Bike Swap Behavior and Deployment Strategy Analysis

Date: November 18, 2025

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1. Executive Summary & Core Recommendations

My analysis of over 425,000 bike swap events reveals that swapping is primarily a function of **long-ride dependency** and **high fleet utilization**, not immediate mechanical faults. The data provides clear, actionable metrics to guide both product strategy and infrastructure deployment.

Metric	Overall Insight	Actionable Threshold
Median Duration (Rental 1)	**163.6 minutes.** Swaps are end-of-journey behavior, not short-term mechanical failures.	**Conclusion:** Our filtering to exclude swaps with a duration under 15 minutes was correct; this is not a 'testing' problem.
Fleet Pressure (Swaps/Bike/Week)	Highest at **ParkBee Lanark Road (15.2)** and **NCP Finsbury (14.2)**.	**Action:** Use this metric to prioritize maintenance and deployment, as it shows where the fleet is under the greatest stress.
Battery Health Flag	**Port Bancroft Road** shows high swap SOC (60.2%) after very long rides.	**Action:** Investigate these hubs for sensor miscalibration or inaccurate battery reporting.

Deployment Priority Summary

Based on a combined assessment of Volume (Total Swaps) and Fleet Pressure (Swaps/Bike/Week), I recommend the following deployment order:

Rank	Hub Name	Primary Need	Justification
1	**ParkBee Lanark Road**	**Extreme Fleet Pressure**	Highest swaps per available bike (15.2). Every bike is being swapped frequently, demanding immediate, automated support.
2	**NCP Finsbury**	**Highest Volume / High Pressure**	Top overall volume (41K+) and second-highest pressure (14.2). Critical workhorse hub.
3	**NCP Vintry**	**High Volume**	Consistent high volume (40K+) and stable demand (13.2 swaps/bike/week).

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2. Methodology & Key Definitions

2.1 Data Sources & Scope

- **Period Analyzed:** Approximately 9 months (Feb - Oct 2025).
- **Data Tables Used:** `rentals_rental`, `users_user`, `hubs_hub`, and the aggregated Sales KPI table (`t_report_daily_kpi`).
- **User Filtering:** Strict filters were applied to exclude internal/test accounts, low-data rentals, and anomalous SOC readings (>100).

2.2 Defining a Valid Swap (The Analytical Model)

My analysis focuses only on **Confirmed Battery Swaps**, defined by the following strict criteria:

- **Consecutive:** Rental 2 must immediately follow Rental 1 by the same user on the same payment token.
- **Time Gap:** The time between Rental 1 End and Rental 2 Start must be **< 15 minutes**.
- **Testing Excluded (New Filter):** The duration of the first rental (Rental 1 Duration) must be **> 15 minutes**. This removes user "testing" or immediate minor fault events, ensuring we only count swaps where the user had genuinely depleted the battery or had a significant ride.

2.3 Understanding the Metrics

Metric	What it Tells Us	Why it Matters (For Matas)
Total Swaps	Absolute demand (Volume).	Justifies total investment budget.
Overall Swap Rate	Percentage of all finished rentals that result in a swap (Intensity).	Measures how crucial swapping is to the hub's operation.
Swaps/Bike/Week	**Fleet Pressure.** Swaps per Avg. Fleet Size per week.	**Highest priority metric.** Normalizes demand for hub size, identifying the most stressed fleets.
Median Rental 1 Min	The user's typical ride duration before swapping.	Confirms user behavior (i.e., ruling out "short-term fault swaps").

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3. Deployment Prioritization & Analysis

3.1 Fleet Pressure Ranking (The Operational Priority)

This table identifies where the fleet is under the most stress. High values here mean the operations team is swapping batteries at an unsustainable rate relative to the number of bikes deployed at that hub.

Rank	hub_name	Swaps/Bike/Week	Total Swaps	Overall Swap Rate (%)
1	ParkBee Lanark Road	15.2	21,032	51.9

2	NCP Finsbury	14.2	41,072	49.6
3	NCP Vintry	13.2	40,398	42.7
4	Business Design Centre	12.7	17,932	46.9
5	NCP Clerkenwell	11.6	18,052	48.1
6	Q-Park Queensway	11.6	23,963	42.0

Insight: The top six hubs have fleet pressures of **11+ swaps per bike per week**. Deploying cabinets here will yield the largest immediate return on operational efficiency.

