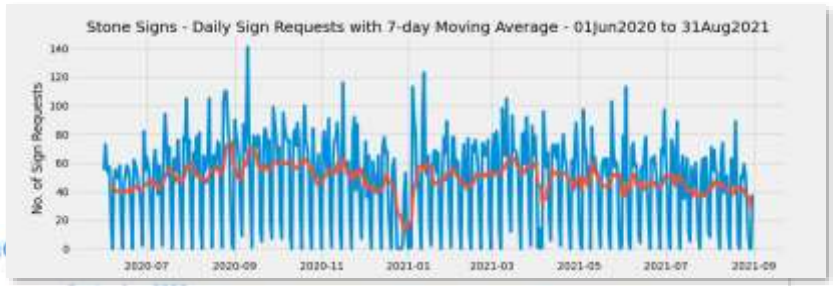
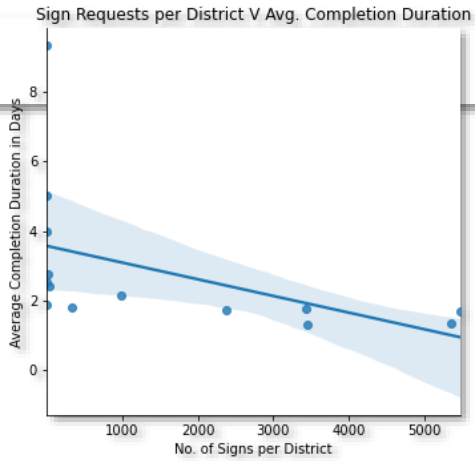
Stone Signs Portal Analysis

Stone Signs is a Sussex based company providing signage services for estate agents. In January 2020, they launched an on-line Portal for managing sign requests and to use as a scheduling tool. The data collated has been used in a series of analyses to reveal insight into Stone Signs' operational practices, and to investigate any contributing factors that may assist with forecasting.

This report explores a range of analysis techniques including: Exploratory Data Analysis, Linear Analysis, Cluster Analysis and Time Series Analysis





Prepared By Hannah Dilley

The Contents

Stone Signs Portal Analysis

The Business

Stone Signs is a Sussex based company that provides a signage service for estate agents for property that is on the market For Sale or To Rent. They also provide signage for commercial property as well as event sponsorship.

In January 2020, Stone Signs launched an on-line Portal to enable estate agents to manage their sign request needs, and for Stone Signs to use as a work scheduling tool.

Since conception, and up to the end of August 2021 the Portal has registered and actioned over 29,000 requests. The data collated has been used in a series of analyses to reveal insight into Stone Signs' operational practices to provide recommendations for business improvement, and to reveal any contributing factors that may assist with forecasting.

To compliment this area of the property market, data from the HM Land Registry relating the price paid for property in 2020 and 2021 has also been sourced.

The Data

- Primary: Estate agent sign requests for property in Sussex made between January 2020 to August 2021.
- Secondary: Land Registry* Price Paid Data (PPD) for England and Wales in 2020 and 2021.
  **Contains HM Land Registry data © Crown copyright and database right 2021. This data is licensed under the Open Government Licence v3.0.*
- Supporting: GeoJSON of Local Authority Districts for Sussex and surrounding area.
- Supporting: GeoJSON of UK Postcodes.

The Background

In March 2020 the UK went into a government instructed lockdown as a result of a worldwide pandemic. This saw the closing of businesses and schools across the nation as the public were instructed to 'stayed-at-home'. The lockdown affected many businesses, including the housing market, and consequentially the need for property signage. By July 2020, to help boost the housing market, the government introduced the Stamp Duty Holiday a Buyer of property did not have to pay the usual tax fees, saving thousands of pounds. The Stamp Duty Holiday ended on 30th September 2021.

The Initial Exploratory Analysis

As is typical for any business analysis report, after cleaning and preparation of the data, initial observations about business performance were drawn. These included:

Overall Business Performance

1. What is the total revenue generated since Portal conception?
2. Compare revenue generate in 2020 to revenue generated in 2021.
3. Compare the average amount of revenue generate over a month for 2020 and 2021.
4. What is the average daily revenue?
5. How do the different sign categories compare in terms of work requests?

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Sales and Letting Requests

6. How long does it take to action a sign request?
7. How many sign requests are received on a daily basis?
8. How many sign requests are completed on a daily basis?
9. How many signs are placed per postcode area?
10. How many signs are placed per district?
11. How many signs are in a sign life-cycle, i.e., how many instructions per property?

Sold Property

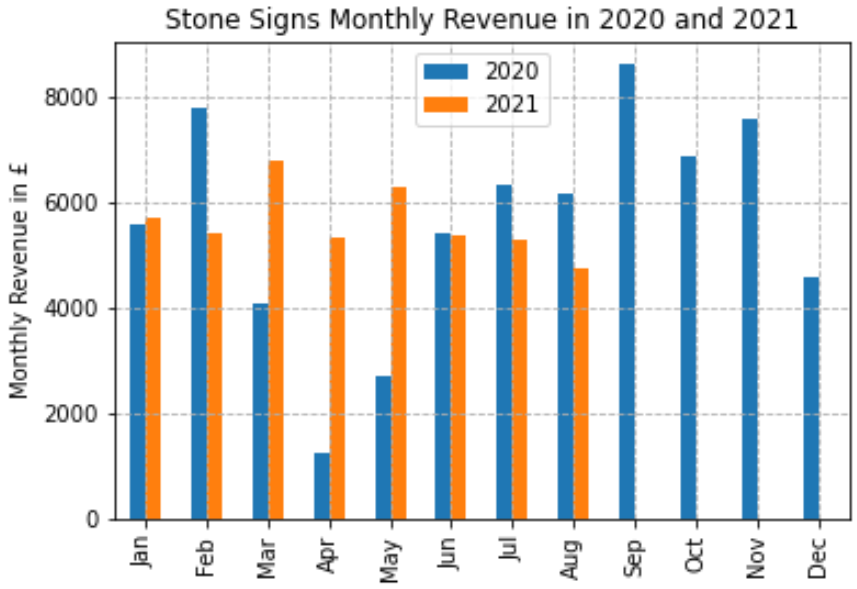
12. What effect does property price have on the number of signs per cycle?

