

"You can't improve what you don't measure" - An end-to-end pilot project of collecting, analyzing, and sharing bicycle traffic data

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Background

Bicycling is a promising transportation mode to make our communities more sustainable, healthier, and more equitable. Motor vehicle traffic, often measured by the Annual Average Daily Traffic (AADT), have been widely used for making and justifying transportation planning and engineering decisions. However, little data on bicycle traffic have been collected or used in most cities in the U.S.

An automated bike counter records the bike traffic volume at a location. The collected data can be used by city planners and local communities to support data-driven decision making in bicycle infrastructure planning, justification, and benchmarking. Although a bike counter itself is often not cost-prohibitive (e.g., at \$3k+), bike counter vendors often charge extra subscription-based fees to publish the data with dashboards or data API. This recurring cost (e.g., at \$400/year) is often prohibitive for many cities and communities. The lack of the ability to easily share the data makes it difficult to justify initiating a bike counter program.

Objectives

1. Use a commercial off-the-shelf bike counter (Eco-counter TUBES pneumatic counter [1]) to collect bike traffic data at multiple locations (Fig. 1),
2. Perform data analysis and visualizations to identify bike traffic patterns,
3. Build an **open-source, web-based, interactive** dashboard for bike counter data.

Results

Data collection: We collected data in Dearborn Rouge Gateway Trail (Fig. 1a) for 5 weeks (Jun 16 to Jul 19, 2022) with a total of **6,218** bicycles counted. We are collecting data in Ann Arbor Division Street Bikeway (Fig. 1b) since Aug. 26 with a total of **19,681** bicycles counted in 12 weeks. Due to space limitation the rest of this poster focuses on the Ann Arbor data.



(a) Multi-use path (Rouge Gateway, Dearborn) (b) Protected bike lane (N Division, Ann Arbor)

Figure 1. Bicycle counter sites

Table 1. Summary bike traffic in the Division Bikeway (11 weeks from Aug. 26 to Nov 10, 2022)

	Total traffic	Avg. daily traffic	Percent (%)
Both directions	19,681	228.8	100.0
Northbound (from downtown)	14,256	165.8	72.4
Southbound (to downtown)	5,425	63.1	27.6

A validation study was conducted to examine the counter accuracy. A video camera was used at the counter site to record the bike lane usage during three 2-hour (4PM-6PM) periods. In the video recordings a total of 191 bicyclists were manually identified. In the same periods of time the counter registered a total of 200 bicycles, which corresponds to an **over-count by 4.7%**. Note the videos show there were an additional 13 e-scooters who passed the counter. If they are considered as valid counts, the counter would **under-count by 2.0%**.

Results (cont'd)