3.2 Total Swap Volume Ranking (The Capacity Priority)

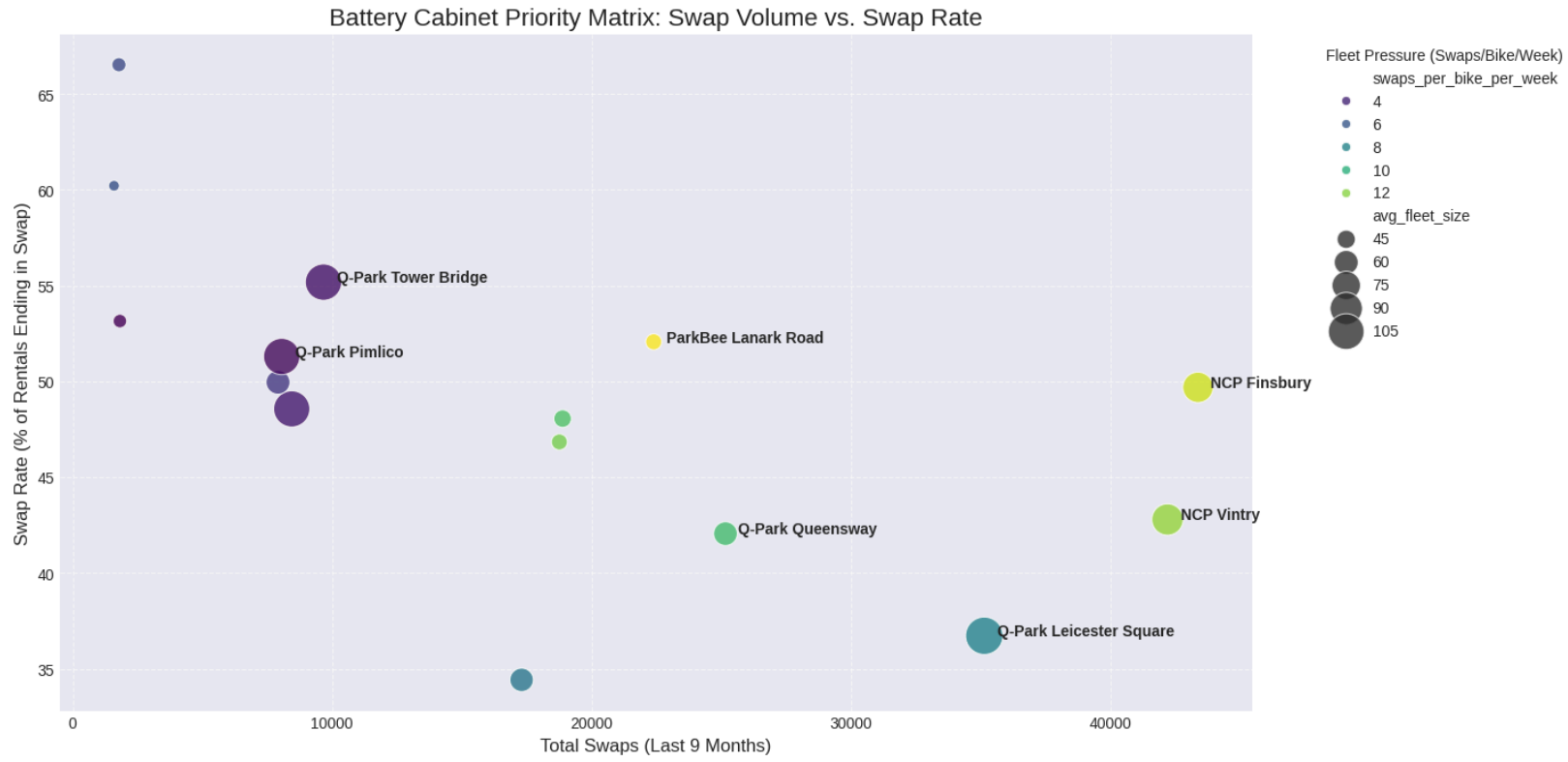
This table shows the absolute largest swap drivers, demanding the largest capacity cabinets.

Rank	hub_name	Total Swaps	Avg Fleet Size	Overall Swap Rate (%)
1	NCP Finsbury	41,072	82.2	49.6
2	NCP Vintry	40,398	86.2	42.7
3	Q-Park Leicester Square	33,397	112.6	36.9

4	Q-Park Queensway	23,963	59.4	42.0
5	ParkBee Lanark Road	21,032	40.2	51.9

Insight from Prioritization Matrix:

The scatter plot below visually maps demand. **ParkBee Lanark Road** demonstrates extreme efficiency (high pressure, high swap rate) despite its smaller fleet size, confirming its critical operational importance.

