IB Geography

Internal Assessment

Urban Environments

- To what extent does Sarıyer Merkez, Istanbul suffer from urban stress? -

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Candidate #

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1 Introduction (309 words)

1.1 Fieldwork Question

To what extent does Sarıyer, Istanbul suffer from urban stress?

1.2 International Baccalaureate Specification

Syllabus reference

Option G: Urban Environments; specifically: urban congestion, stress, and deprivation.

1.3 Geographical Location

Figure 1: Location of Turkey in the world map (*National Geographic Mapmaker Interactive*, n.d.)

Figure 2: Location of Istanbul in Turkey (*National Geographic Mapmaker Interactive*, n.d.)

Figure 3: Location of Sarıyer and the CBD in Istanbul (*National Geographic Mapmaker Interactive*, n.d.)

Figure 4: Close up look of the CBD (*National Geographic Mapmaker Interactive*, n.d.)

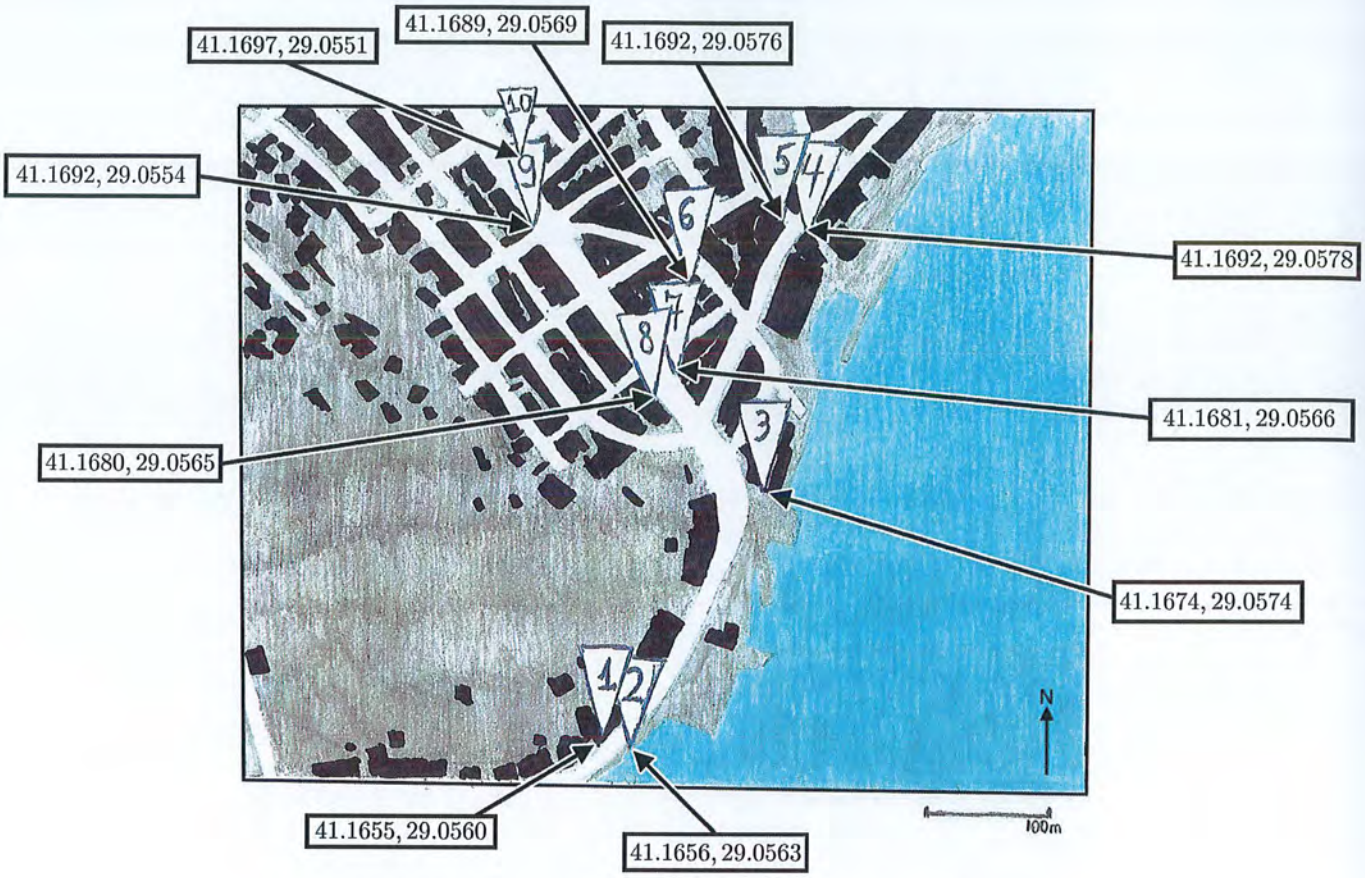

Figure 5: Field Trip Sampling Locations (self-made figure)

Seen

1.4 Background History

Adjacent to the Bosphorus strait is the province of Sarıyer. The Sarıyer CBD contains historical docks which enabled trading between seas. The Bosphorus lead to various formations of towns and erection of buildings shaped into CBDs. Sarıyer Merkez has developed since its foundation in the 16th century (Kaptanoğlu & Mıhçıoğlu Bilgi, 2019).

1.5 Background Theory

1.5.1 Web of Deprivation, Decline and Despair