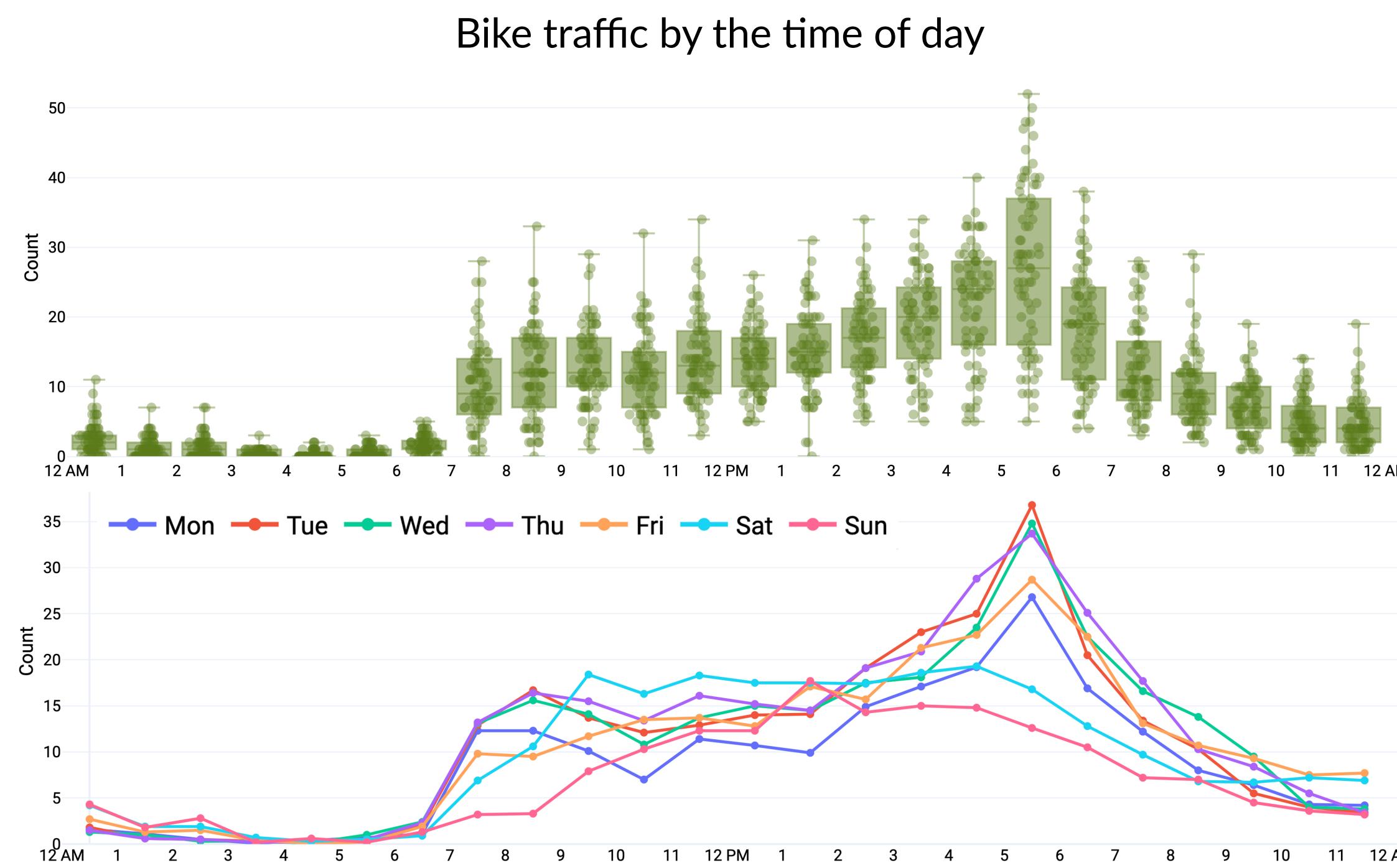


Figure 2. Hourly traffic by time of day, top: all data, bottom: averaged data by days of week

The two plots above show clear afternoon rush hour traffic between 5 PM and 6 PM. There is no clear presence of the morning rush hour, possibly in part due to this bike lane is not preferred as a to-downtown route (see Table 1)