Overall Business Performance

1. How much revenue has been generated since Portal conception?
   - ☐ From 1st January 2020 to 31st August 2021 £111,827
   - ☐ Average monthly takings: £5,591

2. Compare revenue generate in 2020 to revenue generated in 2021.
3. Compare the average amount of revenue generate over a month for 2020 and 2021.
4. What is the average daily revenue generated for each year?

	2021	**2020**
Revenue for Year to Date	£44,929 (8 months)	£66 897 (12 months)
Average Revenue per month	£5,616	£5,575
Average Revenue per Day	£185	£183

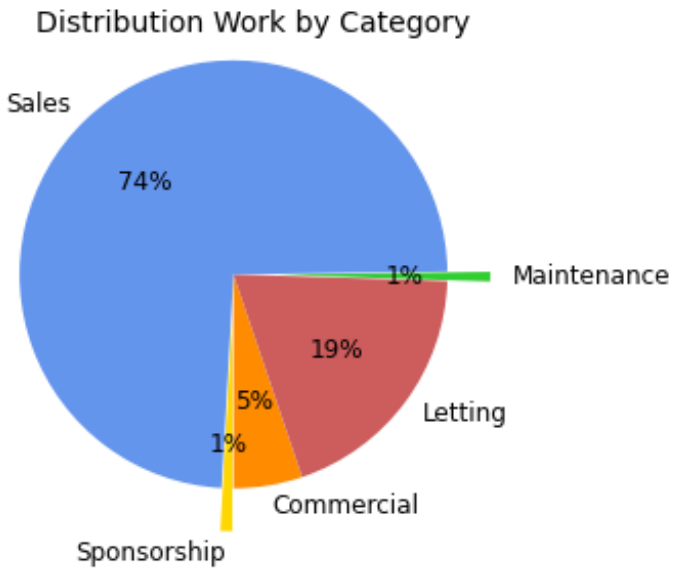


- ☐ The results show that on average, the revenue generated in 2020 is similar to the revenue generated in 2021. It is evident from the data that the Stamp Duty Holiday has had the desired effect on the housing market, and consequentially on Stone Signs' business.

Stone Signs Portal Analysis

5. How do the different sign categories compare in terms of work requests?

Work Areas: Sales, Letting, Sponsorship, Commercial and Maintenance

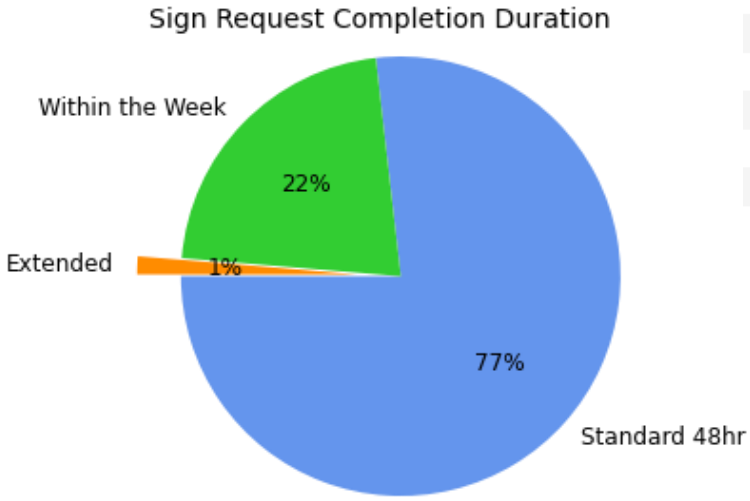


- Sales and Letting signs contribute to 93% of the business. However, Sponsorship requests have been lower than normal owing to the lack of public events. In addition, "Maintenance" is a new feature on the Portal, introduced just two months ago and so the % proportion may not be a true reflection of normal maintenance work carried out.

Sales and Letting Requests

Owing to the bulk of work being attributed to Sales and Letting, and the patterns of work in these categories being similar, the data was filtered to include these areas for further analysis.

6. How long does it take to action a sign request?



	completed_duration_days	completed_duration_hours
count	26920.000000	26920.000000
mean	1.581337	37.951501
std	1.827606	43.863184
min	0.000000	0.100000
25%	0.830000	19.900000
50%	1.070000	25.700000
75%	1.970000	47.300000
max	49.820000	1195.800000

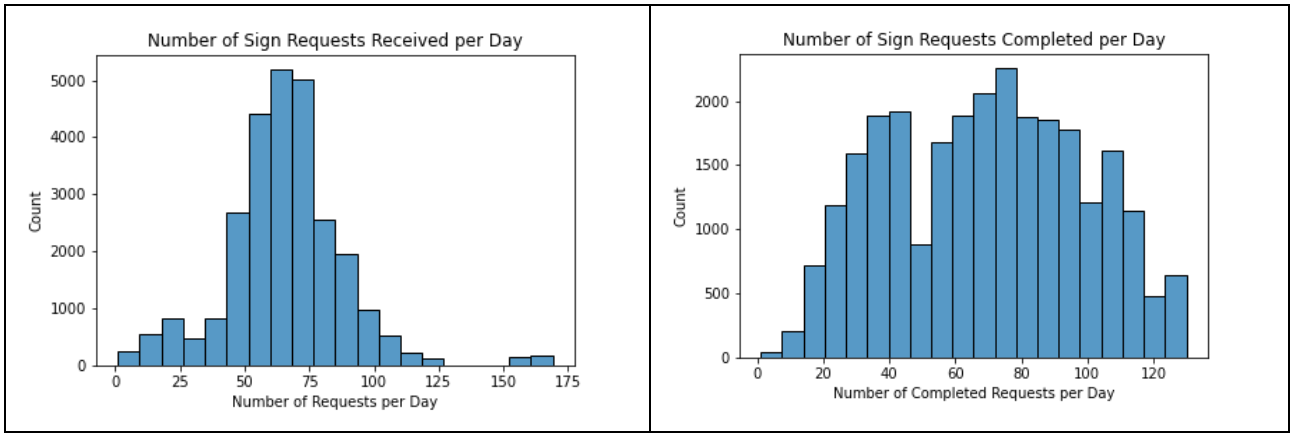
Mode:

	completed_duration_days	completed_duration_hours
0	0.93	24.0

- The results show that 77% of sign requests are completed within 48 hours but the modal value, meaning the majority, reveals that this is closer to 24 hours. What can be taken from 24-hour turnarounds to make room for reduced lead-times in other areas?
  NB: some sign requests have a delayed 'up' instruction which may be attributed to the "Extended" lead-time.

