Predicting Staffing Levels for Front Line Workers

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Risk Management Analysis

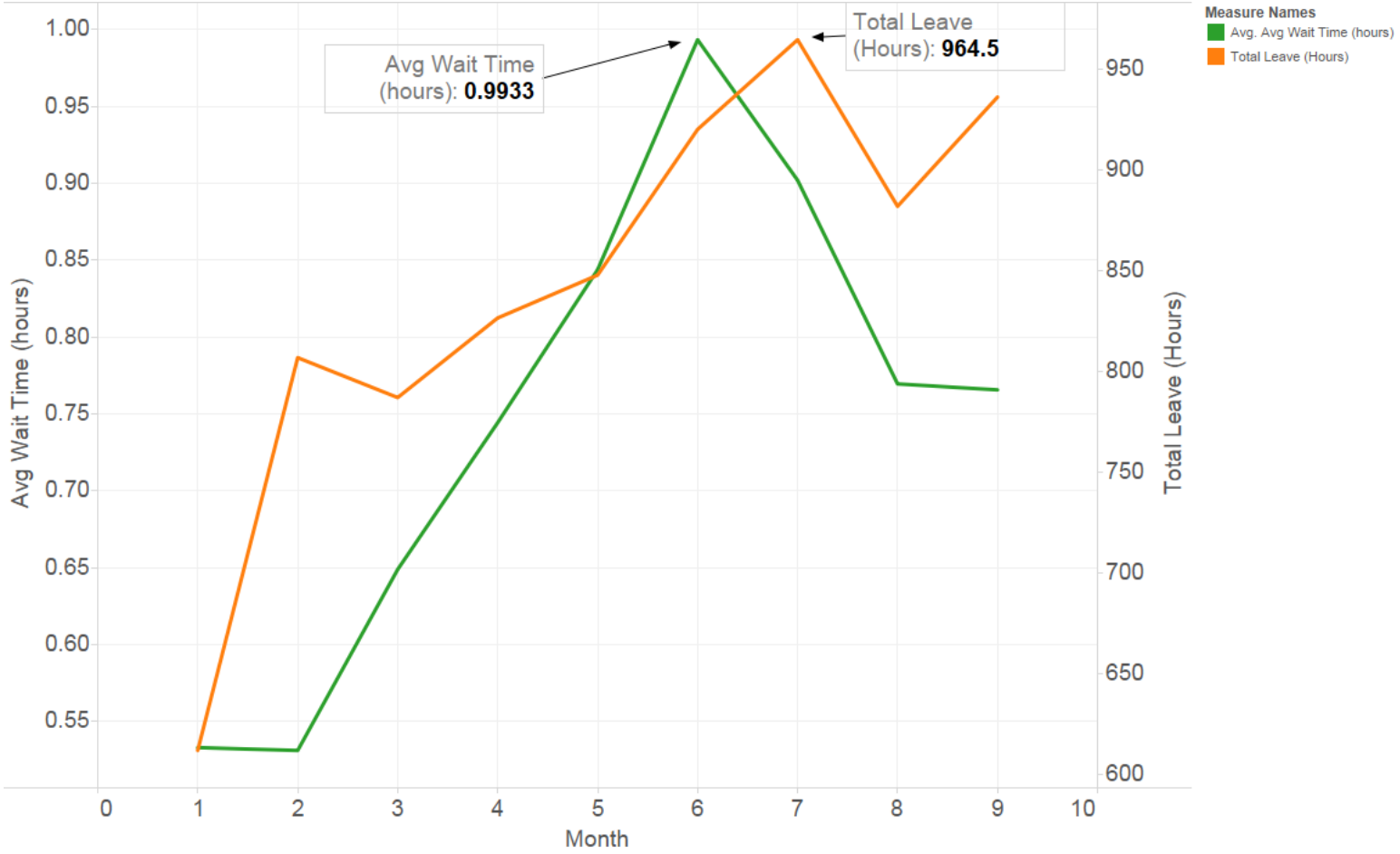
Objective

To study the correlation between the average wait time for DOB customers and the leave time of front line workers.

