ANALYSIS OF PEDESTRIAN TRAFFIC DATA DURING COVID-19 IN AUCKLAND

1. Introduction

The reverberations of the COVID-19 pandemic have been far-reaching, reshaping our societal norms and redefining our ways of life. Among its myriad impacts, the transformation of work dynamics stands out prominently. Remote work has swiftly become a staple, with a surge in individuals embracing the flexibility it offers. Yet, nestled within this paradigm shift lies a growing concern for retail and hospitality enterprises, deeply rooted in the vibrant heart of central business districts (CBDs). For these businesses, the vitality of bustling city centers and the rhythmic foot traffic they attract have been cornerstones of success.

The allure of urban centers, characterized by the flurry of activity and the constant stream of passersby, is intricately woven into the fabric of these enterprises. However, the rise of remote work has cast a shadow of uncertainty over their future, sparking apprehensions about altered foot traffic patterns. Business owners within Auckland's CBD are at the forefront of this evolution, harboring convictions that the once-familiar foot traffic landscape has morphed – both in sheer volume and daily rhythms.

In this context, a collective of local business proprietors seeks to substantiate their intuitions through data-driven exploration. Their gaze turns toward a comprehensive dataset spanning from January 2017 to July 2021, encompassing hourly pedestrian counts across key CBD locations. Augmenting this trove of data, insights into the ebbs and flows of COVID-19 alert levels in Auckland have also been provided.

As entrusted stewards of this inquiry, our task is to navigate these datasets, unraveling the intricacies they hold and discerning the dance between foot traffic shifts and the pandemic's ebb and flow. This report endeavors to validate the concerns of these business owners, offering insights that will guide their adaptation strategies within a business landscape forever altered by the forces of change.