Stone Signs Portal Analysis

7. How many sign requests are received on a daily basis?
8. How many sign requests are completed on a daily basis?

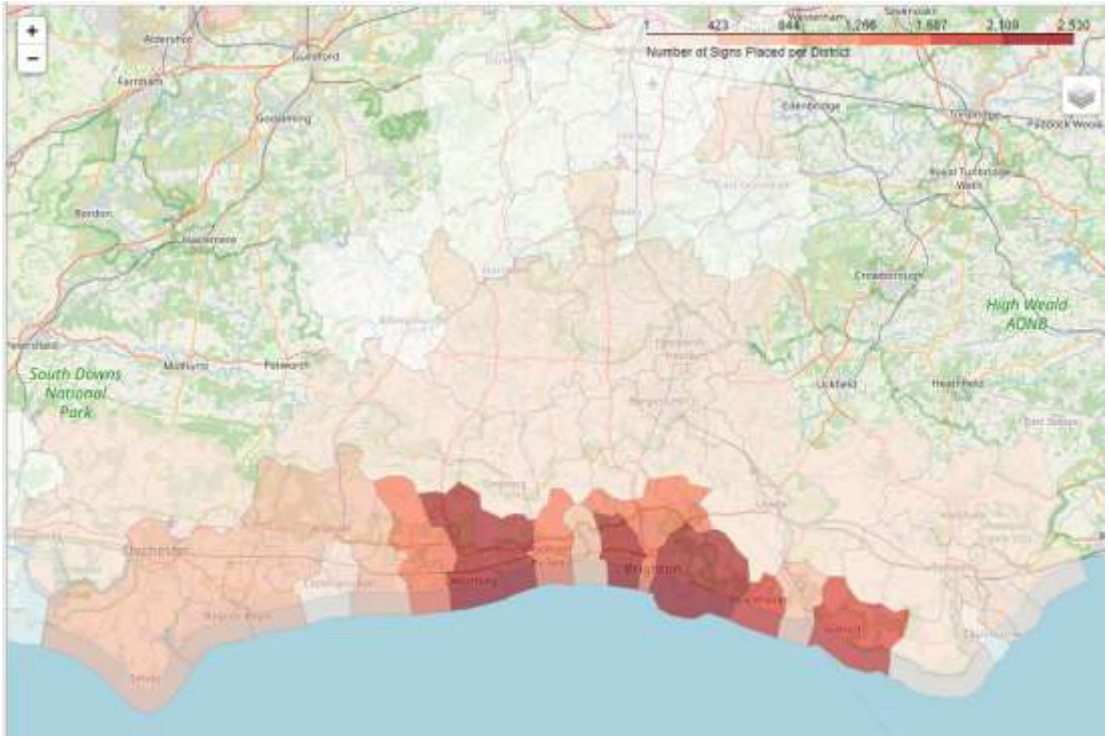


- ☐ Both the mean and the mode show that more signs are completed each day that are actually requested which is not actually possible. However, some factors that may contribute to these figures include:
  a) The removal of £0.00 sign requests as they were assumed to be duplicates.
  b) The removal of 0 hour sign requests as they were assumed to Portal updates.

Sales and Letting – Spatial Analysis

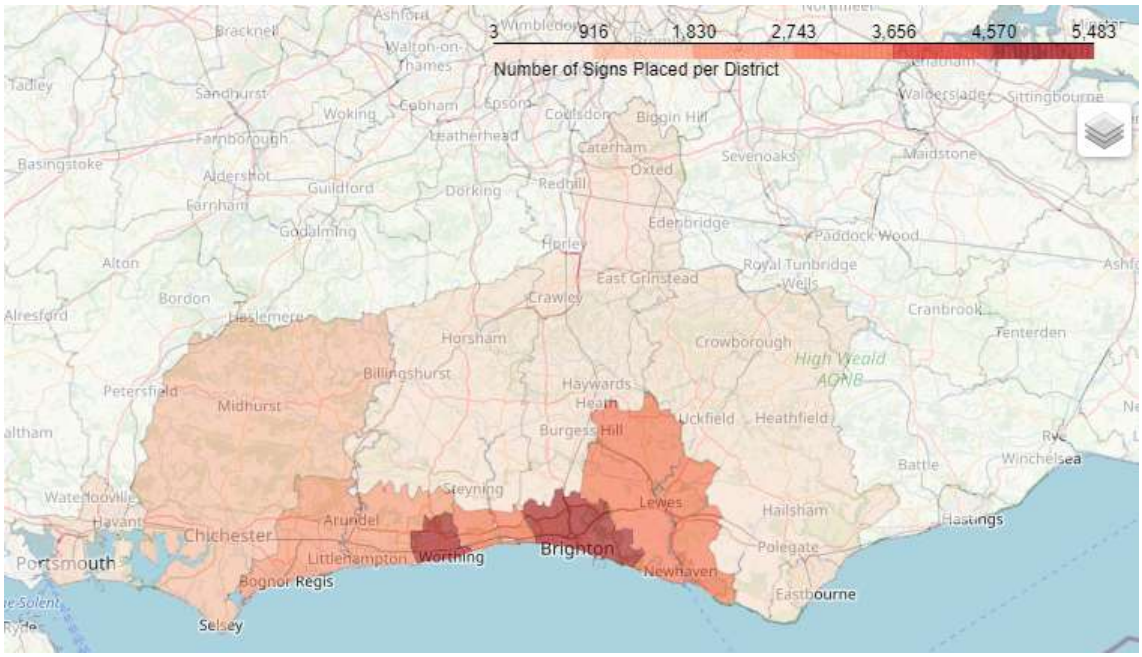
Looking at the locations that provide the most moving activity and therefore business can help to highlight areas of concentration, and provide insight on where to focus business.