The Web of Deprivation is a method of measuring urban symptoms theorised in 1991 (Nagle, 2002) to measure urban stress and spatial incidence in a city. Higher count of webs imply lower spatial incidence from inner CBD. By plotting these symptoms, it is possible to contrast which urban stress symptoms the CBD experiences categorised into decline, despair and deprivation in relative to its spatial distance.

theory

Figure 6: Web of Deprivation in the UK (Garrett Nagle, 2017, p.346)

1.5.2 Bid Rent Curve

The Bid Rent Curve theory states that the highest rent prices are to be found near the center of the CBD, with different sectors prices being more prevalent in different distances away from the CBD (Alonso, 1964). The decline in prices are also theorised to be linear.

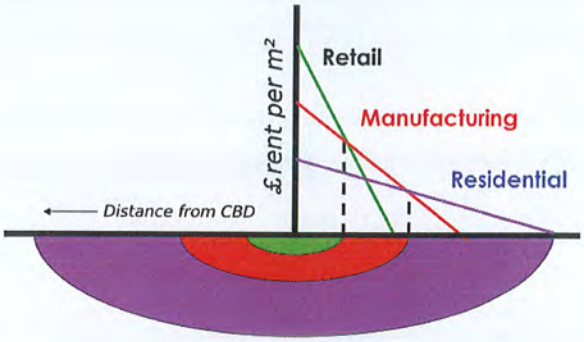

Figure 7: Bid Rent Curve (*Bid rent theory*, 2020)

1.6 Hypotheses

1.6.1 Hypothesis 1

Urban stress is more prominent in the inner city - By considering theory 1.5.1, I believe that urban stress symptoms will be significantly more prominent within the inner city. I believe recorded urban stress symptoms will also be come less prominent as one moves away from the inner city. This is because CBDs are very dense with population, putting a strain on various resources in a small area causing factors such as traffic, litter, noise etc.

1.6.2 Hypothesis 2

Increase in price of residential rent further from the CBD - Contrary to theory 1.5.2, I hypothesise there will be a non-linear shape demonstrating an increase in price after some distance from the CBD. I believe the presence of urban deprivation and its symptoms[2] caused a great decrease in land and rent values, resulting in formation of luxurious housing towards the outskirts.

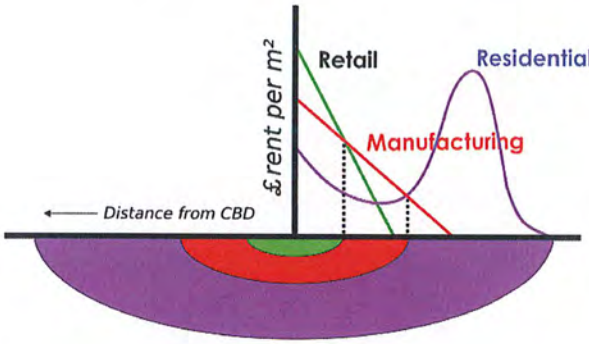

Figure 8: Hypothetical Bid Rent Curve (*Bid rent theory*, 2020)

