Better Management of Bicycle Fleet - BikeShare

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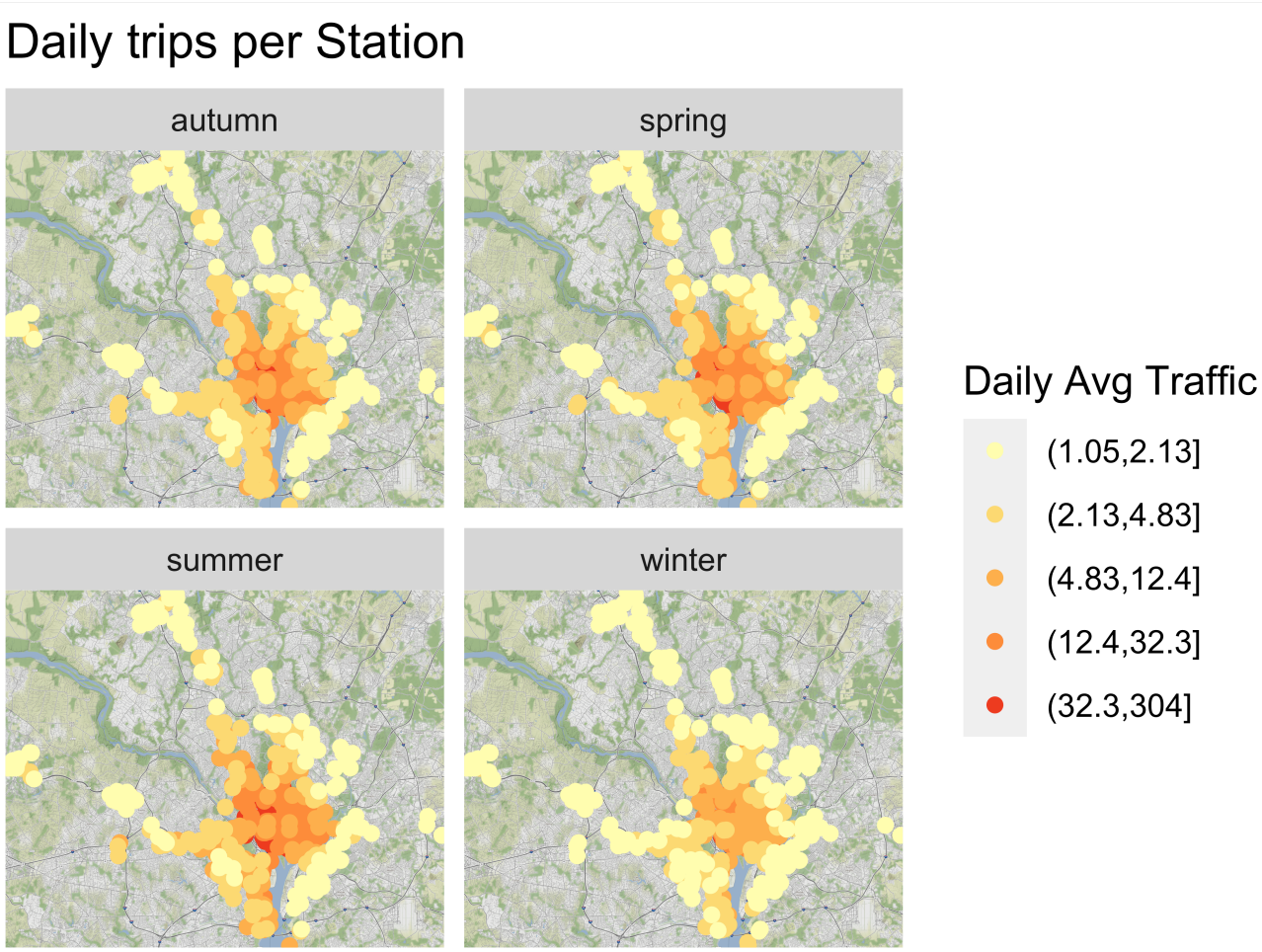
Introduction and Purpose

As the Council-owned bike sharing scheme for the City, *BikeShare* has the mission to provide a reliable, cost-effective bicycle sharing service across the Metropolitan area. In 2017 alone, *BikeShare* served over 3.8 % million trips with a fleet of 4,652 bicycles.

As of today, bike repairs only occur when a bike is detected broken. Apart from the obvious impact on customer satisfaction when a bike breaks, this model is also inefficient from a workshop's workload perspective, affecting workload and time to repair.