9. How many signs are placed per postcode area?



Stone Signs Portal Analysis

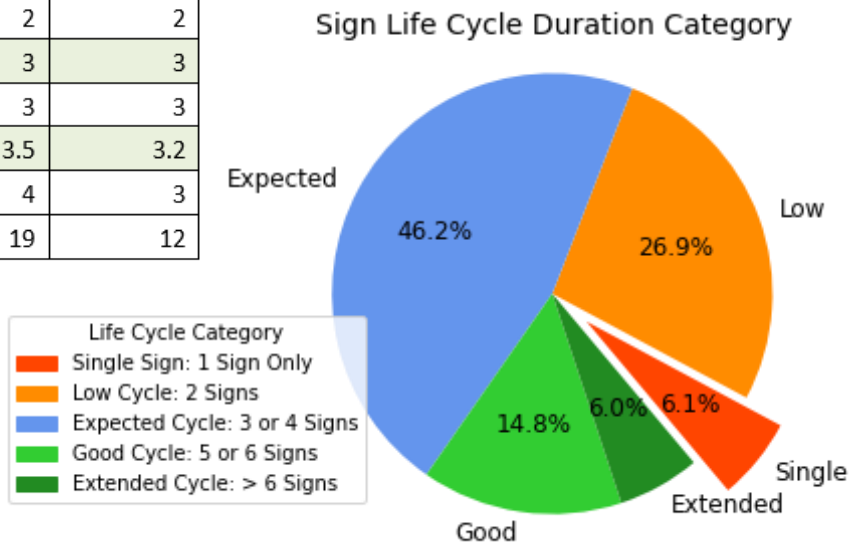
10. How many signs placed per District?



- ☐ The majority of work is to the east of Worthing with fewer opportunities to the west of Worthing.
- ☐ Recommend: Focusing work in the Worthing to Seaford area to minimise travel expense and time, and to optimise work efficiency: Number of signs completed per day & Sign completion duration.
- ☐ Recommend: Revising method of work in locations from west of Worthing to Portsmouth. E.g., Instead of visiting this area twice a week, reduce to once a week only, or twice per 10 days.

11. How many signs in a sign life-cycle, i.e., how many instructions per property?

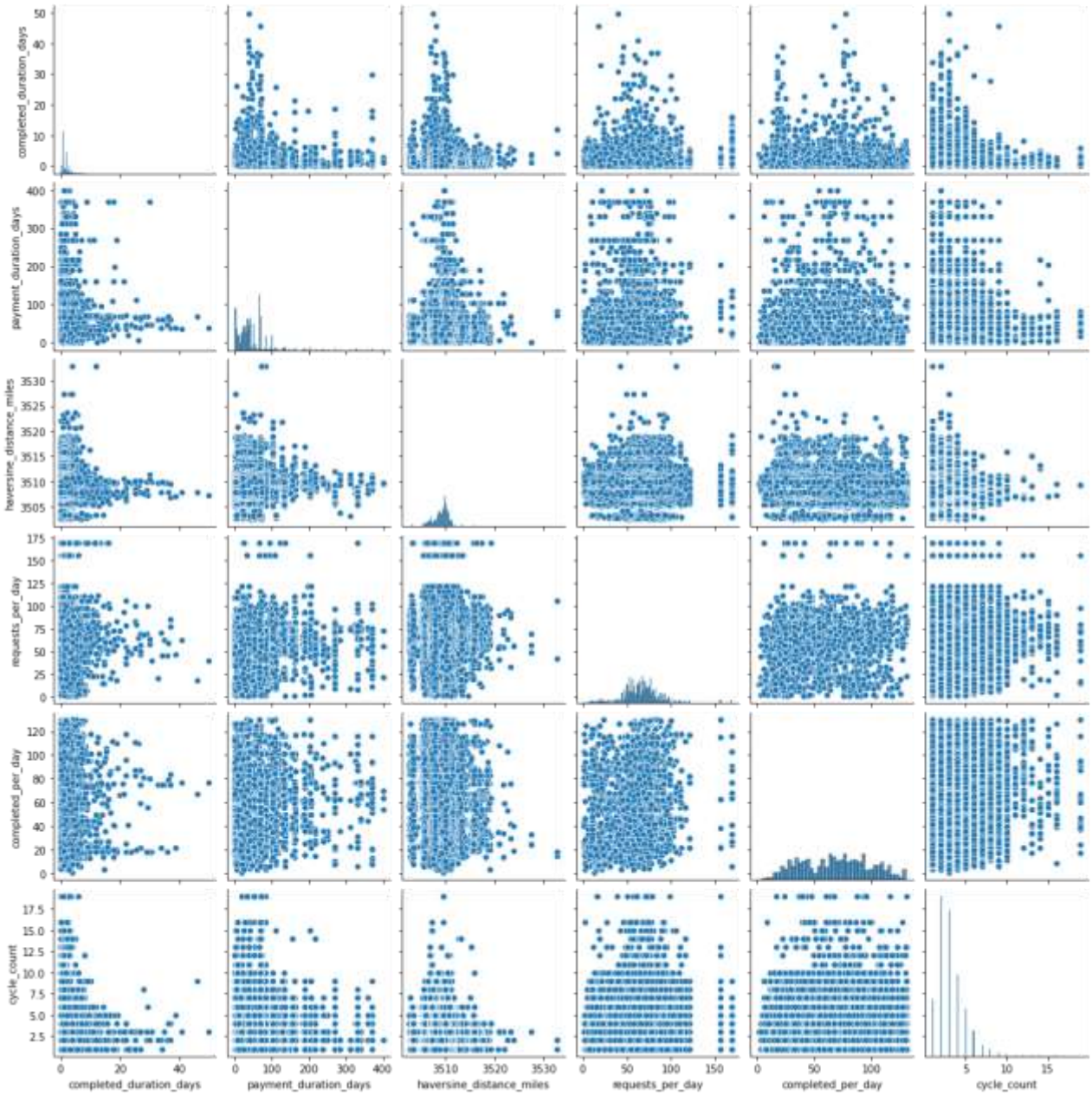
No. of Signs per Life Cycle	**Sales & Letting**	**Sales**	**Letting**
Record Count	24,209	19,156	5,053
Min	1	1	1
Q1	2	2	2
Mode	3	3	3
Q2 – Median	3	3	3
Mean	3.5	3.5	3.2
Q3	4	4	3
Max	19	19	12

