Glenmore Street Bike Count Data Quality Assurance Report

Data Sources: BeCounted, VivaCity and manual counts

Transport class: Bike

Analysis: Reviewing data accuracy and reliability

Time frame: June 2024 - February 2025

Reviewer: City Insights

April 2025

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Version	Date	Author	Approver
1	15/04/2025	Transport Strategy Advisor	Manager City Insights

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Purpose

This report reviews bike count data along the Glenmore Street cycleway from June 2024 to February 2025. It documents data cleaning in preparation for the release of the data.

Location

The locations of BeCounted sensors along and near the Glenmore Street cycleway are as follows:

- Bowen Street near Glenmore Street, city bound
- Bowen Street near Glenmore Street, outbound
- Glenmore Street near Garden Road, downhill (city bound)
- Glenmore Street near Garden Road, uphill (outbound)
- Karori tunnel, Karori bound (to December 2024)
- Karori tunnel, city bound (to December 2024).

Methodology

A systematic review has been undertaken rigorously following the process set out below.

1. **System health and metadata review**
    - System downtime or data transmission issues that may have impacted data collection. Records were checked, if available.
2. **Monthly and daily pattern analysis**
    - Monthly and daily bike count totals, patterns and trends were examined to identify missing data or abnormal patterns, such as unusually high or low counts, and imbalanced in directional totals.
3. **Hourly data examination**
    - If any unusual monthly and daily counts were detected, then the relevant hourly counts were examined to detect irregularities and potential data inconsistencies. Unexplainable anomalies were repaired or removed from the data set.
4. **External factors analysis**
    - If any unusual counts were detected, external factors such as adverse weather conditions, roadworks, or major city events that could have influenced the recorded bike counts were examined.

Quality assurance

The following data quality assessment standard has been applied to checking the data for this review.

Table 1 Data quality assessment standards

Data quality assessment standard	Description
None	Data has not been checked.
Bronze	Data has been checked for internal consistency. Unexplainable anomalies have been repaired or removed.
Silver	Data has been checked for internal consistency and compared to a nearby data source. Unexplainable anomalies have been repaired or removed.
Gold	Data has been checked for internal consistency, compared to a nearby data source, and compared to at least one manual validation sample. Unexplainable anomalies have been repaired or removed.
Platinum	Data has been checked for internal consistency, compared to a nearby data source, and compared to more than one manual validation samples. Unexplainable anomalies have been repaired or removed.

We have developed a four-star data quality assurance rating for transport data accuracy as set out below. As our practice in this area develops, we will endeavour to assign accuracy metrics. However, this is currently a subjective assessment as it is not yet based on a robust quantitative methodology.

Table 2 Data quality assurance ratings

Data quality assurance rating	Description
☆☆☆☆	Unchecked raw or unreliable data. This should not be released as it of poor or unknown quality.
★☆☆☆	Low quality assurance level for non-critical applications.
★★☆☆	Intermediate standard appropriate when more than minimum assurance is required, and a comparable data source has confirmed the data is valid.
★★★☆	High standard appropriate for key insights such as the central area cordon counts and most traffic count data including bike counts.
★★★★	Highest standard for the most critical data supporting critical decisions, includes key performance indicators used for annual reporting.

Results

System health and metadata review

Table 3 records system health for the selected BeCounted sensors. The table shows the relevant timeline along with the issues that are likely to impact data quality.

Data reconstruction was the main action undertaken to address the issues. A data reconstruction tool is built into the EcoVisio dashboard. The tool can reconstruct single days. It was recommended use for up to seven consecutive days of use. The tool works by calculating the hourly averages of data collected on the same day of week during the previous four weeks. For example, reconstructing a Sunday would be based on the averages of the four preceding Sundays. This method utilises statistical correlation to nearby counting sites from the counter of interest. Once satisfied, the reconstructed data is uploaded to the EcoVisio dashboard.