Explained hypotheses

Student generated

[2] directly linked with hypothesis 1.6.1

2 Methodology (353 words)

2.1 Safety Precautions

Risk	Associated Control Measures
COVID-19 Transmission	-Have a scouting group determine the safety of the CBD -Pick safer sites real-time to avoid risk if necessary -Avoid using school transportation and agree upon a time out of school -Wear a mask and bring a disinfectant
Pedestrians and traffic	-Avoid talking to anyone -Avoid staying on the pavement or going close to people -Cross the roads only during appropriate times e.g. red traffic light

Table 1: Risk and associated control measures

The intended site sampling was systematic. However, sites were minimally modified real-time to avoid COVID-19 transmission risk. As a result, the final sampling method was selective.

2.2 Primary Data

With pairs in each site, each pair answered designed surveys below[3].

Survey Name	Aim	Method Used	Justification
Traffic Scale	To measure the traffic congestion in the site	Tally counting the number of vehicles that pass the students within 5 minutes. One student is responsible for counting the quantity and type of vehicles that pass in one direction. Another student is responsible for keeping the time.	These surveys directly relate to hypothesis 1.6.1 and theory 1.5.1. These results will allow me to measure symptoms of urban stress quantitatively for analysis.
Pedestrian	To measure pedestrian flow on a sidewalk	Tally counting the number of pedestrians that pass the students within 5 minutes. One student is responsible for tally counting, the other for keeping the time.	
Bipolar	Assess urban stress with various factors such as safety, green areas, building quality etc.	Rated from 0 to 5, and depending on the question, it indicates quality or quantity. 0 is the most poor quality/not present and is 5 high quality or abundant. This rating is based upon judgment of students.	
Litter	Measure the levels of litter in the given area	The presence of litter is ranked from 1 to 8, with each value having a clear criterion[4]. 1 indicates extremely dirty, 8 indicates extremely clean.	
Noise	To record the loudness in the given area	A student records noise with software (Neal, 2018) for a period of 1 minute. This software records maximum, minimum and calculates the average loudness in decibels.	

Table 2: Table of used surveys for analysis, their aim, method, and justification

[3]The full survey format can be found in Appendix A

2.3 Secondary Data

2.3.1 Rent Value Recording

Aim: To find and record the residential rent prices of Sarıyer, Merkez

Method: Recording all residential rent prices within 1.1km radius from the CBD using a real estate website (Emlak, 2021).