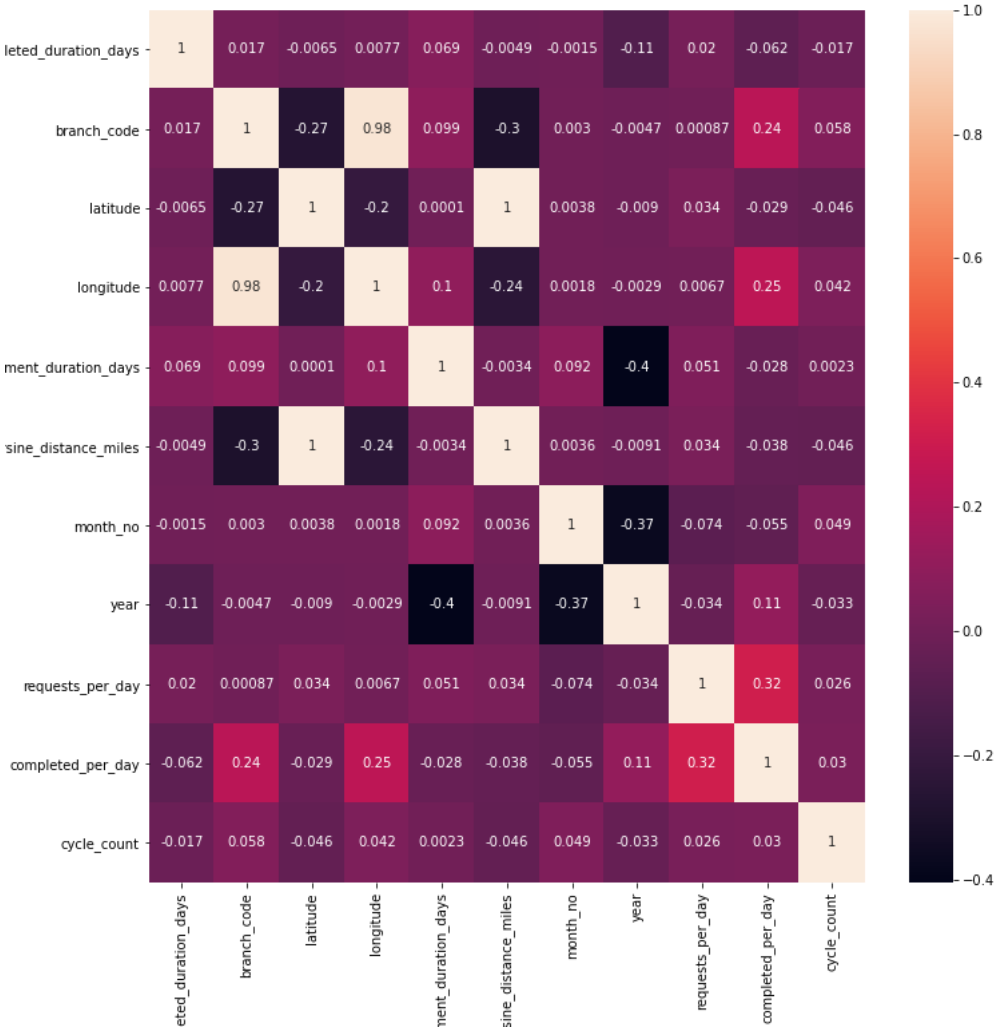


- ☐ To make business worthwhile, a sign life cycle is expected to be a minimum of 3 signs. 67% of business meets this requirement which means that 33% of the business has room for improvement. This is particularly evident in the case of the single sign which requires further investigation, as once a sign is put up, in theory it should at some point be removed.
- ☐ Recommend: Doubling cost of a New Sign to include free removal (normally charged separately). This will ensure that there is a minimum of two signs per life cycle.

The Further Exploratory Analysis

After the initial observations had been made, Pair Plots and Heat Maps were used to ascertain if any correlations existed between the numerical variable. Nothing more than a weak correlation revealed but this exercise led to the forming hypotheses. Refer to section **The Hypotheses**.





The Hypotheses

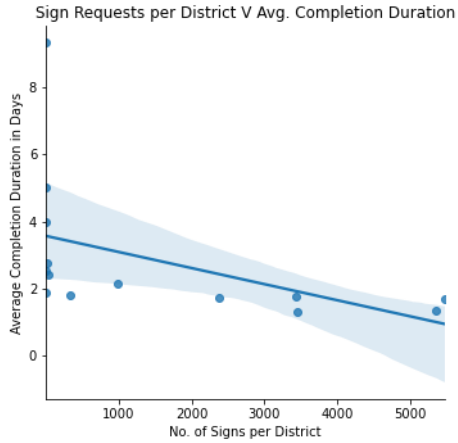
- ☐ *Hypothesis 1a: Locations with a greater number of sign requests have a shorter completion duration.*
- ☐ *Hypothesis 1b: The greater the number of sign requests per location, the greater the average number of signs completed per day.*
- ☐ *Hypothesis 2: Properties with a lower selling price have a greater number of signs per life cycle.*

