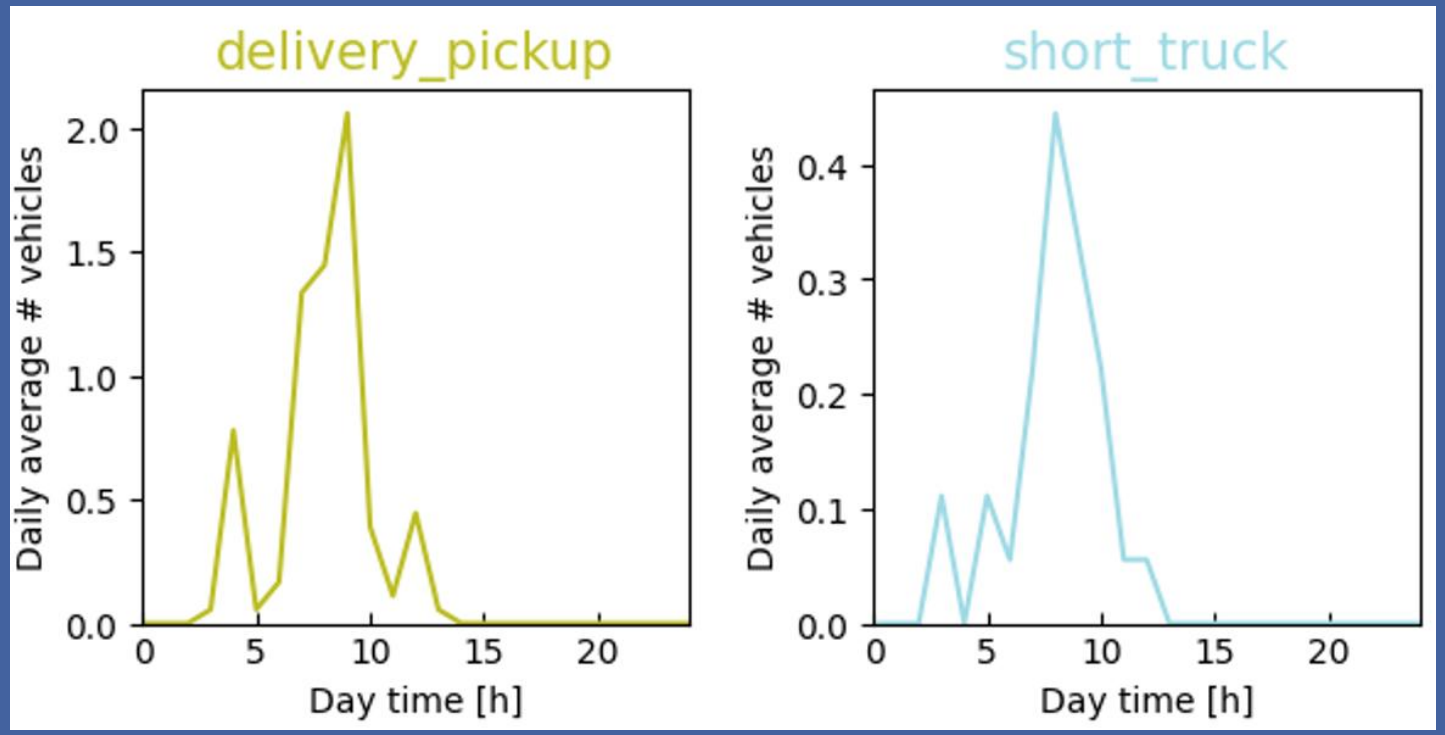


There are on average 10 passenger cars staying more than 5 min per day



Passanger cars parking on the loading zone around 7am, 11am and 2pm

4. Results / Fabianinkatu 29



Delivery pickups are mainly parking on the loading zone around 9am-10am

Almost no bicycles/motorcycles parking on the 3 loading zones. No long truck parking on the 3 loading zones

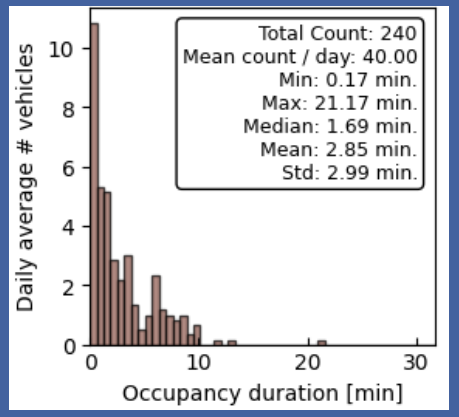
Delivery pickups & short trucks mainly parked

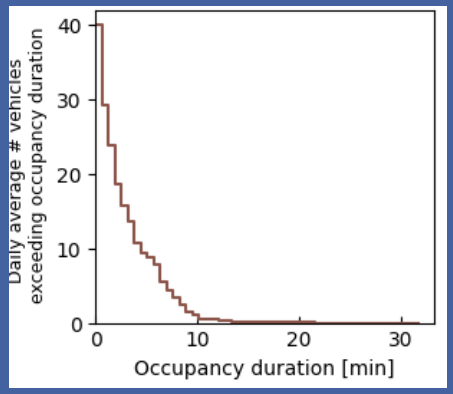
- Fredikinkatu: around 9-10am
- Fabianinkatu & Aleksanterinkatu: between 5-10am

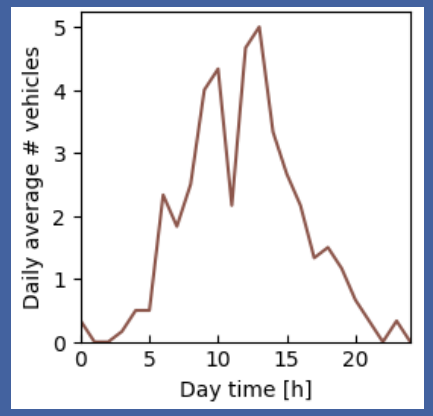
Passenger cars

- Fabianinkatu
  - loading zone with the highest mean count per day (~70 passenger cars/day). The longest loading zone (20m)
  - Loading zone with the highest mean occupancy duration (~6 min)
- Aleksanterinkatu
  - Loading zone with the longest max occupancy duration (~6h)
- Fredikinkatu
  - Mean average occupancy of ~2 min (due to Fredi pizzeria?)