Predict the increase in staffing during busy months (i.e. summer) required to maintain a wait time of ½ hour.

Average Wait Time and Leave by Month

Average wait and total leave steadily increases throughout the year and peaks in June and July.



Data and Methods

Data:

- 10 months of average wait time from QMATIC.
- Leave time for each worker from City Time
- Data aggregated to the unit level (work group)
- Each group categorized according to job function:
  - Application processing
  - Records
  - Certificate of occupations

Measuring Work Capacity

To better measure the correlation between leave and average wait time, a *percent hours of leave for each group per month (PHL)* metric was developed.

Why? Want to measure the reduction in *work capacity* for each group as a result of increased leave time.

PHL calculated by dividing the total leave of workers per group by the total work capacity for the group for the month.

Example

Group has 5 workers

Total leave for the group in July is 100 hours

Each worker can work a maximum of 140 hours in July

PHL = 100/(5*140) = 0.14

What does this mean?

For the month of July, 14% of total work hours for the group was consumed by leave time (or the total capacity was reduced by 14% as a result of leave)

Correlation Analysis Results

- Correlation between average wait time and leave for all job functions is weak and not significant.

- Correlation between average wait time and leave for *application processing* is moderate and statistically significant (correlation is probably moderate due to noise in data).

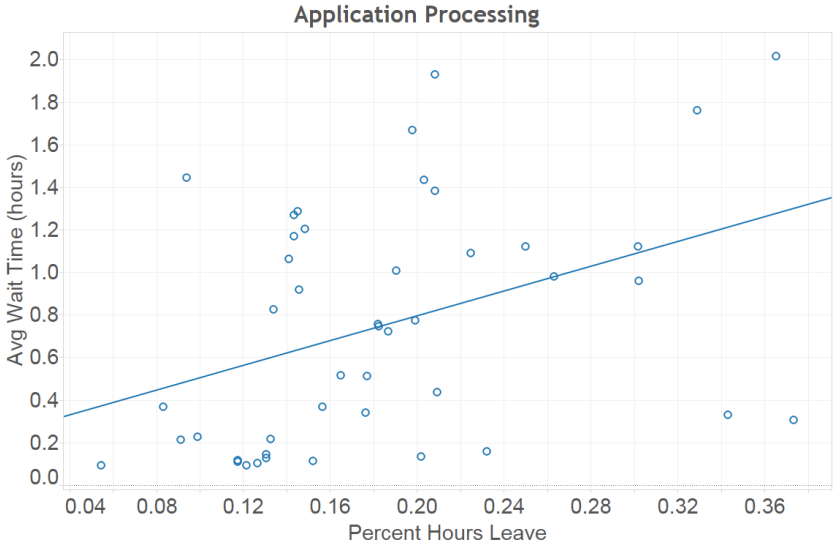
- Correlation between average wait time and leave for *records* and *certificate of occupancy* not significant due to low frequency of transactions (most transactions are in application processing).

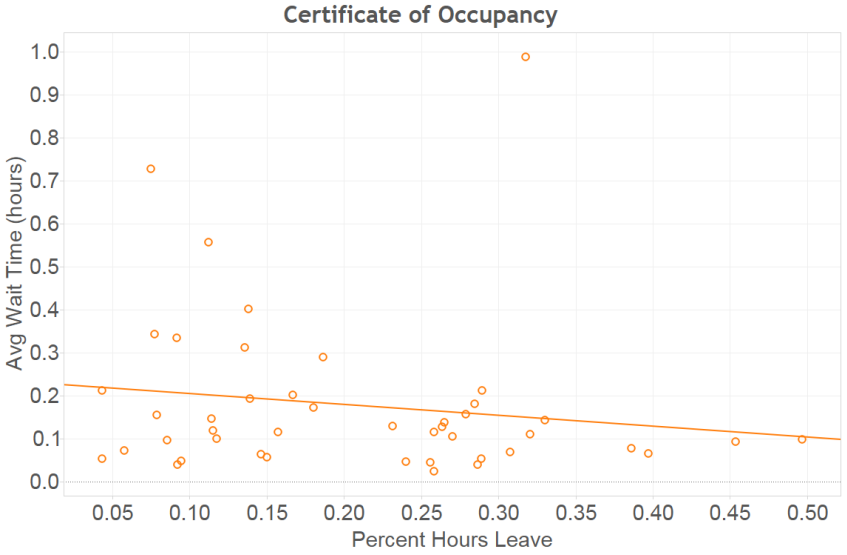
- Correlation between average wait time and leave for boroughs – not enough data for analysis.