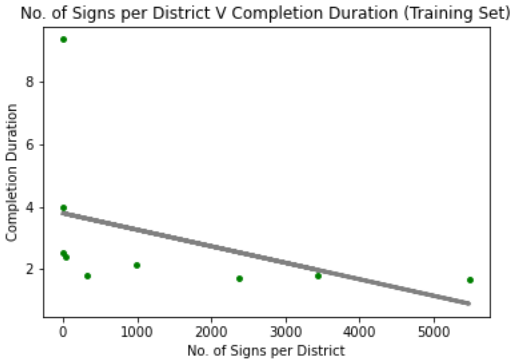
The Linear Analysis

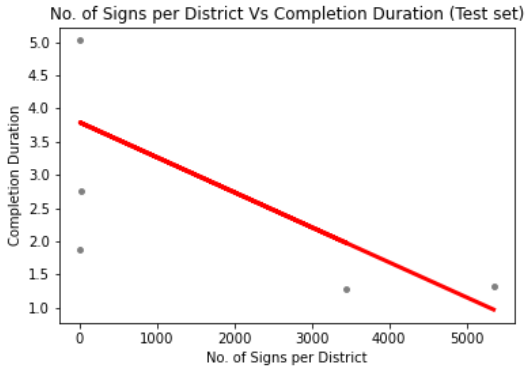
From the exploratory analysis it was evident that the original Portal data does not lend itself well to the discover of Linear relationships between variables. Some linear relationships have been discovered as a result of aggregating values but owing to this aggregation, the data then becomes unsuitable for Linear Regression analysis because of the reduction in data points.

Where a linear regression analysis was carried out the results showed for H1a: a model that fitted less than 30% of the data points, and for H1b & H2 a model that did not follow the trend of the data: this was represented by a negative R-Squared value.

Hypothesis 1a: Districts with a greater number of sign requests have a shorter completion duration



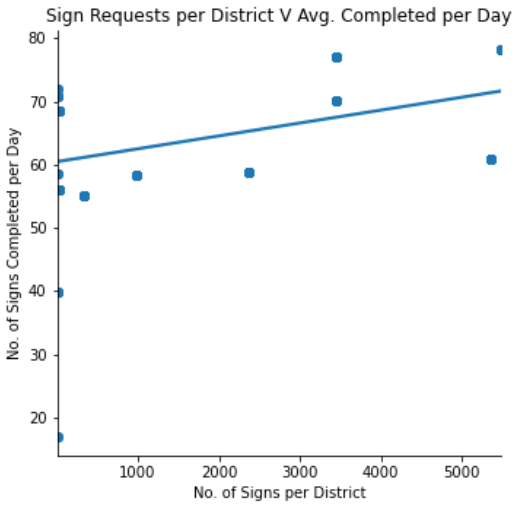


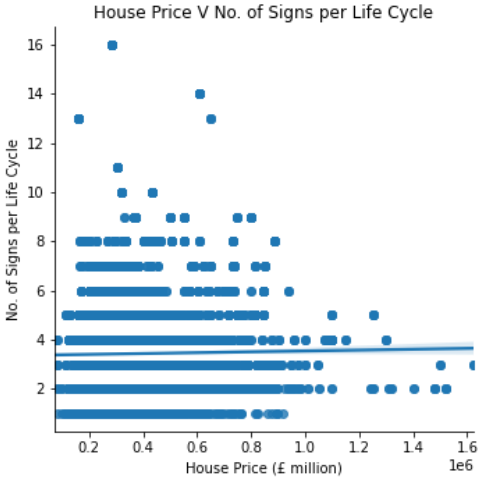


Stone Signs Portal Analysis

Hypothesis 1b: The greater the number of sign requests per district, the greater the average number of signs completed per day.

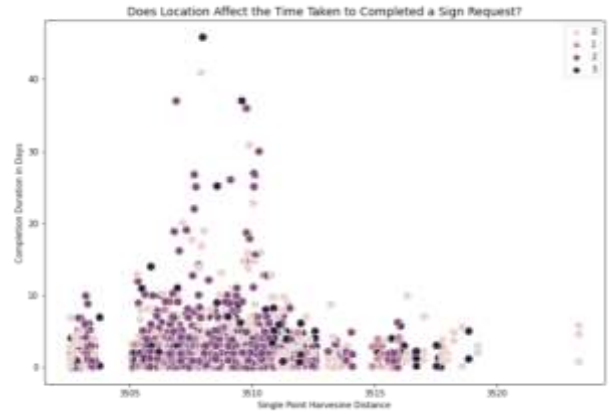
Hypothesis 2: Properties with a lower selling price have a greater number of signs per life cycle.

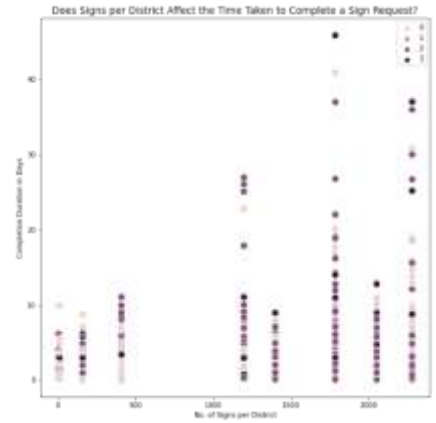




The Cluster Analysis

Carrying out a Cluster Analysis using k-Means algorithm on the numerical variables did not reveal any great insight into the data, and the only successful result, where like clusters were grouped together, involved the variables House Sale Price and the No. of Signs per Cycle, relating to *Hypothesis 2: Properties with a lower selling price have a greater number of signs per life cycle.* However, when reviewing the Mean and Median for each clustering group, the cycle count values for each cluster were very similar meaning that there was not enough variance in the data to make predictions based on these factors.