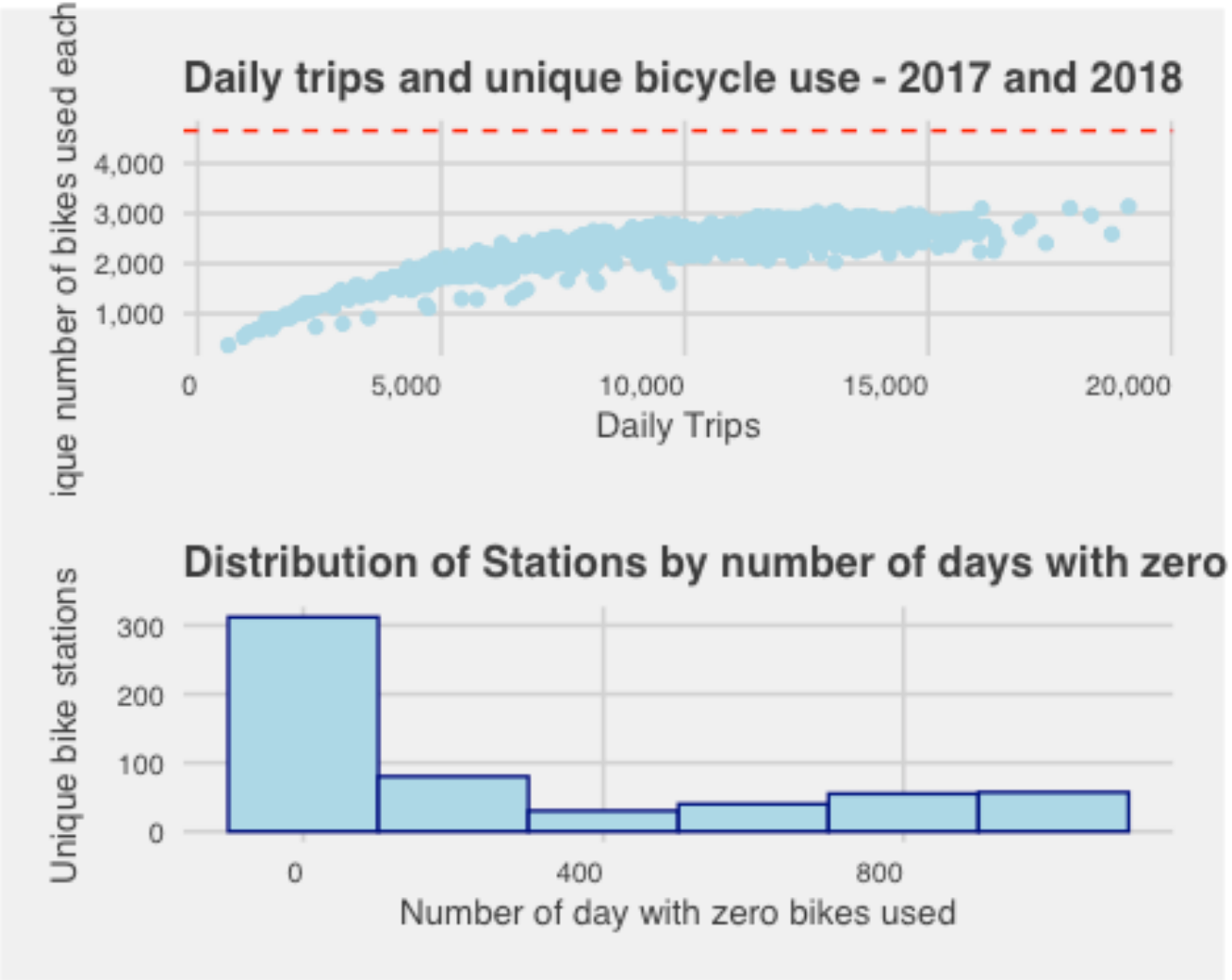
In order to address, this BikeShare can tap into the existing operational data and use analytics to optimise this problem.



Data analysis of fleet and station utilisation

However, when further analysis has been conducted, it has become apparent that the previous problem statement is **not** relevant:

- The fleet (4652 % bicycles) exceeds by far its daily demand.
- Only a fraction (37 %) of all stations are used daily (or nearly daily). Over a quarter (26 %) of all stations are half of the time or less.
- Nearly 39 percent of the stations operate at an average utilisation of less than 25%, while a similar amount operates with an average utilisation of over 75%.