Table 3. Records of BeCounted system health

Sensor	Estimated start date	Estimated end date	Issue type	Issue description	Action undertaken
Bowen Street	1/12/2022	1/03/2023	Data transmitted incorrectly	Hardware malfunction	Data reconstructed
Bowen Street	1/01/2023	1/03/2023	Undercounting	Battery flatline	Data reconstructed
Bowen Street	1/03/2023	1/04/2023	Data transmitted incorrectly	Hardware malfunction	Data reconstructed
Bowen Street	1/12/2024	ongoing	Data transmitted incorrectly	Hardware malfunction	Data reconstruction
Glenmore Street near Garden Road	1/07/2023	1/07/2023	Uphill hardware changed	Sensor loop extended across the road to capture all cyclists across the road corridor	No changes as the data is correct
Karori tunnel city bound	1/10/2024	ongoing	No data	Counter hardware removed during construction	Data reconstructed

Monthly, daily, and hourly pattern analysis

A typical bike count data pattern reflects both long-term monthly trends and short-term daily and hourly variations. Over the months, we expect to see higher volumes during spring, summer and autumn, influenced by better weather and daylight hours. This could be also influenced by recurring travel demand patterns such as the return of commuters after holiday periods. Monthly totals generally fall within a predictable range and deviations. Therefore, sudden drops or increases which are not explained by known events or disruptions may indicate data issues. On a daily and hourly basis, we typically observe lower volumes on weekends and clear weekday peaks during morning and evening commute periods.

1. Bowen Street, city bound and outbound

Figure 1 shows the monthly total counts of cyclists recorded by the BeCounted sensor from June 2024 to February 2025. The chart shows city bound totals in green and outbound totals in orange. The data towards Karori shows typical monthly variability which results from variations in the number of working days, weather, and events. The city bound data shows significant undercounting. Therefore, a very unbalanced directional cycling activity is observed.

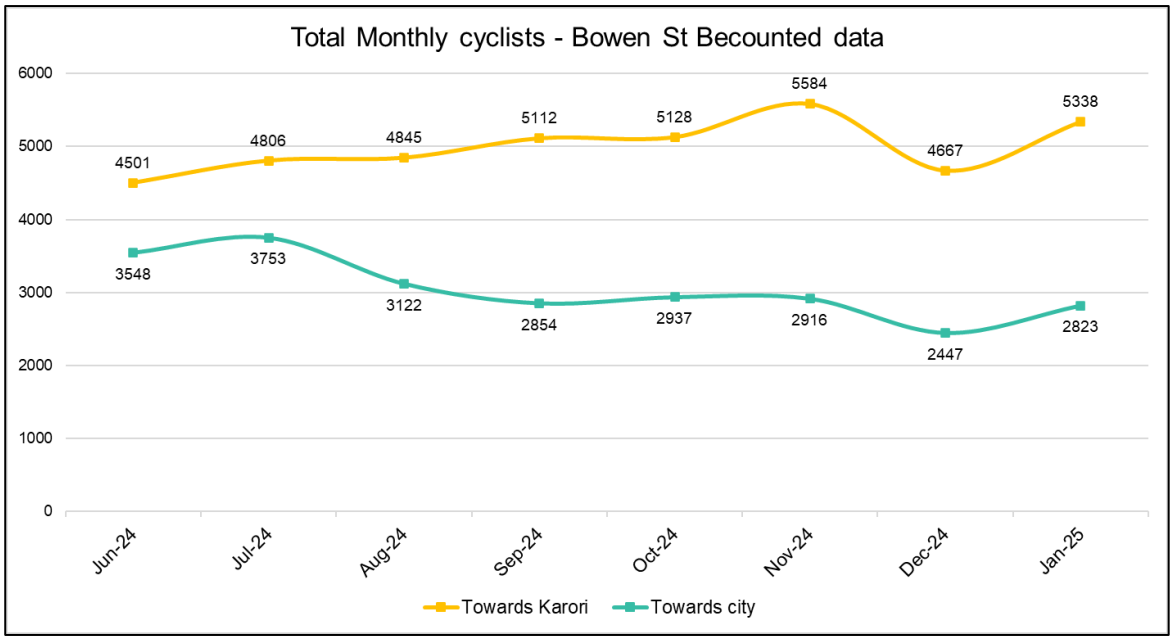

Figure 1. Monthly total bike trips on Bowen Street, city bound and outbound (raw data from BeCounted)

Comparison to VivaCity sensors

Figure 2 shows the monthly total counts of Karori-bound cyclists recorded by the BeCounted and VivaCity sensors from June 2024. The BeCounted data records higher numbers than VivaCity data for this location. The variance ranges from 338 to 857 cyclists per month, which indicates 84% to 93% of similarity between the two data sources.