2. Overall behavior of pedestrian traffic before and during the pandemic

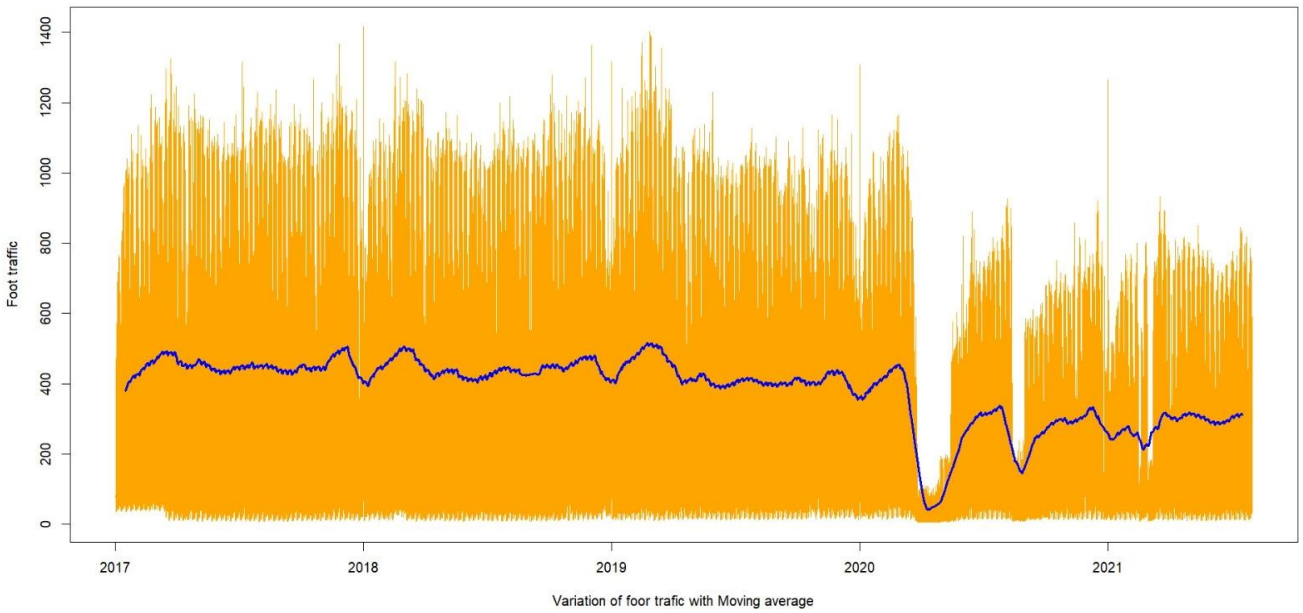


Figure 2.1 – Behavior of the foot traffic over the time

Figure 2.1 depicts the hourly data of pedestrian counts spanning from January 1, 2017, to July 31, 2021. The moving average values for the pedestrian count are visually represented by the blue line. Notably, the data's variability undergoes changes over time. Both the mean and variance of the series are not stable with time. Furthermore, we can see that there is a sudden change in the series at some point. This phenomenon is more distinctly observed in the subsequent chart.

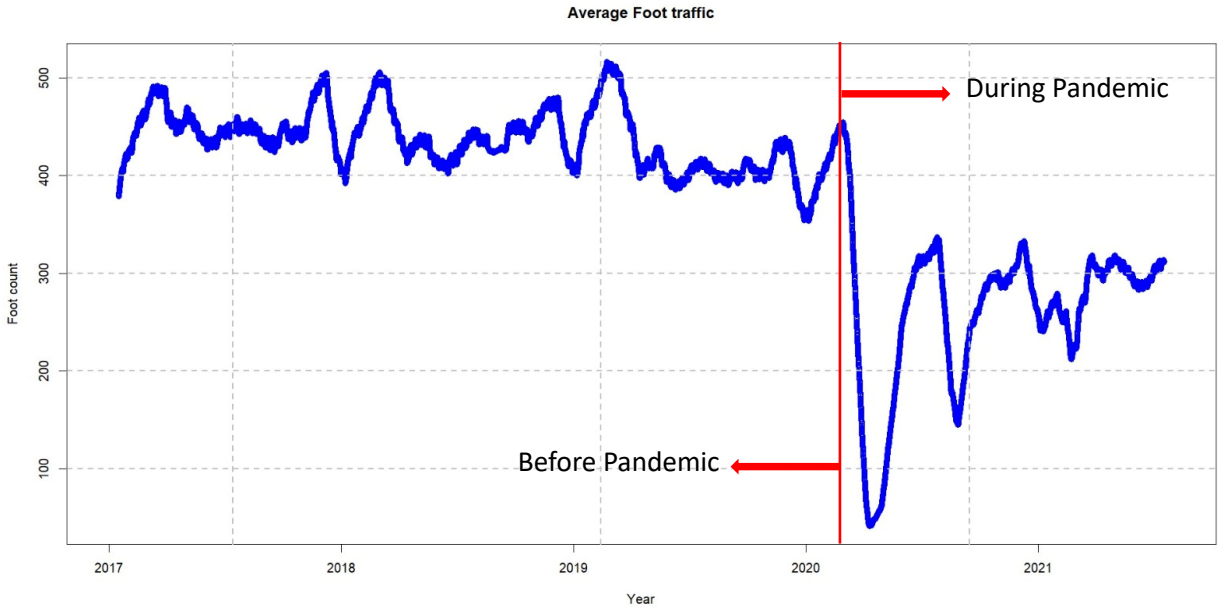


Figure 2.2 Moving average of pedestrian count over time.

As depicted in the preceding graph (Figure 2.2), it becomes apparent that this time series exhibits a lack of stationarity and a descending trend. Prior to the onset of the pandemic, the series displayed a degree of fluctuation around an average pedestrian count of 438. However, during the pandemic, a notable reduction in the series' mean becomes evident, with data oscillating around an approximate pedestrian count of 270. Notably, the variance of the data series escalated during this pandemic period. Peaks in the data materialized from January to March before the pandemic, likely attributed to the summer season. Yet, this characteristic pattern is less discernible throughout the pandemic period. To gain deeper insights, a decomposition of the time series is warranted. This decomposition will enable the identification of trends, seasonal patterns, and stochastic fluctuations inherent in the data series.