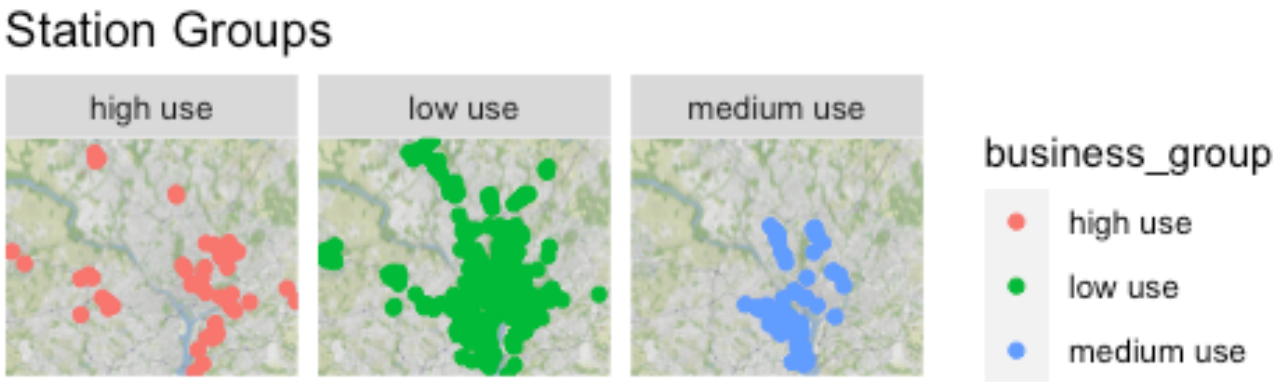


Further Analysis : There is a geographic station gap.

In order to perform further analysis, bike stations were clustered using their key statistical measures. After reviewing the results, they are were aggregated into three distinct usage groups:

- **High use**. These stations are frequently use and during summer they may carry several times their capacity. They exhibit the highest seasonality and variation. They are mostly located in the inner city and dense suburban pockets, and they are close to each other.
- **Medium use**. Stations with lower average usage compared with the high use group. They have a slightly lower seasonality, They are located in inner city districts (sometime opposite the street from high use locations) or along peri-urban commuting corridors and dense near-city suburban centres.
- **Low use**. These stations have very low usages, and many of them go unused for days. They are located in the city but also peripheral suburbs. The low volume of data makes it difficult to forecast demand.

It is interesting to note that stations of the three categories share the inner city. This makes any demand prediction challenging, due to utilisation influence by other variables difficult to quantify, such as proximity to key landmark of public transport exit.