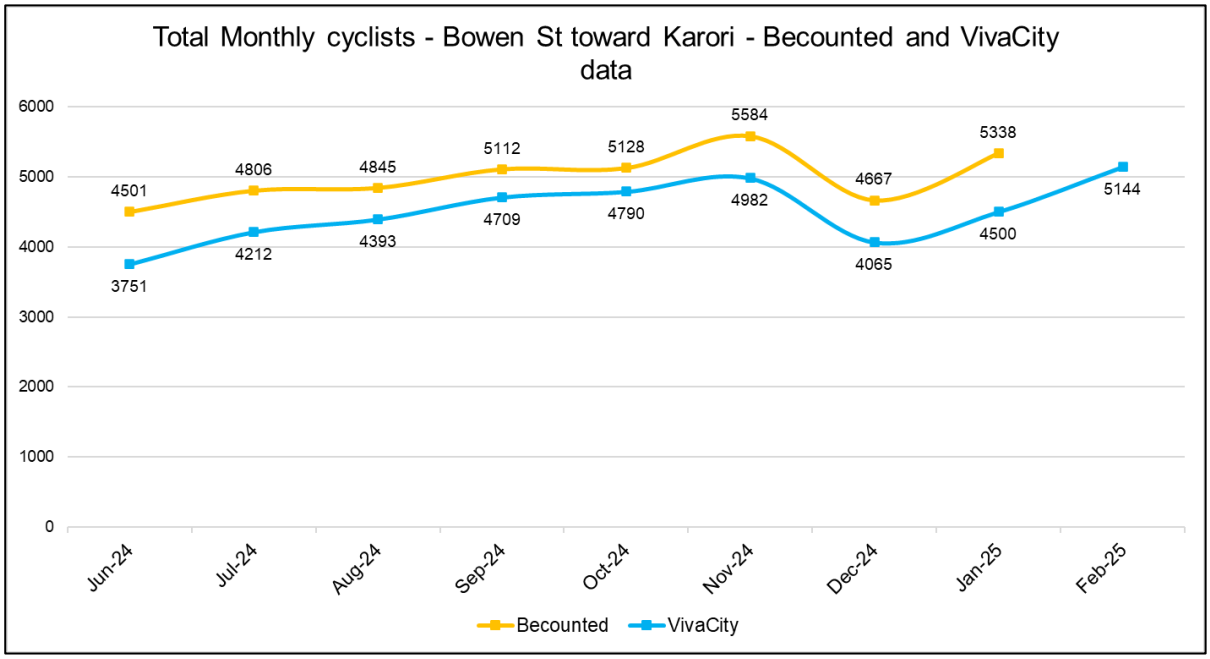

Figure 2. Monthly bike counts in Bowen Street towards Karori (BeCounted and VivaCity data)

Figure 3 shows the monthly total counts of city-bound cyclists recorded by the BeCounted and VivaCity sensors from June 2024. From August 2024, BeCounted data appears to be very unreliable due to a considerable decrease in numbers compared to the VivaCity data. This suggests data from this BeCounted sensor is materially under counted and should be considered unreliable due to technical issues in the specific downhill counter.