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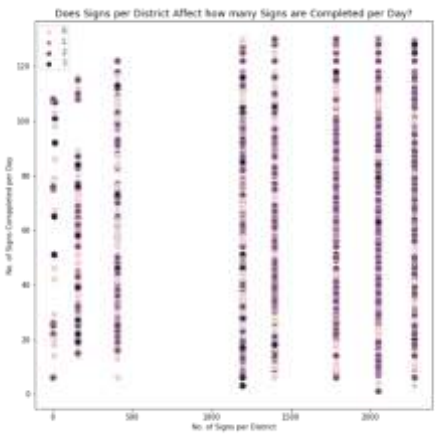


Cluster Statistics: House Sale Price & Life Cycle Count

Mean

cluster_colour	sale_price	cycle_count
Dark Purple	608641.452639	3.448579
Mauve	926012.800562	3.584270
Pink	408660.383754	3.424930
Purple	265514.484903	3.427840

Median

cluster_colour	sale_price	cycle_count
Dark Purple	600000	3
Mauve	865000	3
Pink	400000	3
Purple	277500	3

The Time Series Analysis

As a final analysis, an attempt was made to apply the ARIMA model to time series data that recorded the number of sign requests made each day. To help with providing a stationary time series, the effect of the first pandemic lockdown was removed, giving a revised time series date range from 1st June 2020 to 31st August 2021. However, despite a number of approaches it was not possible to provide an accurate forecast model.

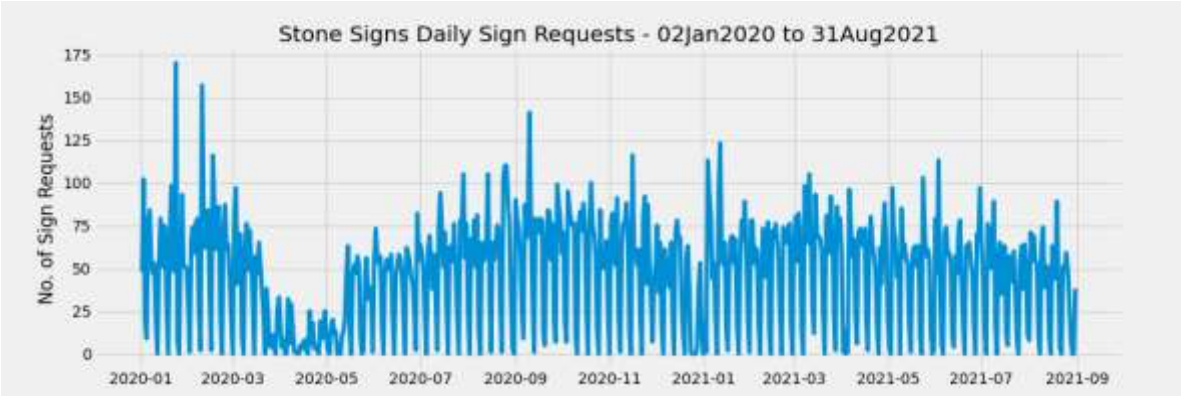
Approaches included:

1. Carrying out Differencing to 12 rounds on the original raw data only to discover that the ARIMA model does not support $d>2$, where d represents the number of rounds of Differencing.
2. Smoothing the data by a 5-day Moving Average and 6-day Moving Average but two rounds of Differencing did not expunge the autocorrelation.
3. Smoothing the data by providing a 7-day Moving Average, meant that the autocorrelations were removed with one round of Differencing but the result of the ARIMA modeling could not provide an accurate prediction despite reducing all parameter values to 1, and the Confidence Level from 95% to 90%.

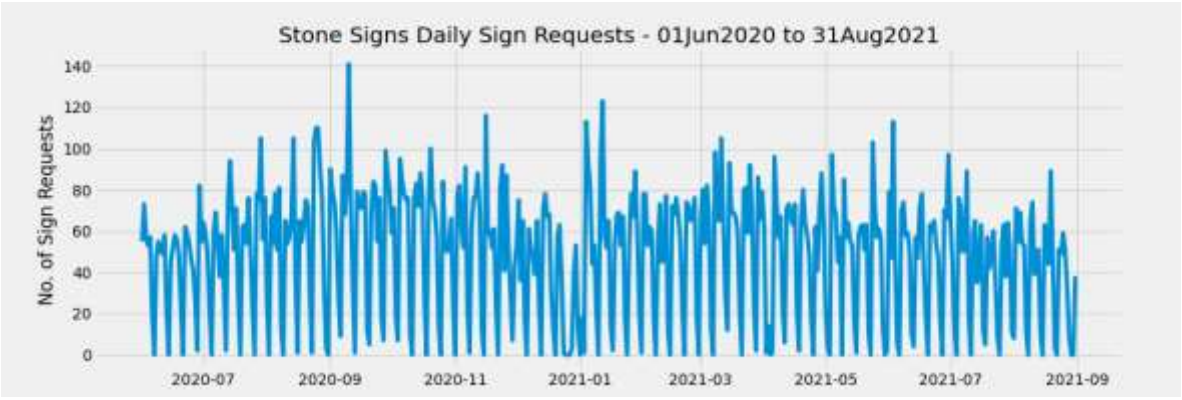
In all of the above cases, one round of Differencing provided a Stationary result using Dickey-Fuller statistical testing.