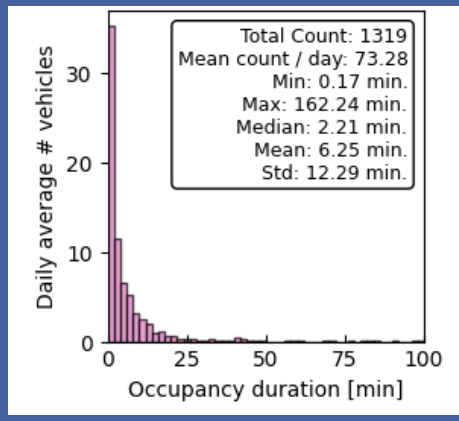
Fredikinkatu

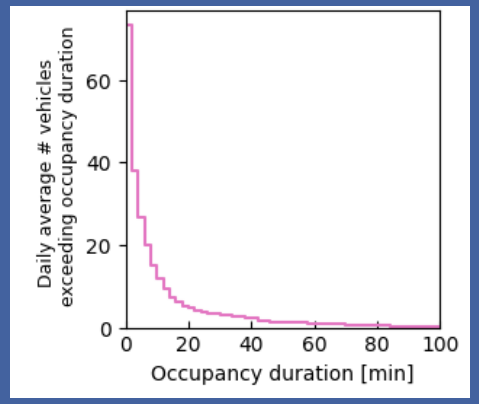


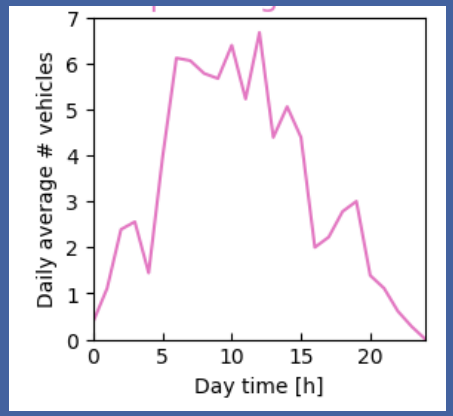




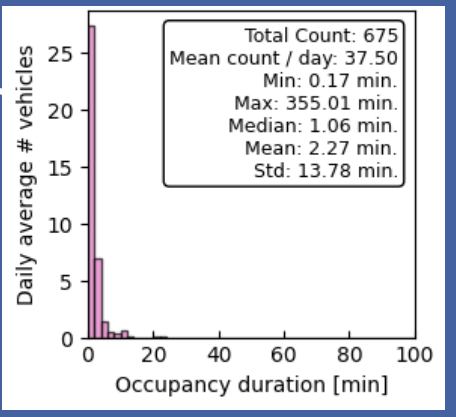
Fabianinkatu

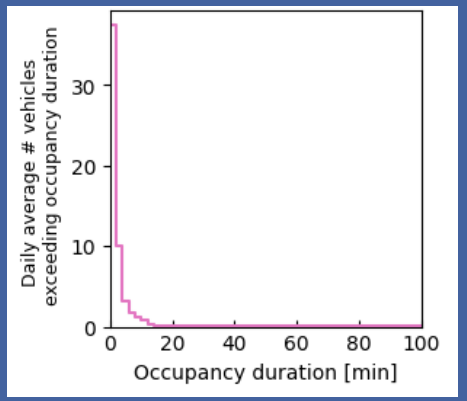


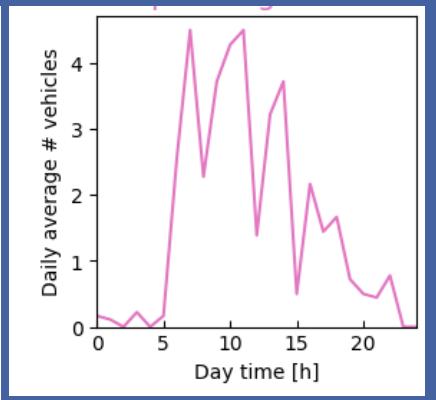




Aleksanterinkatu







5. Key findings

1. **High usage during morning hours –** Trucks and delivery vehicles primarily use the zones between 5 AM and 10 AM, especially for pickups.
2. **Short stops dominate –** Most vehicles make brief stops, especially vans and passenger cars.
3. **Passenger car misuse –** Passenger cars often occupy loading zones during peak delivery hours, especially around lunchtime, reducing availability for legitimate use.
4. **Variation between locations –** On Fabianinkatu, vehicles tend to park longer than on Fredrikinkatu, indicating differences in delivery needs.
5. **Outliers in parking times –** Some vehicles park for unexpectedly long periods. These could distort average values but can be addressed through data cleaning.
6. **Effective LiDAR monitoring –** Despite distance and challenging angles, LiDAR provided reliable coverage, including multiple loading zones and intersections from a single position.
7. **Further analysis is easy to develop**, but it would be useful to first discuss with data users to better understand their needs. ie. Peak capacity still unknown – It might be useful to assess how full the zones get during peak hours. This can be done with existing data.

6. Contacts

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FVH

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