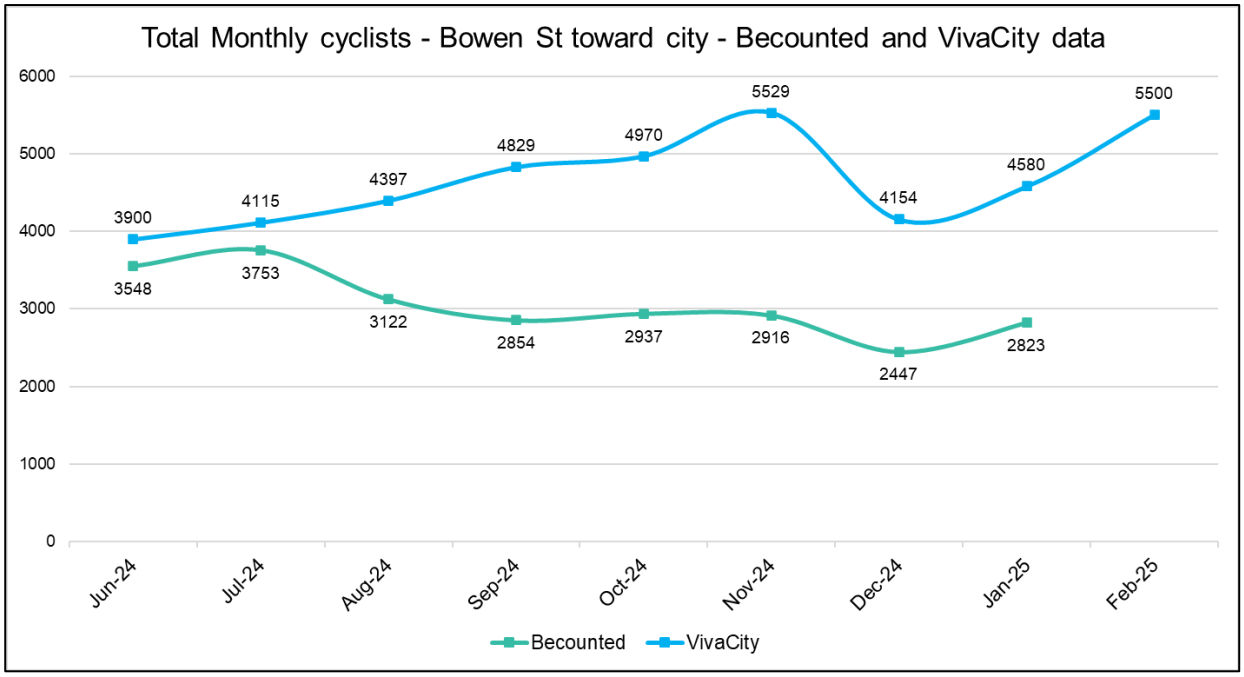

Figure 3. Monthly bike counts in Bowen Street towards the central city

- ✓ A silver standard quality assurance check has been completed.
- ✓ The patterns towards Karori have passed the monthly and daily pattern tests. This achieves a 2-star rating.
- ✗ The patterns towards the city does not pass the monthly and daily pattern tests We assess this as unreliable (0-stars).

2. Glenmore Street near Garden Road

Figure 4 shows the monthly total counts of cyclists recorded by the BeCounted sensor from June 2024 to February 2025 with city bound totals in green and outbound totals in red. The data shows typical monthly variability which results from variations in the number of working days, weather, and events. Daily total cyclist counts show typical variability with higher activity on weekdays (Figure 5). We note very unbalanced directional cycling totals.

A validation count was undertaken in early March 2025 which indicated data counts on both city bound and Karori bound are **not** reliable. Details are reported in the Glenmore Street Bike Data Analysis attached to Agenda of Koata Hātepe | Regulatory Processes Committee - Wednesday, 9 April 2025 (Page 312 and 313). Therefore, data from these BeCounted sensors is not considered reliable enough to produce insights to inform decisions.