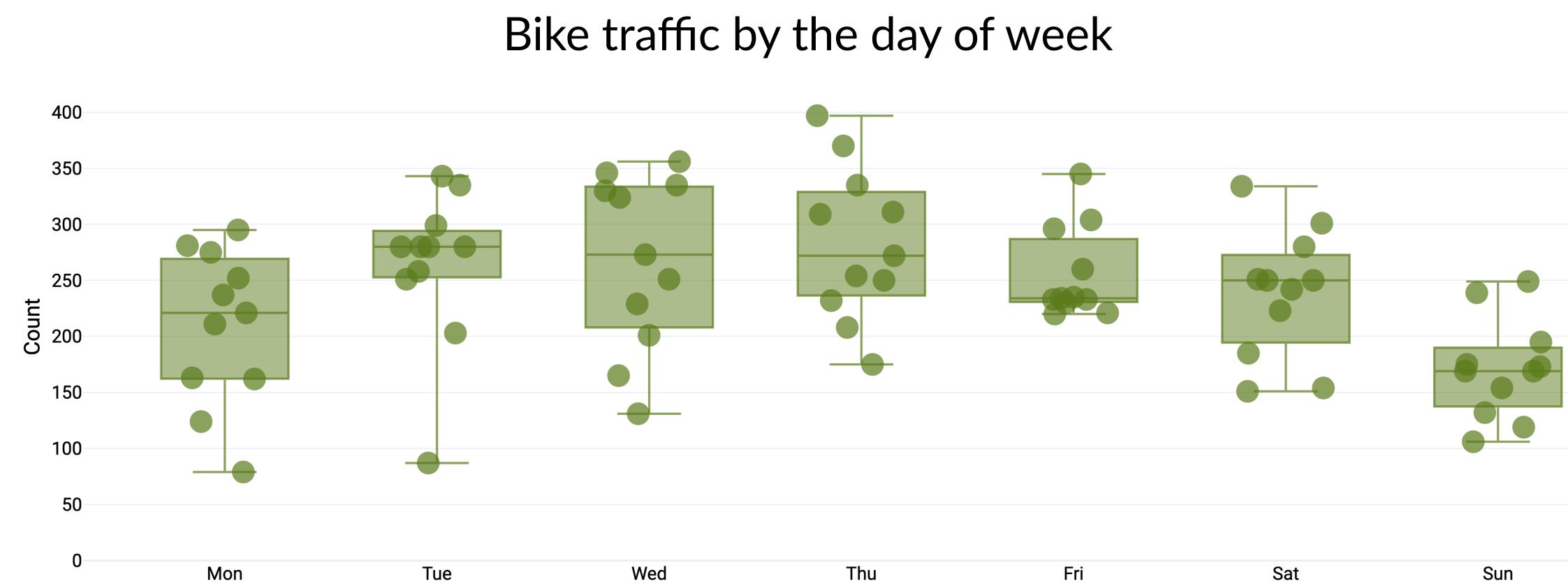


Figure 3. Daily traffic by day of week

The above plots show higher traffic on weekdays (especially Tuesdays, Wednesdays, and Thursdays) than weekends. It suggests the bike lane is mostly used for commuting/utilitarian rather than recreational/exercising purposes.

Weather impact on bike traffic: Weather data from the stations near the bike counter sites were obtained from NOAA [2]. Fig. 4 shows the relationship between daily traffic and the daily high temperature. A linear regression analysis shows daily traffic has a significant relationship with both (1) high temperature (p -value < 0.001) and (2) whether it rained or not (p -value = 0.006).