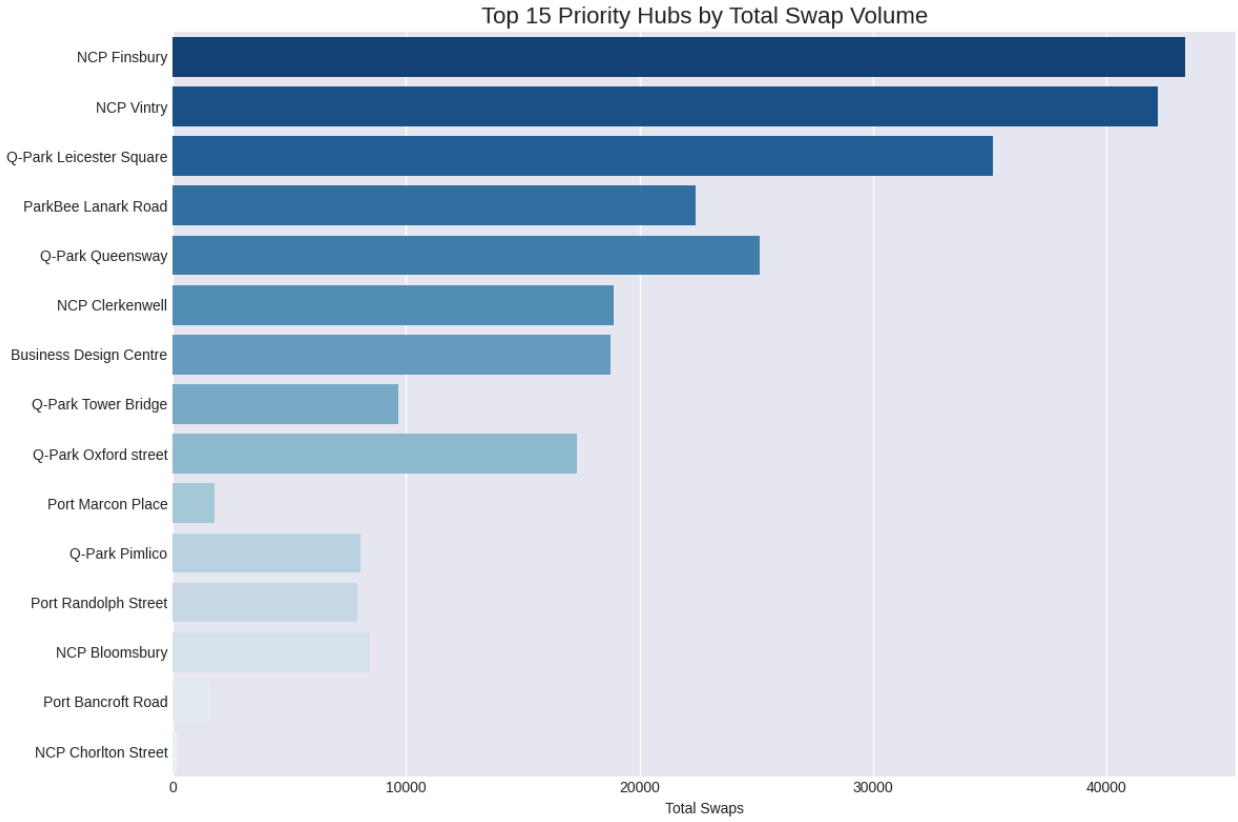


3.3 Battery Health Check (Sensor Investigation)

This filter highlights hubs where users are swapping bikes with unusually high battery levels after having already completed a long, meaningful ride. This is likely a symptom of battery sensor error.

Rank	hub_name	Median Swap SOC	Median Rental 1 Min
1	Port Bancroft Road	60.2%	478.0 min

Insight: Port Bancroft Road requires an investigation into its fleet's battery sensor calibration. A user riding for nearly 8 hours and swapping at 60% SOC is highly anomalous behavior, indicating a lack of trust in the displayed battery level.



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4. Conclusion and Next Steps

The data strongly supports deploying large cabinets at the **NCP/Q-Park** hubs for **Volume** and prioritizing **ParkBee Lanark Road** for **Intensity**.

- **Deployment Target:** Deploy first at **NCP Finsbury** and **NCP Vintry** due to their simultaneous high volume and high fleet pressure.
- **Product Action:** Lower the in-app low battery warning threshold to **35%** (aligning with the p25 user-driven benchmark).

- **Operations Action:** Investigate **Port Bancroft Road** for possible battery reporting anomalies.