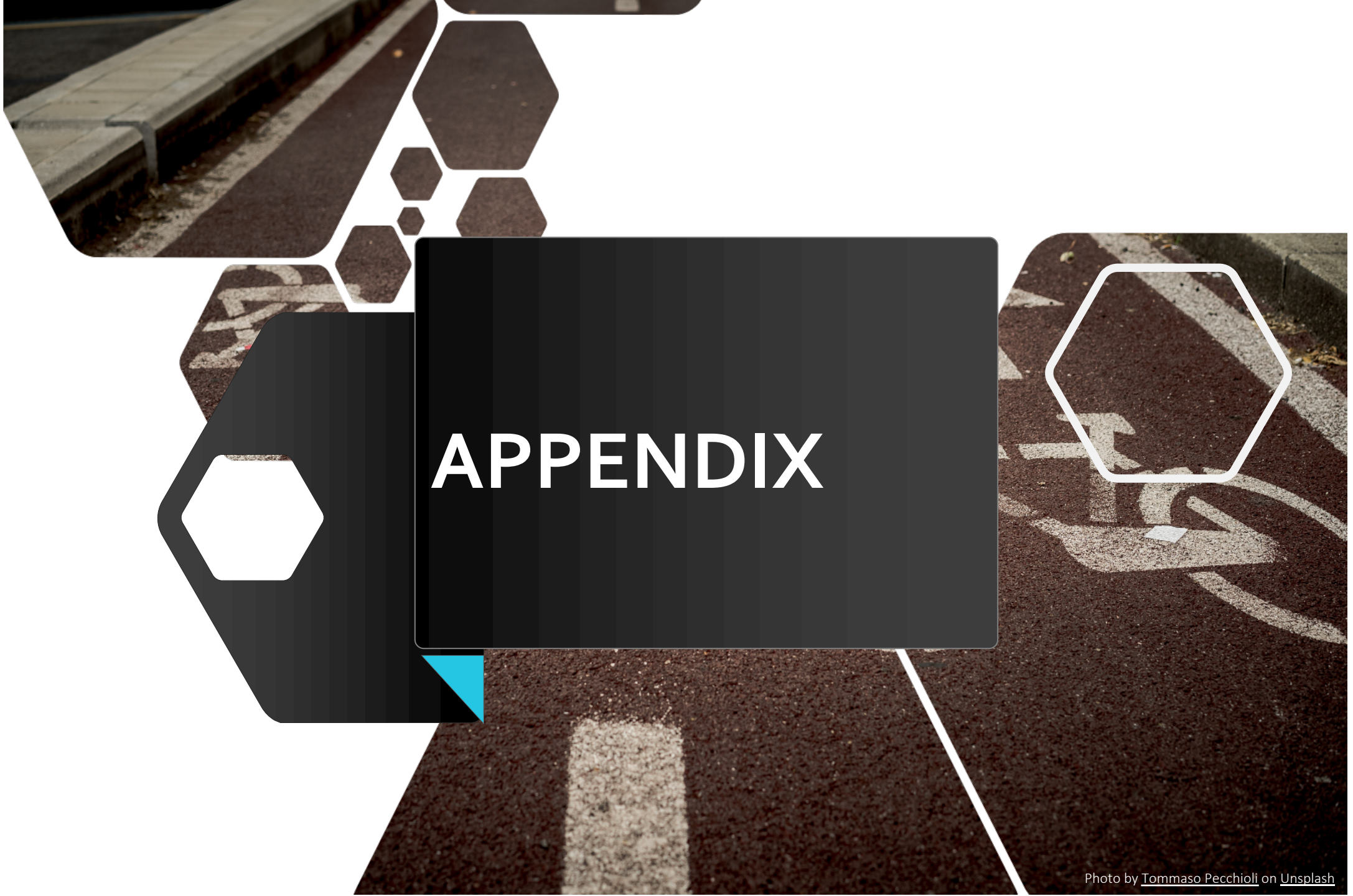
Results and recommendations

Based on the previous analysis, we can confirm that maintenance planning and demand utilisation are not priority items to address, given the existing fleet size and location in each station.

Nevertheless, it has become clear that the points to tackle are the underutilisation of the fleet and disparate station usage. Therefore, we present the below recommendations:

- Address the large number of spares by reducing the fleet or leveraging this asset in the below recommendations.
- Conduct experiments to redirect demand in inner city to medium and low use stations.
- After redirection attempts, optimise location and size or inner city stations. Optimise the peripheral network.
- Use excess capacity to deploy "pop up" stations on high usage events and locations (e.g. offer them as a public transport alternative during massive events, bring bikes to parks in spring).
- Explore innovate bike use models/service offerings, such as:
  - Multi-day (weekend) trips for registered users.
  - Allow suburban commuters to take bike home overnight - taking advantage of excess bikes.
  - Allow bikes to be parked on regular bike parking spots - to reduce walking distances.
- Explore park & ride scheme with car parks in the inner city fringe.
- Explore ride & train scheme for suburbs.