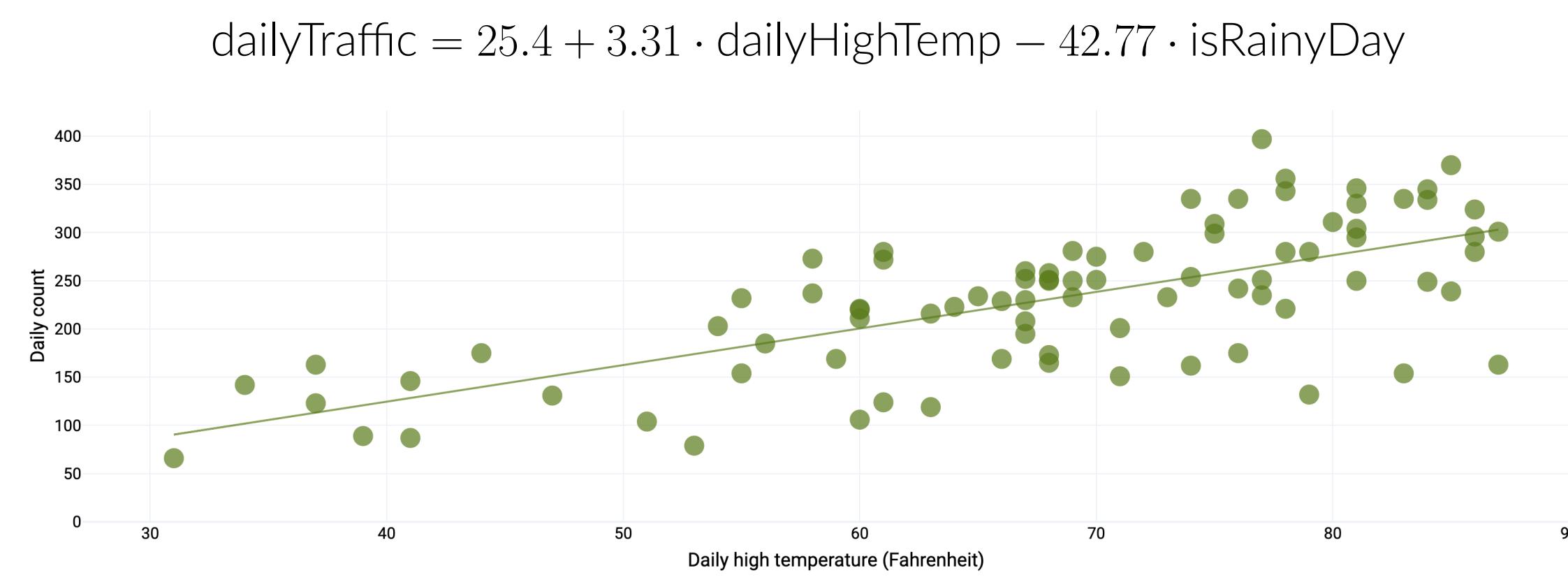


Figure 4. Daily traffic by daily high temperature

An open-source, web-based, interactive dashboard

We built an open-source, web-based, interactive dashboard that allows city planners, traffic engineers, researchers, and local communities to easily explore bike traffic data. The dashboard supports selecting the dates of interest, days of the week, traffic direction, data resolution, etc. The charts support tooltips with additional information such as weather. The dashboard was built with Python and Plotly Dash and deployed with Google Cloud Run. The open-source software repository can be accessed at <https://github.com/fenggroup/bike-traffic-plotly-dash>. The dashboards can be accessed at <https://bikecounter.org>