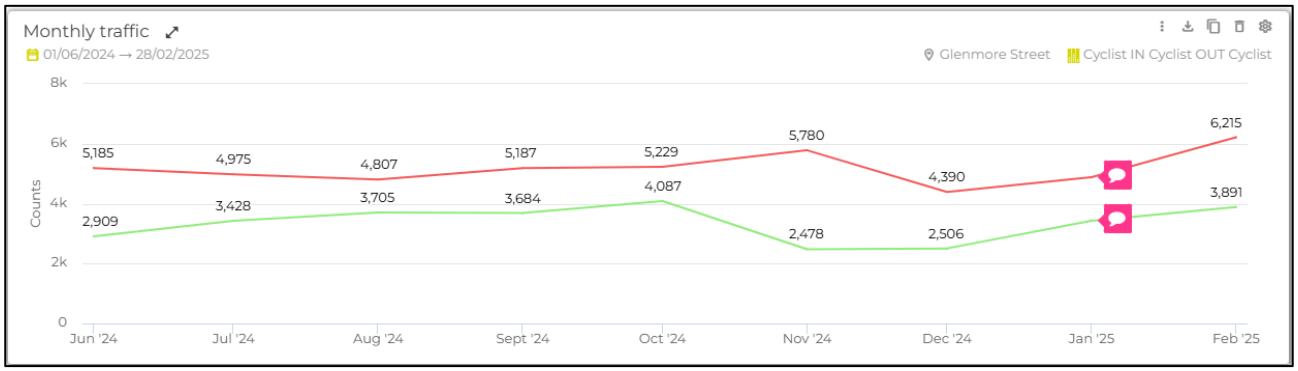

Figure 4 Monthly total bike trips on Glenmore Street, city bound and outbound (raw data from BeCounted)

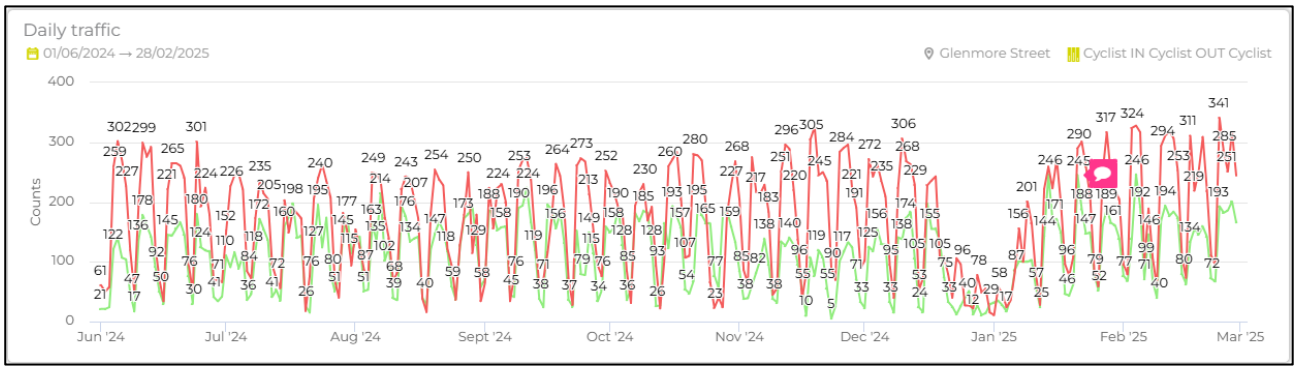

Figure 5 Daily total bike trips on Glenmore Street, city bound and outbound (raw data from BeCounted)

- ✓ A gold standard quality assurance check has been completed.
- ✗ The patterns do not pass the monthly and daily pattern tests and a validation test, therefore we rate this data as unreliable (0-stars).

3. Karori tunnel Karori bound

Figure 6 shows the monthly total counts of cyclists recorded by the BeCounted sensor from June to December 2024. The data shows typical monthly variability. The BeCounted data shows typical monthly variability. The BeCounted data for January and February 2025 was not considered because the counters being temporarily out of service due to construction works.

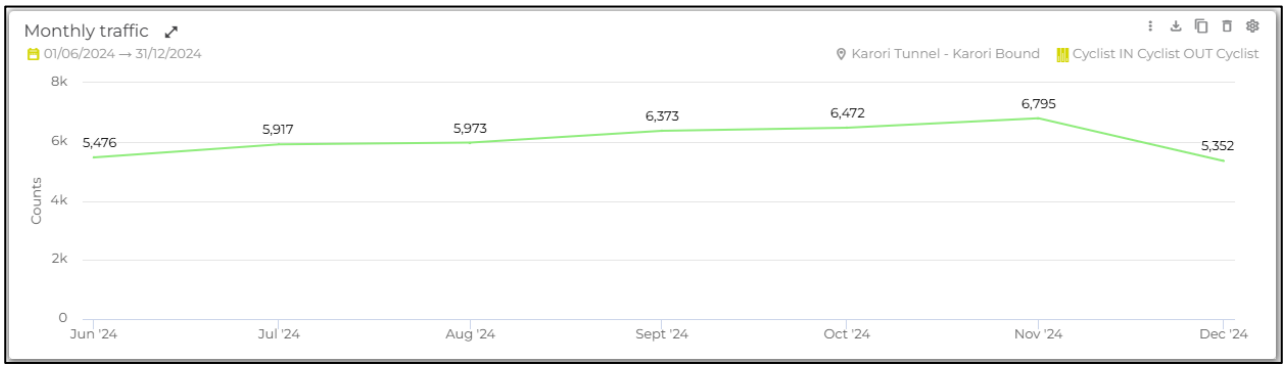

Figure 6. Monthly total bike trips at Karori tunnel, Karori bound (raw data from BeCounted)