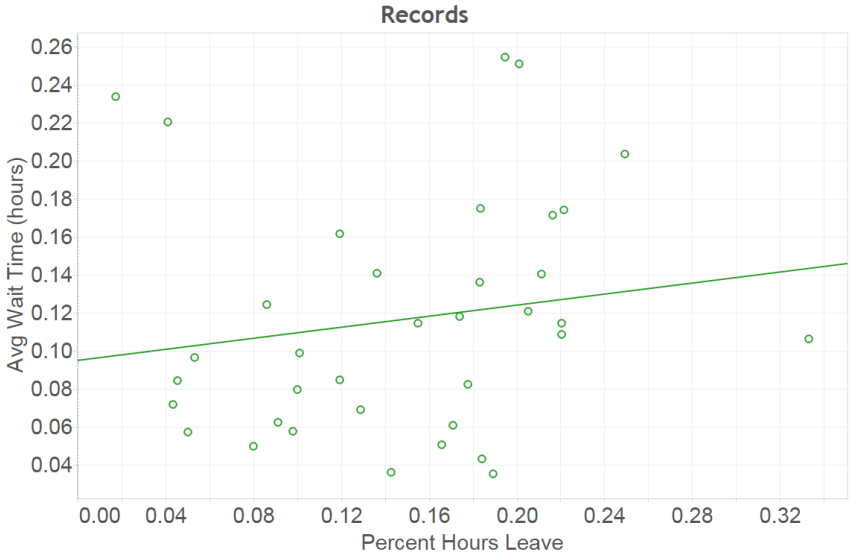
Results

Correlation Analysis by Job Function	Correlation
All Job Functions	0.13
Application Processing	0.45
Certificate of Occupancy	-0.2
Records	0.27

Plots of Correlation Analysis by Job Function







Regression Analysis

Regression analysis is used to *predict* the average wait time with increased leave time.

More specifically, when leave increases we want to know the increase in the number of workers required to maintain an average wait time at or below ½ hour.