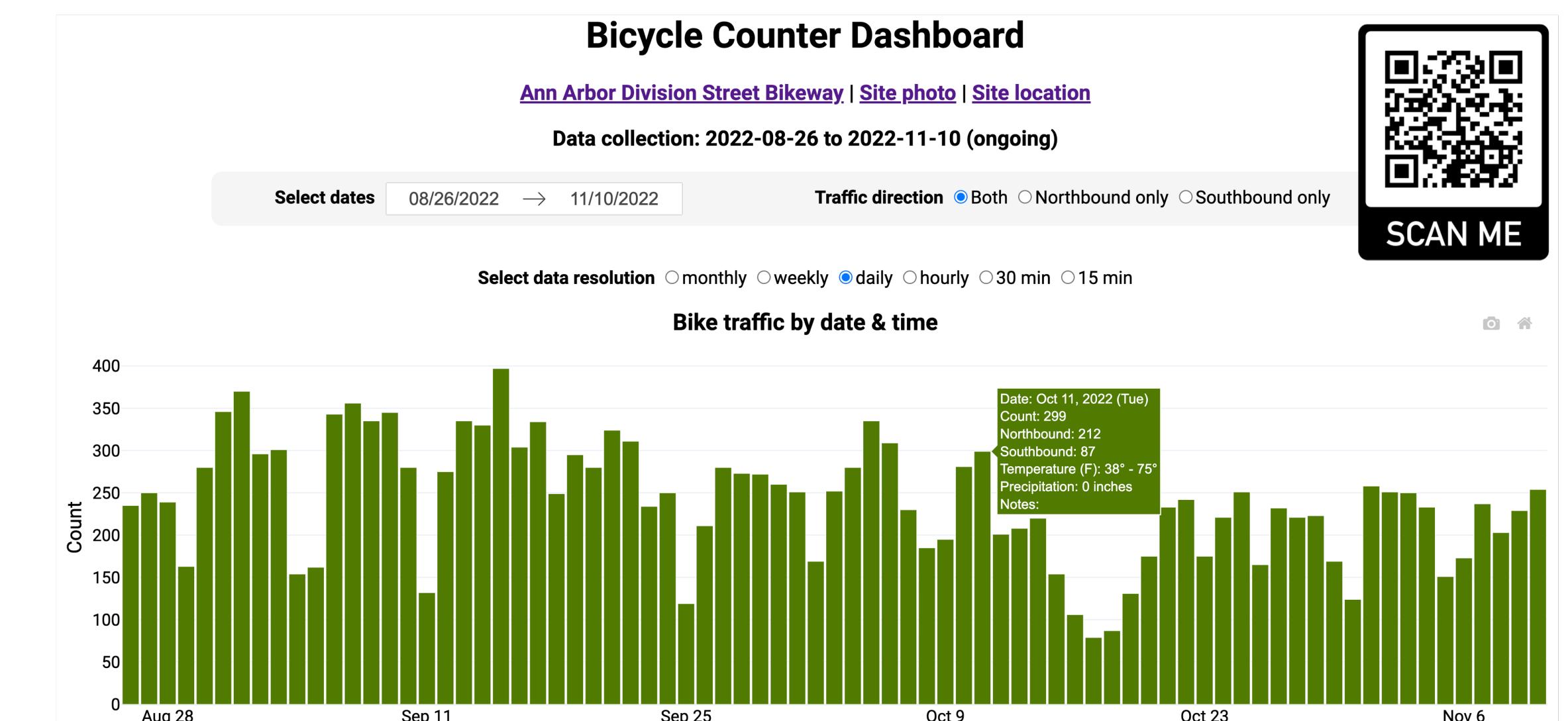


Figure 5. Top part of the dashboard that shows daily traffic (<https://bikecounter.org>)

Who are using the Division Bikeway?

From the 6-hour counter validation videos in which a total of 217 people crossed the bike lane, we also manually extracted some additional information about the bike lane users. The information were extracted by two independent, trained data reductionists, and then cross-checked by a third reductionist for consistency. Note the results in Fig. 6, especially the *perceived* gender, are entirely based on video images and inherently limited by the subjectivity of the data reduction procedure, and thus should be used with caution.

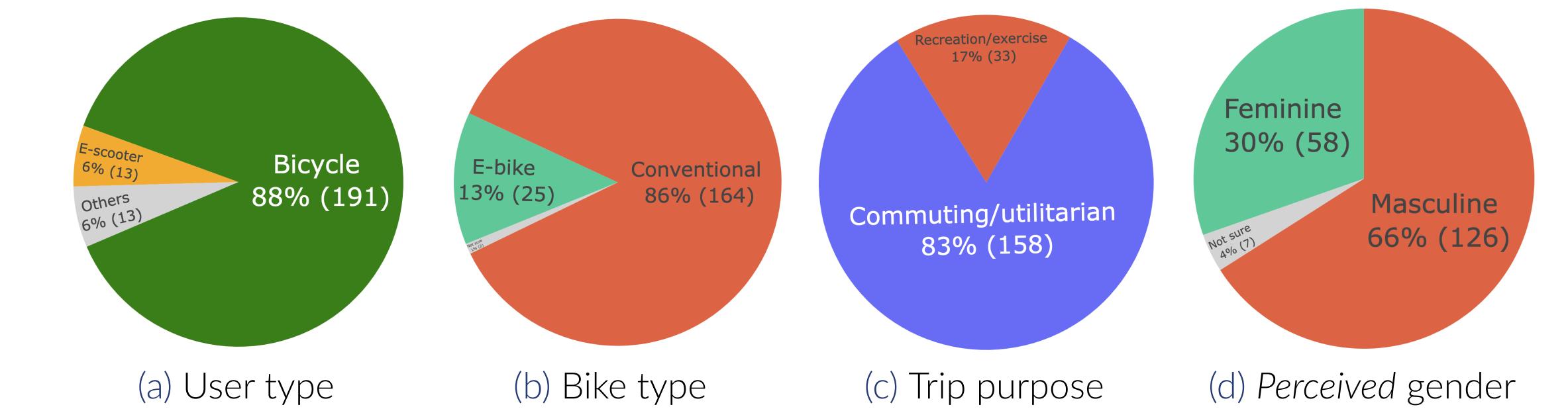


Figure 6. Who are using the Division Bikeway?

- 12% of the bikeway users are not on a bike (e.g., e-scooters, skateboards)
- 13% of the cyclists are riding electric bicycles.
- 83% of the riders are for commuting or utilitarian purposes.
- 30% of the riders are perceived feminine.

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References

- [1] Eco-Counter. Tubes - short term bike traffic studies. <https://www.eco-counter.com>.
- [2] NOAA. Climate data online search. <https://www.ncdc.noaa.gov/cdo-web/search>.