Stone Signs Portal Analysis

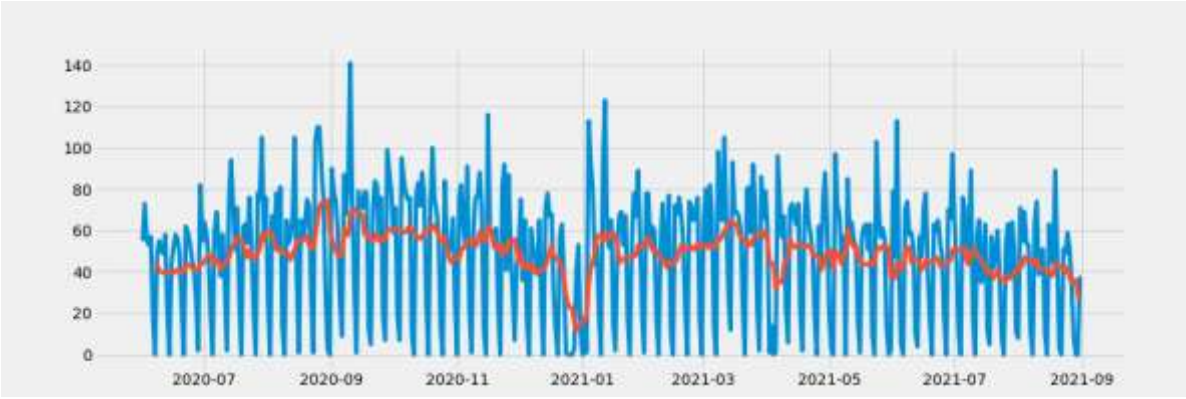
Original Time Series Data – 2nd January 2020 to 31st August 2021



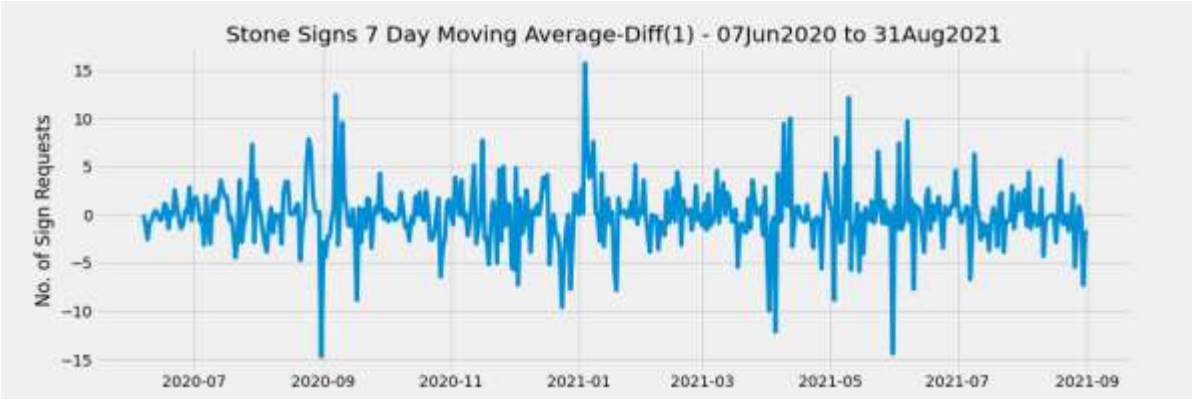
Filtered Time Series Data – 1st June 2020 to 31st August 2021



Filtered Time Series Data with 7-day Moving Average – 1st June 2020 to 31st August 2021



Filtered Time Series Data with 7-day Moving Average, one round of Differencing – 07JUN20 31AUG21



Results of the ARIMA Model

```
                             ARIMA Model Results
==============================================================================
Dep. Variable:                   D.MA   No. Observations:                  315
Model:                 ARIMA(1, 1, 1)   Log Likelihood                -815.015
Method:                       css-mle   S.D. of innovations              3.189
Date:                Fri, 12 Nov 2021   AIC                           1638.030
Time:                        05:51:23   BIC                           1653.041
Sample:                  06-08-2020   HQIC                          1644.028
                       - 04-18-2021
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
const         -0.0003      0.002     -0.117      0.907      -0.005       0.004
ar.L1.D.MA     0.1432      0.056      2.566      0.010       0.034       0.253
ma.L1.D.MA    -1.0000      0.008   -119.958      0.000      -1.016      -0.984
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            6.9818           +0.0000j            6.9818            0.0000
MA.1            1.0000           +0.0000j            1.0000            0.0000
-----------------------------------------------------------------------------
```

The Limitations

Despite being in business since 1974 Stone Signs has less than two years' worth of transactional data. Much of the data is non-numeric, and although additional numerical values can be derived from the data to help reveal insight, the investigative algorithms used in this report have not helped to expose any firm patterns.

In terms of Portal data input validation, the Portal does include a postcode validation feature but it does not include a spell check, or any validation that the address provided belongs to the given postcode. This gives room for error has not revealed itself as an issue for Stone Signs when conducting business but does provide problems when attempting to combine Portal data with structured government data, such as Price Paid Data.

Stone Signs Portal Analysis

The Recommendations

The analyses used in this report have not exposed any predicting factors to indicate how business will perform in the future, and it is evident that the business relies heavily on the buoyancy of the housing market. There are however a few tweaks be made to improve work output and reduce costs.

- Recommendation: Doubling the cost of a New Sign to include free removal (normally charged separately). This is to ensure that there is a minimum of two signs per life cycle.
- Recommendation: Focus work in the more densely populated East Sussex areas to minimise travel expenses and optimise work output.
- Recommendation: Revise method of work in locations in the West Sussex area such as, instead of visiting this area twice a week, reduce to once a week only, or twice per 10 days.

The Conclusion

The data collected for Stone Signs' business since January 2020 has seen three pandemic related lockdowns. It is evident from the original data that the first of the lockdowns had the greatest effect, and by the time the subsequent lockdowns followed, many businesses had found new ways to remain working. The introduction of the Stamp Duty Holiday that helped to boost the housing market, had the desired effect but has equally had a slowing effect from around the Summer of 2021 as the incentive drew to a close. The resulting dataset shows in a set of very inconsistent data points making it difficult to provide predictions.

The Next Steps

It would not be recommended to carry out further predictive analysis on this set of data using alternative algorithms because it is likely that outcome will generally be the same. As the work has a seasonal element it might be worth investigating what other work could be carried out to supplement the business during quiet times.

Because the business relies heavily on the buoyancy of the housing market more could be revealed about the future activity of Stone Signs by looking at data for the housing market. These times could be anticipated using data about the housing market to help with planning.

The Final Note

On a positive note, there will always be a housing market, and the future of signage remains strong owing to estate agent boards doubling up as advertising tools in a competitive market.

The Tableau Storyboard

StoneSigns On-line Portal Analysis | Tableau Public