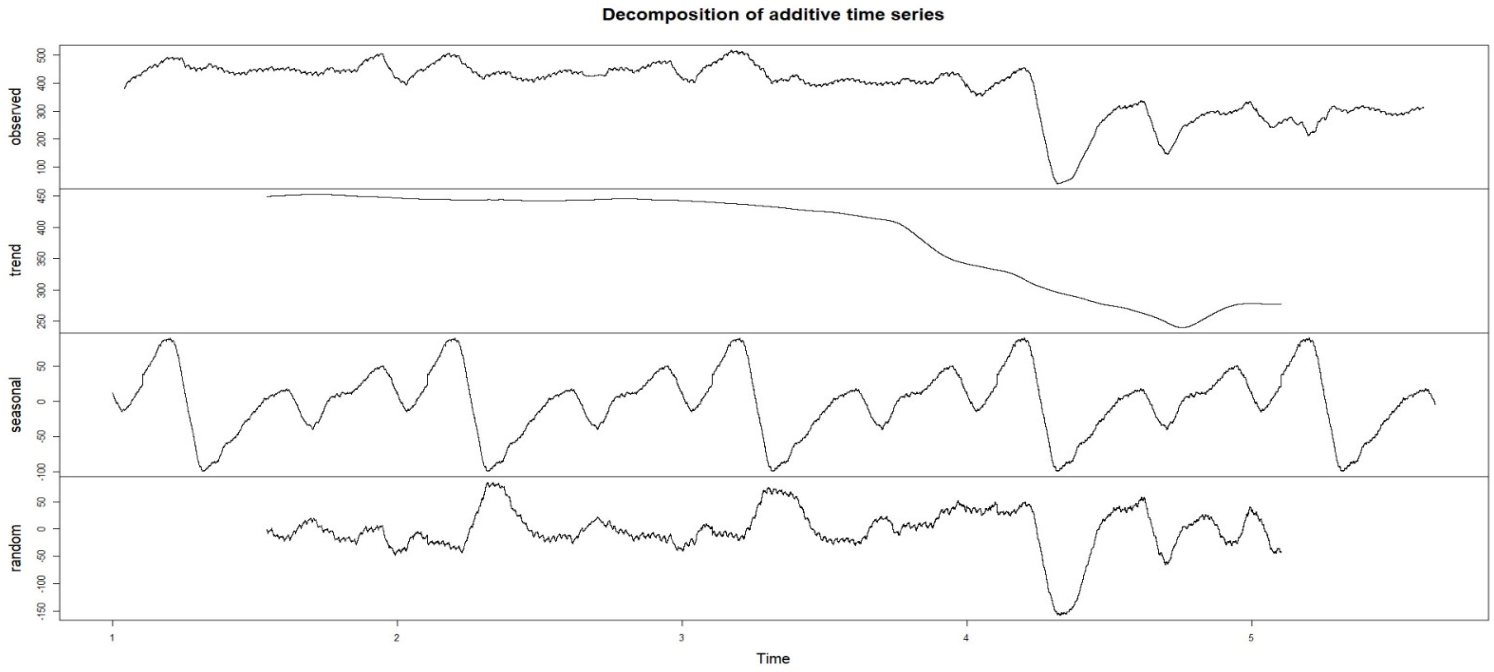


Figure 2.3 Decomposition of the time series

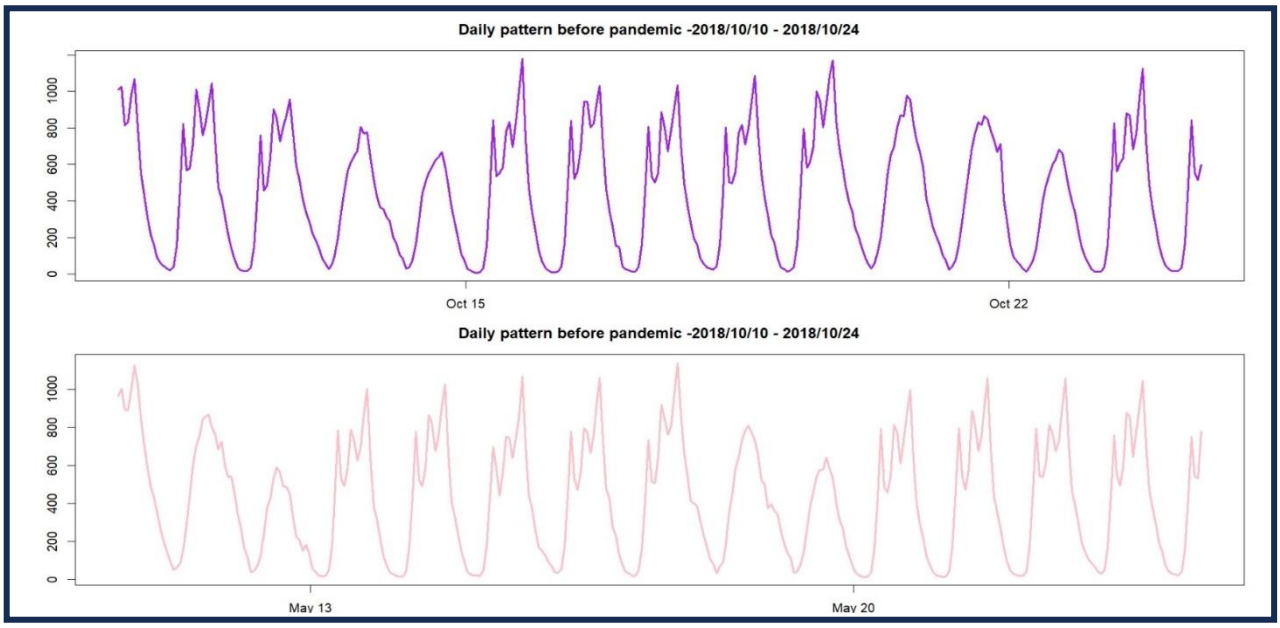
Displayed in the illustrated graph (Figure 2.3) are discernible patterns trends, seasonal patterns, and random fluctuations within the dataset. The trend component indicates the long-term movement in the data. In this context, the trend initially maintained a relatively steady trajectory before the pandemic period, only to undergo a pronounced decline subsequently. This shift underscores a notable reduction in pedestrian volume during the pandemic phase.