APPENDIX



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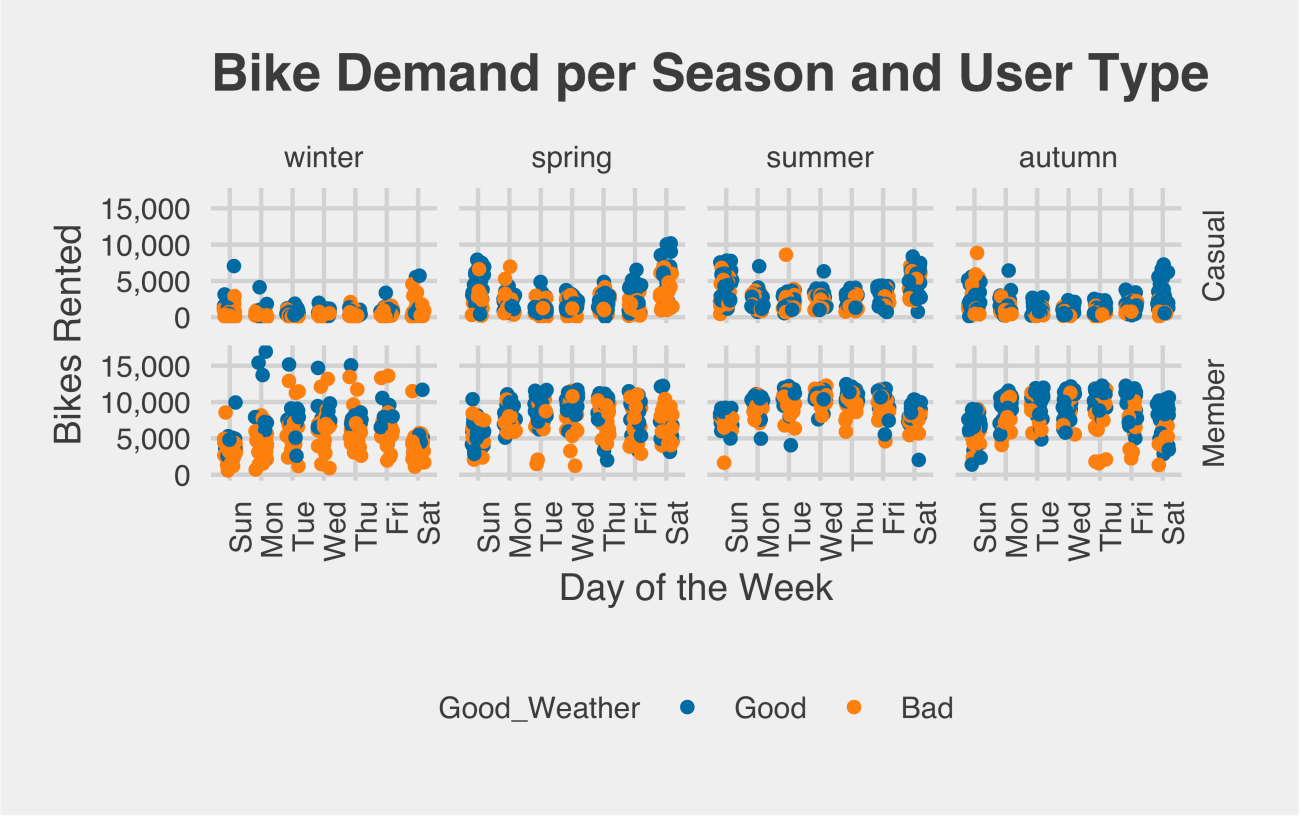
Appendix

The below slides were used in previous stages and are presented here for reference purposes

Fleet maintenance volumes and windows need to be carefully chosen

In order to **provide a good service** for the users of the bike sharing scheme, **unavailability needs to be avoided**. Unavailability is caused by lack of maintenance or lack of supply. Thus, maintenance windows need to be selected **smartly**.

- Shared bikes are **used every day of the week**. Registered users provide a constant demand baseline.
- There is **some seasonality** in the demand: registered users brave through the winter keeping the numbers high.
- At first look, it seems that **weather conditions are the biggest deterrent** for bike usage. If it is too cold, or too hot or too windy casual users won't ride; registered users' numbers will also drop.
- Bikes will **keep breaking** - even if they are well built! Thus, **every opportunity** to undertake maintenance **needs to be taken**.



Challenge: Using data analytics, we can leverage the **weather forecast** to optimise the fleet **maintenace without compromising availibilty SLAs**.