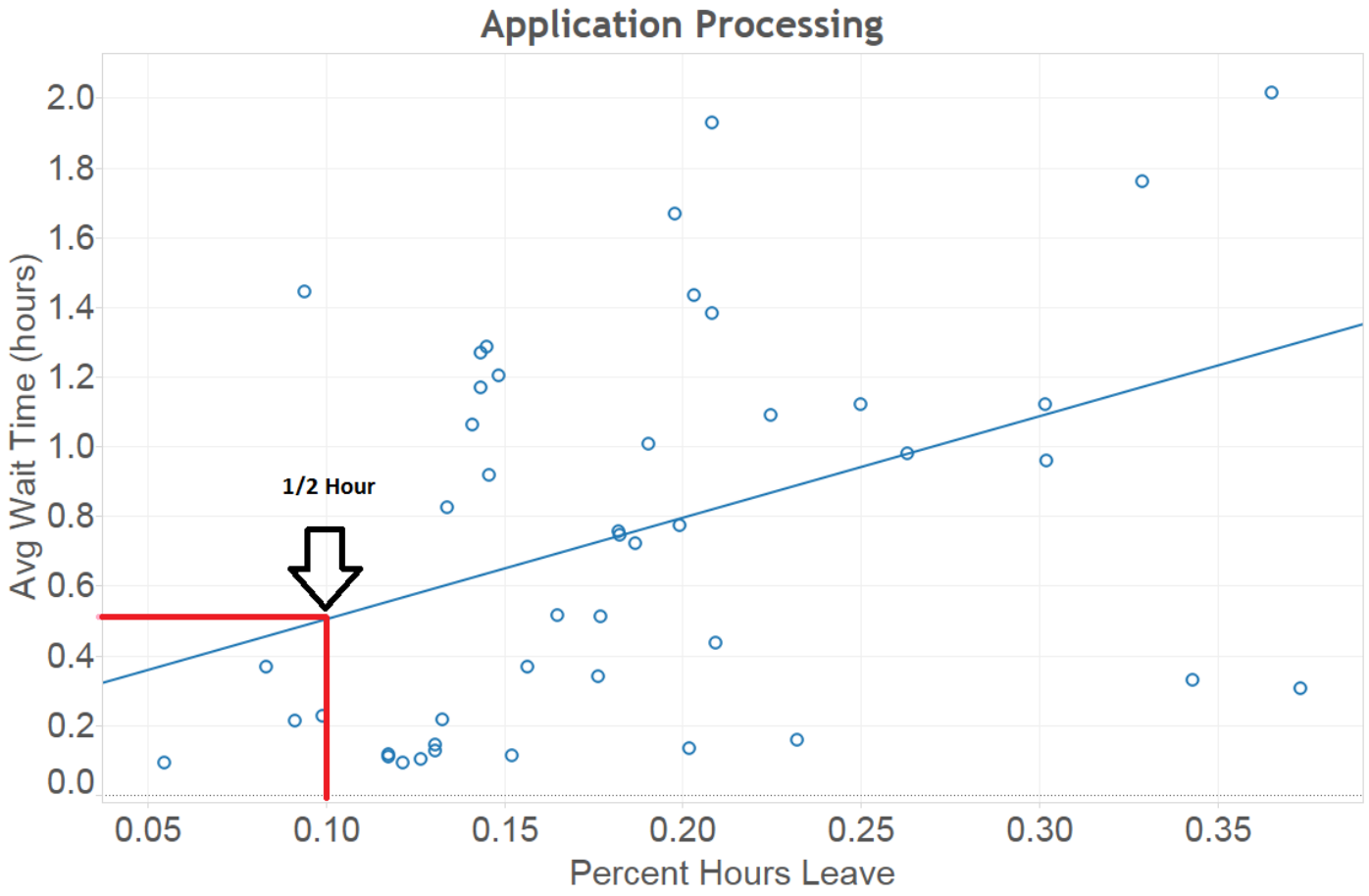
The dependent variable in our analysis is the average wait time and the independent variable is percent hours of leave for each work group.

The remainder of this analysis includes application processing only (there is no correlation between the average wait time for other job functions and leave time, and borough and leave time).

Model

Using regression results to predict average wait time

Average wait time of ½ hour is found at 10 percent hours of leave per group



Prediction

- We can use percent hours leave for group (measure of work capacity) in the regression model to predict additional hours required to compensate for increased leave in the summer.

- Equation:

  Hours of Additional Work = Leave - Total Hours Worked * 0.10

- Example:
  - Prediction for May 2017

    May 2016 : Leave = 848, Total Work Hours = 3969

    Hours of Add. Work = 848 – 3969 (0.10) = 451 hours

    Increase staff by about 3 workers

Prediction by Month

Estimate of Additional Work Hours for Increased Leave in the Summer (Application Processing)				
Month	Total Working Hours	Leave to Predict Avg Wait Time 1/2 Hour	Leave 2016	Hours of Work To Add to Keep Average Wait Time to ½ Hour
May	3969	396.9	848	451.1
June	5082	508.2	920	411.8
July	4340	434	965	531
August	5152	515.2	882	366.8

Moving Forward with Staff Analytics

- Need to improve model by gathering more QMATIC data (currently only have 10 months).
- Can possibly improve model by disaggregating the data at the weekly or biweekly level.
- Gathering more data will allow us to analyze staffing at the borough level, and comparing the types of leave.