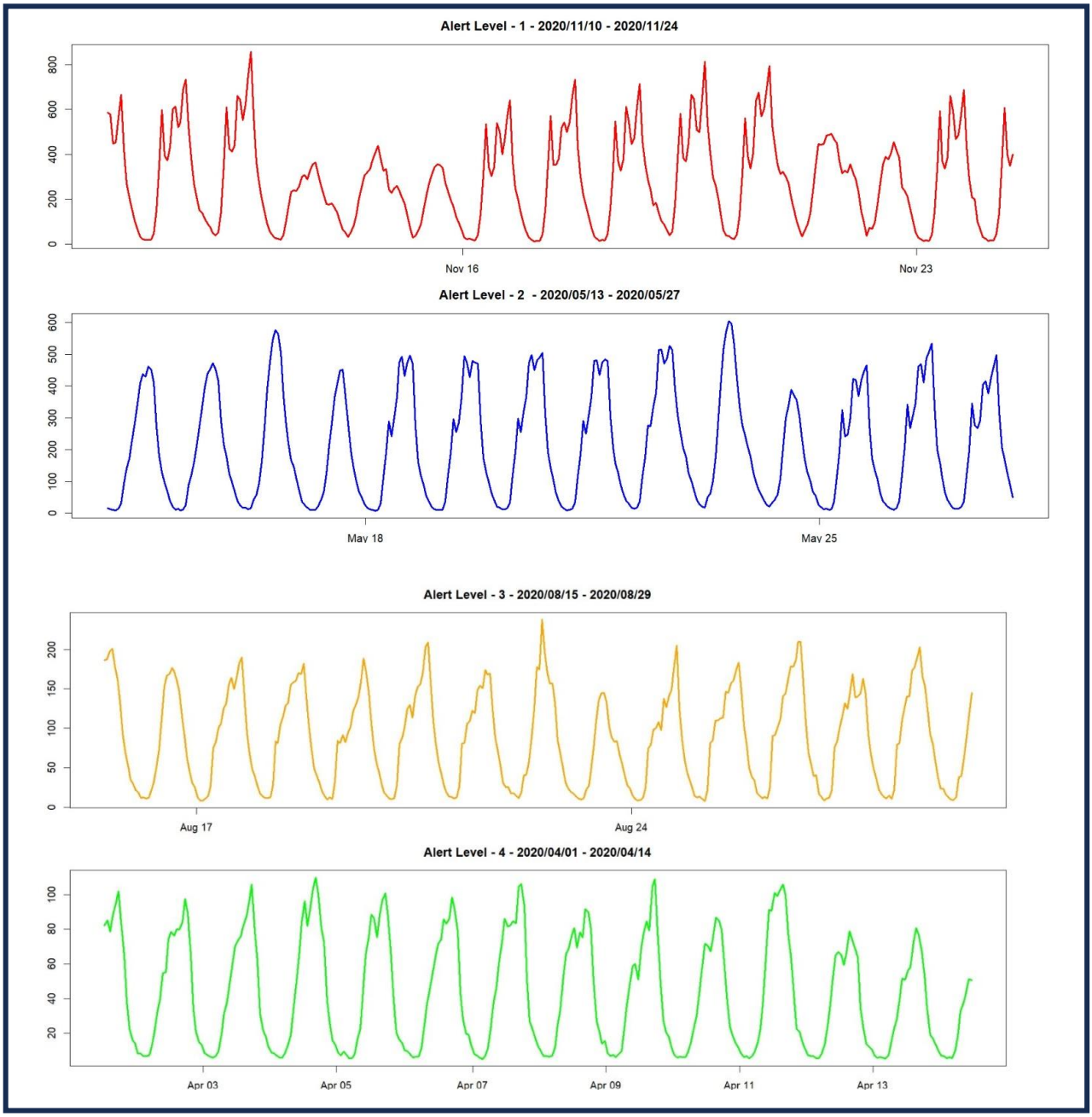
The seasonal component reflects the recurring patterns that repeat at regular intervals. In this case, the seasonal component shows peaks and valleys that repeat approximately every 12 months. This cyclical behavior highlights that pedestrian traffic experiences spikes and dips influenced by season-related factors like weather variations, holidays, and festivals. Interestingly, the monthly cyclic patterns appear relatively consistent both before and during the pandemic era.

Lastly, the residual component represents the random fluctuations and noise that are not explained by the trend and seasonality. In this scenario, the residual plot underscores heightened deviations in the data during specific points within the pandemic period.

3. Pedestrian Traffic Patterns according to different COVID-19 alert levels.

Examining the figures below that pertain to the non-pandemic period, it is evident that distinct consistent patterns emerge on weekdays and weekends. Notably, these patterns vary significantly in shape and magnitude. In contrast, throughout the pandemic, a nearly uniform pattern persists throughout the week, excluding instances of Alert Level 1. Remarkably, the pattern during Alert Level 1 closely resembles the daily pattern witnessed prior to the pandemic, primarily due to the limited travel and gathering restrictions during that particular period.


Daily pattern before pandemic -2018/10/10 - 2018/10/24
0
200
400
600
800
1000
Oct 15
Oct 22
Daily pattern before pandemic -2018/10/10 - 2018/10/24
0
200
400
600
800
1000
May 13
May 20


Alert Level - 1 - 2020/11/10 - 2020/11/24
0
200
400
600
800
Nov 16
Nov 23
Alert Level - 2 - 2020/05/13 - 2020/05/27
0
100
200
300
400
500
600
May 18
May 25
Alert Level - 3 - 2020/08/15 - 2020/08/29
0
50
100
150
200
Aug 17
Aug 24
Alert Level - 4 - 2020/04/01 - 2020/04/14
20
40
60
80
100
Apr 03
Apr 05
Apr 07
Apr 09
Apr 11
Apr 13

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4. Conclusion

- Based on the analysis, it is evident that there is a significant change in the volume of pedestrian traffic before and during the pandemic period.
- There is a notable difference in daily and weekly patterns between before and during the pandemic period.
- Finally we can justify the business owners' claim.