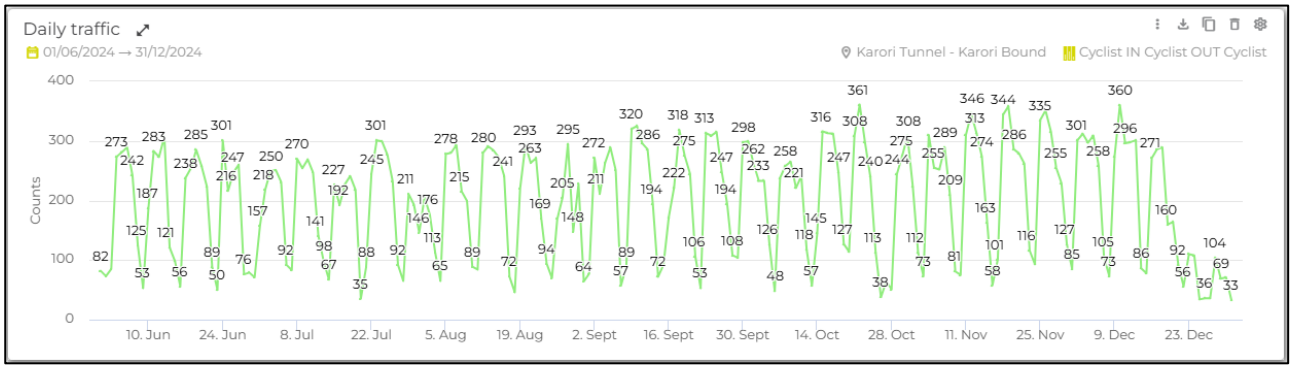

Figure 7. Daily total bike trips at Karori tunnel, Karori bound (raw data from BeCounted)

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Comparison to VivaCity sensors

Data for this location has been checked at an intermediate standard level by checking the internal consistency and comparing data to a nearby data source (VivaCity sensor 18 on Chaytor Street). Figure 8 shows the monthly total counts of Karori-bound cycle trips in Chaytor Street recorded by the BeCounted and VivaCity sensors from June 2024. BeCounted data records slightly lower numbers than VivaCity data for this location. The variance ranges from 106 to 348 cyclists per month, which indicates 95% to 98% of similarity between the two data sources.