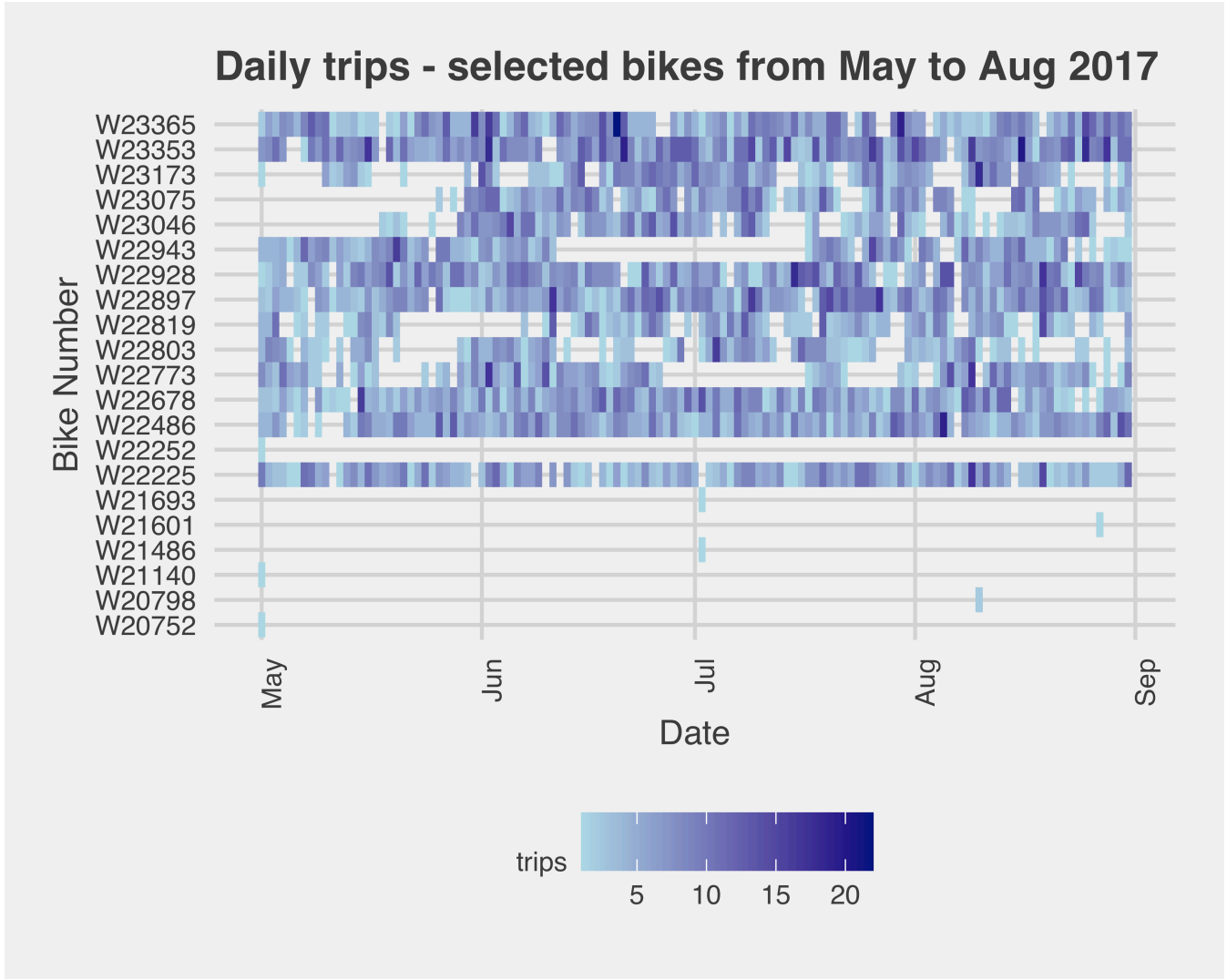
By addressing uneven bike utilisation, it is possible to extend the life of the fleet

Some bicycles in the fleet are heavily used almost every single days, while others are seldomly ridden. As a result:

- **Heavily used bikes will be at higher risk of failure** and accelerated asset ageing.
- **Unused bikes will be at risk of neglect** - e.g. left with flat tyres in an low traffic station.

By obtaining a detailed log of all bike travel, it will be possible to identify which bikes are being used the most and calculate their risk of failing. This will allow to proactively book them for service.

When those bike are taken out for service, they can be replaced with lower used bikes , evening asset utilisation.



Data Collection to Optimise Maintenance workload and bike availability

To achieve the objectives, the below data needs to be collected:

- Detailed trip data, itemised per each trip taken by each bicycle
- Weather Observations/Forecast for each day of the year
- Bike failure rates.
- Workshop's repair turnaround stats.

Based on the data, the below metrics will be generated:

Metric	Description	Source
Daily Service Capacity	Number of bikes that can be maintain any day, based on workshop capacity and predicted demand	Workshop Turnaround stats, Summary of daily trip data, weather
Need to Service Factor	Indicator whether a bike needs service ahead of probable failure	Detailed trip data

These metrics (combined with spontaneous failure rates) should serve as input for a proactive service plan.

Data Sources

- Bike scheme data: https://www.capitalbikeshare.com/system-data
- Weather data: https://www.ncdc.noaa.gov/cdo-web/search;jsessionid=FC6D9E3A1F49486E29E7130142A60038