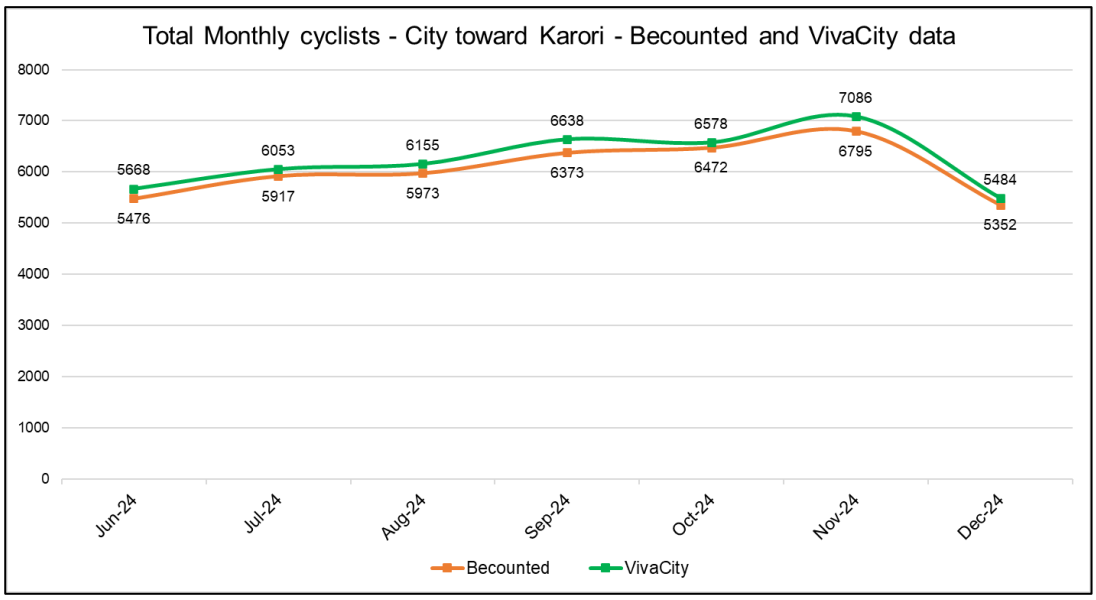

Figure 8. Monthly bike counts in Karori tunnel Karori bound (BeCounted and VivaCity data)

- ✓ A silver standard quality assurance check has been completed.
- ✓ The patterns pass the monthly and daily pattern tests up to December 2024, and shows a strong correlation compared to a nearby VivaCity sensor.
- ✓ This achieves a 2-star data quality rating.

4. Karori tunnel City bound

Figure 9 shows the monthly total counts of cyclists recorded by the BeCounted sensor from June to December 2024. The BeCounted data shows typical monthly variability. The BeCounted data for January and February 2025 was not considered due to the counters being temporarily out of service due to construction works.

The variance between city-bound (Figure 9) and Karori-bound (Figure 6) monthly totals ranges from 151 to 752 cyclists per month, which indicates 87% to 98% of similarity between the two directions.

Figure 9. Monthly total bike trips at Karori tunnel, city bound (raw data from BeCounted)

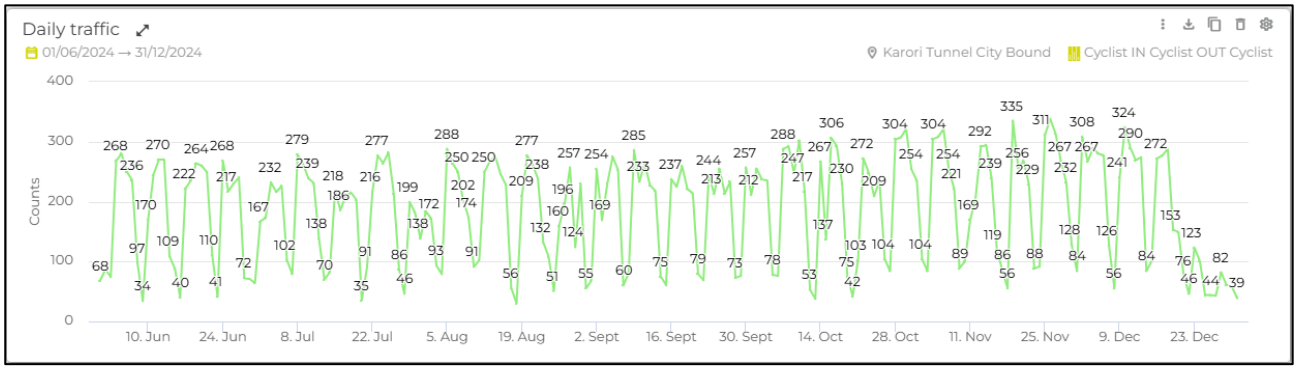

Figure 10. Daily total bike trips at Karori tunnel, city bound (raw data from BeCounted)

Comparison to VivaCity sensors

Data for this location has been checked at an intermediate standard by checking the internal consistency and comparing data to a nearby data source (VivaCity sensor 18 on Chaytor Street). Figure 11 shows the monthly total counts of city-bound cyclists on Chaytor Street recorded by the BeCounted and VivaCity sensors from June 2024. BeCounted data records slightly lower numbers than VivaCity data for this location. The variance ranges from 86 to 844 cyclists per month, which indicates 87% to 98% of similarity between the two data sources.

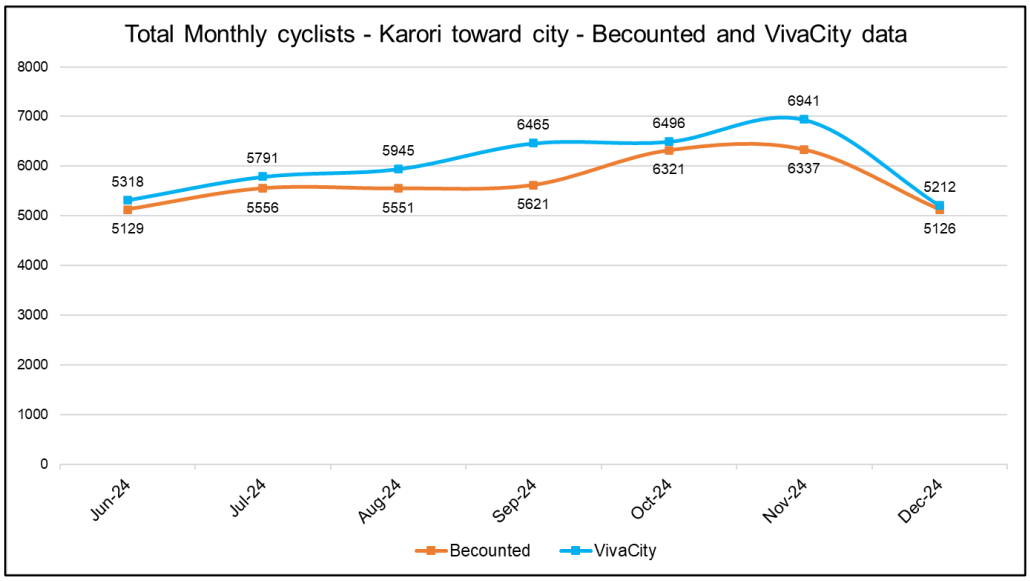

Figure 11. Monthly bike counts in Karori tunnel city bound (BeCounted and VivaCity data)

- ✓ A silver standard quality assurance check has been completed.
- ✓ The patterns pass the monthly and daily pattern tests up to December 2024, and a comparison test to nearby VivaCity sensors.
- ✓ This achieves a 2-star data quality rating.

Conclusions

BeCounted data sets from six sites has been reviewed. The results are summarised in the table below. Data was examined to **silver and gold standards of data quality assessment** which means cross-validation assessment was conducted by comparing BeCounted data to other data sources for reviewing Bowen Street and Karori tunnel counters. A comparison to at least one manual validation sample was undertaken for Glenmore Street counters. Findings about unreliable or questionable data have been documented in this report, including decisions to remove data for Glenmore Street and Bowen Street city bound data which judged to the very unreliable. Table 4 summarised the results of this bike data review.

Table 4. Summary of the results of selected BeCounted bike data review

Row	BeCounted sensor location	Data quality assessment standard	System health	Monthly and Daily pattern	Hourly pattern	Comparison to VivaCity	Validation (manual counts)	Data quality assurance rating
1	Bowen Street city bound	Silver	✓	×	×	×	Not conducted	☆☆☆☆ Not reliable
2	Bowen Street outbound	Silver	✓	✓	✓	✓	Not conducted	★★☆☆ Intermediate
3	Glenmore Street near Garden Road uphill	Gold	✓	×	×	N/A	×	☆☆☆☆ Not reliable
4	Glenmore Street near Garden Road downhill	Gold	✓	×	×	N/A	×	☆☆☆☆ Not reliable
5	Karori tunnel Karori bound (up to Dec 2024)	Silver	✓	✓	✓	✓	N/A	★★☆☆ Intermediate up to Dec 2024
6	Karori tunnel city bound (up to Dec 2024)	Silver	✓	✓	✓	✓	N/A	★★☆☆ Intermediate up to Dec 2024
✓ = test passed × = test failed N/A = test not applicable								

This shows:

- Two sites in Glenmore Street near Garden Road have very unreliable data which should not be released.
- The site at Bowen Street towards city has been rated 0-star data quality, meaning the data is very unreliable which should not be released.
- Three sites have mostly reliable data and should be released:
    - The site at Bowen Street towards Karori has achieved 2-star data quality rating, meaning the data is internally consistent and is also consistent with a nearby data set.
    - The two sites at Karori tunnel have achieved 2-star data quality ratings, meaning that the data is internally consistent and is also consistent with a nearby data sets.

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