Justification: Extracting data of prices for hypothesis 1.6.2

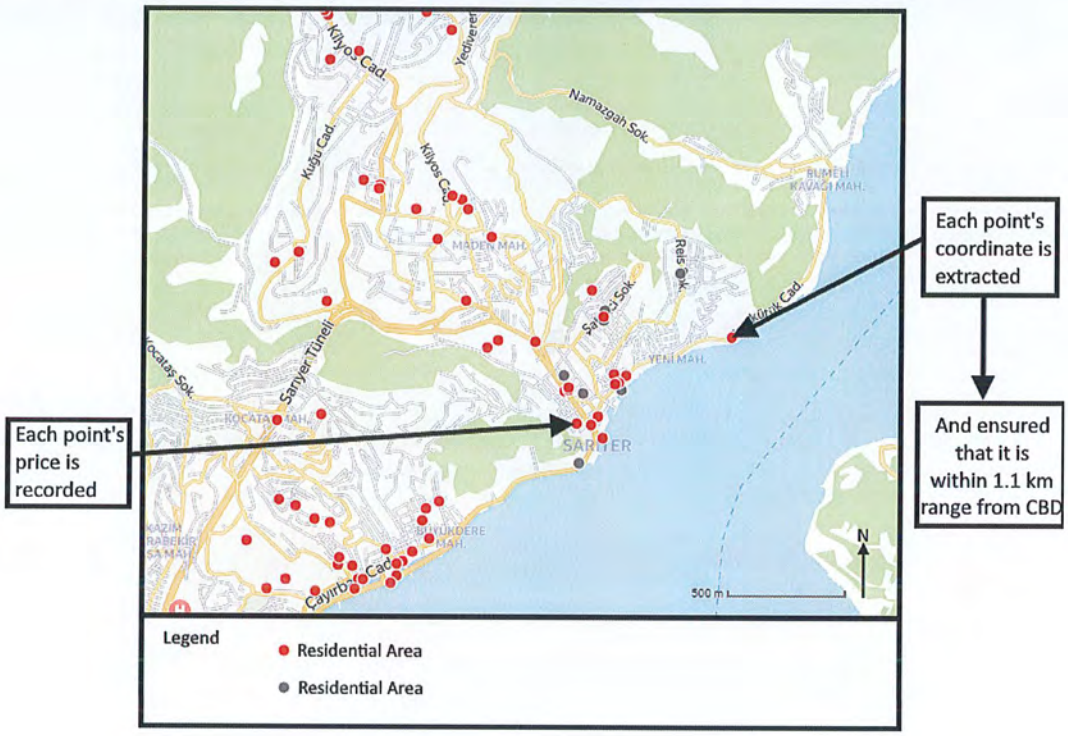

Figure 9: Annotated map of methodology for secondary data[5](Emlak, 2021)

seen

[4]These criterias can be viewed in Appendix A table 15

[5]This map is not representative of real locations and data collected.

3 Data & Analysis (1304 words)

3.1 Mathematical Tools

3.1.1 Polynomial Interpolation

Polynomial interpolation is a tool which allows to define a polynomial of best fit using data points that are known. The higher the degree of a polynomial, the more data points it intersects. However, this can also make a graph too complex and lose generalisability and applicability of the data.

3.1.2 Pearson Correlation Test

The Pearson correlation test R allows us to find whether there is a positive, negative or no correlation between two variables. $-1 \leq R \leq 1$, where 1 indicates strong positive, 0 indicates no correlation and -1 indicates strong negative correlation. It is calculated by the formula

$$R = \frac{\sum_{i=1}^{N}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{N}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{N}(y_i - \bar{y})^2}} \tag{1}$$

where

N is the sample size

$\bar{y}$ and $\bar{x}$ are the means of respective variables

x_i, y_i are data points for some i

The coefficient of determination R^2, on the other hand, "assesses the ability of a model to predict or explain an outcome in the linear regression setting" (Enders, n.d.).

3.2 Pinpointing the location of CBD

For the purpose of analysis, the CBD point location was chosen as the green star in the map:

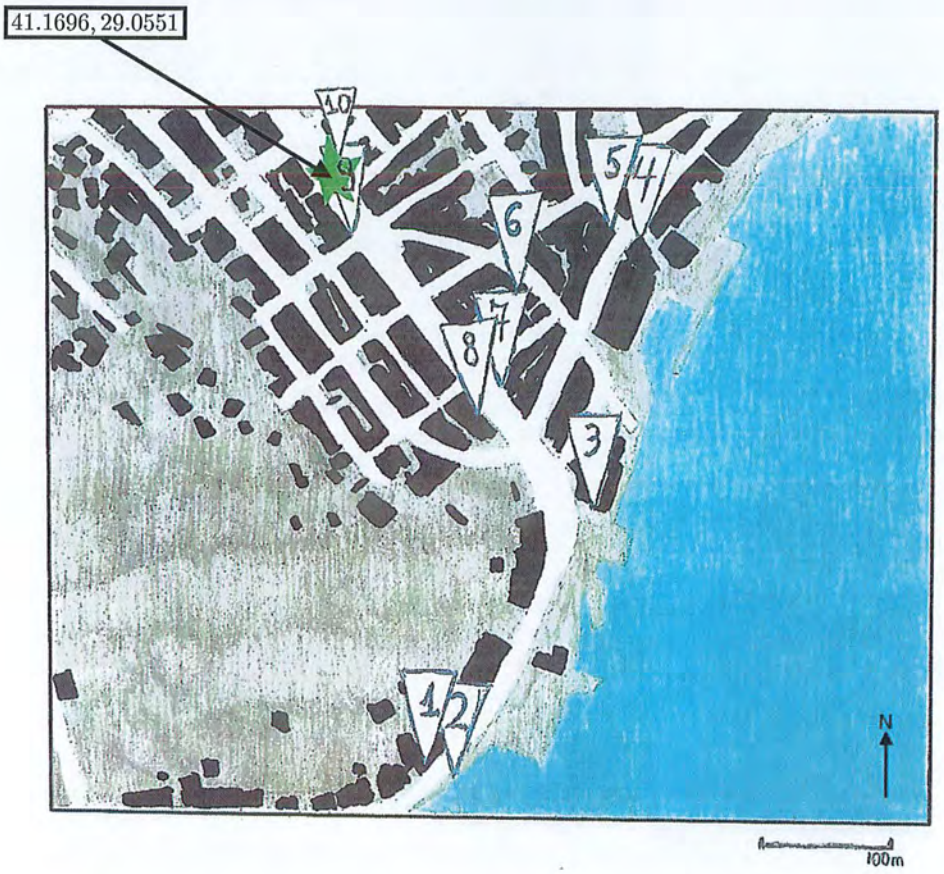

Figure 10: Location of the center of the CBD (self-made figure)

This spot was chosen because it is the center of the main road of the CBD, whilst at the same time being the location of main hub for public transport and maintaining highest amount of shops.

Explanation;

3.3 Testing Hypothesis 1

In order to record the distance between the CBD and location of the data collection points, the haversine formula (Casio, 2020)was used to increase accuracy.

3.3.1 Traffic

	Traffic Survey						
Site № (i)	**Distance from CBD (m) (x_i)**	**Car**	**Motor**	**Bus**	**Taxi**	**Lorry**	**Vehicles (y_i) ($\sum$ car, motor, bus, taxi, lorry)**
1	410	41	7	5	5	7	65
2	412	37	5	8	4	4	58
3	340	33	2	8	4	3	50
4	306	31	4	5	1	3	44
5	293	34	4	5	3	3	49
6	213	16	3	2	1	3	25
7	221	40	15	6	12	5	78
8	224	29	29	4	4	8	74
9	54	27	2	6	3	2	40
10	12	10	4	6	1	0	21

Mean Distance (m)
248.5

Mean Vehicles
50.4

R	R^2
0.5074	**0.2575**

Table 3: Traffic Survey results and Pearson test result

For the calculation of R, x was chosen to be the distance from CBD in metres and y was chosen to be sum of vehicles. Applying our formula:

$$R = \frac{(410 - 248.5)(65 - 50.4) + \ldots + (12 - 248.5)(21 - 50.4)}{\sqrt{(410 - 248.5)^2 + \ldots + (12 - 248.5)^2}\sqrt{(65 - 50.4)^2 + \ldots + (21 - 50.4)^2}}$$

$$\implies R = 0.5074$$

$$\implies R^2 = 0.2575$$

Graphing our results in a map:

Figure 11: Map of results for Traffic survey (Esri, n.d.)

Graphing our Pearson correlation coefficient:

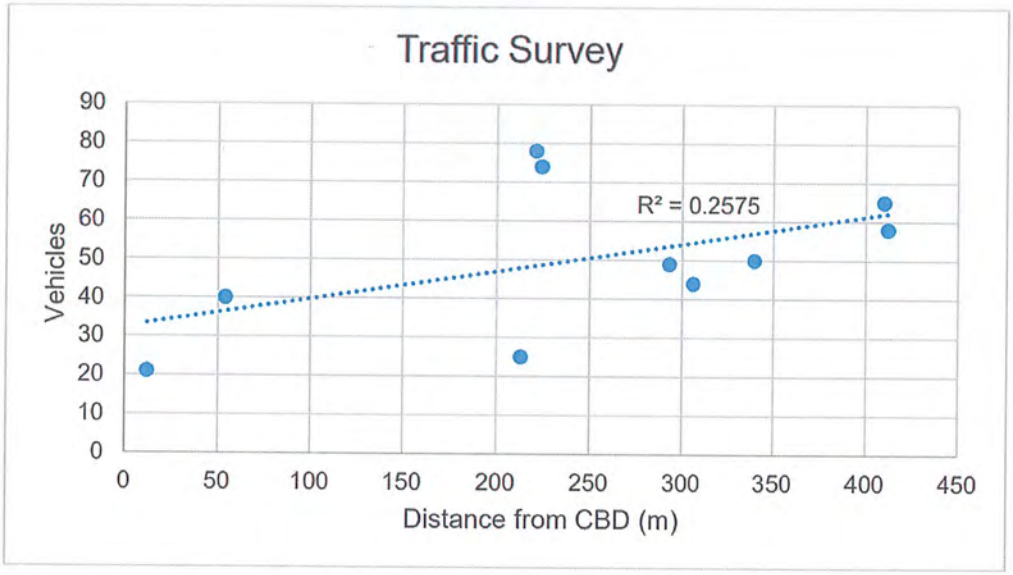

Figure 12: Traffic Survey Pearson Correlation Test graph

A medium positive correlation of 0.5074 implies an increase in vehicle flow as one moves away from the CBD. This is arguably caused by the high prevalence of shops, meaning people are more likely to visit with vehicles. Furthemore, sites 7 and 8 are anomalies with values 78 and 74 respectively, a high sum of vehicles in comparison to mean of 50.4. A possible reason for this may be because the road at that site is connected

to a larger road, allowing extra room. The low count of vehicles in central sites is a symptom of urban stress due to the lack of vehicles counted as they are unable to pass through students. This is more evident with photos of sites 10 and 3:

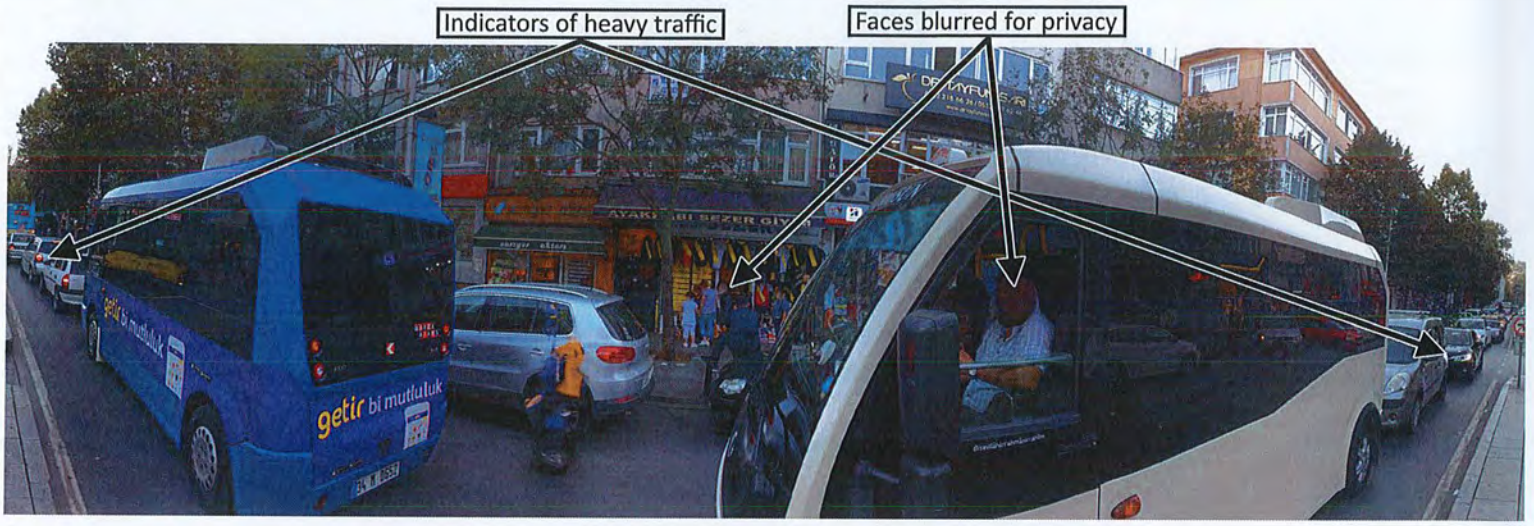

Figure 13: Panoramic photo of traffic congestion in location 10 (self-taken photograph)

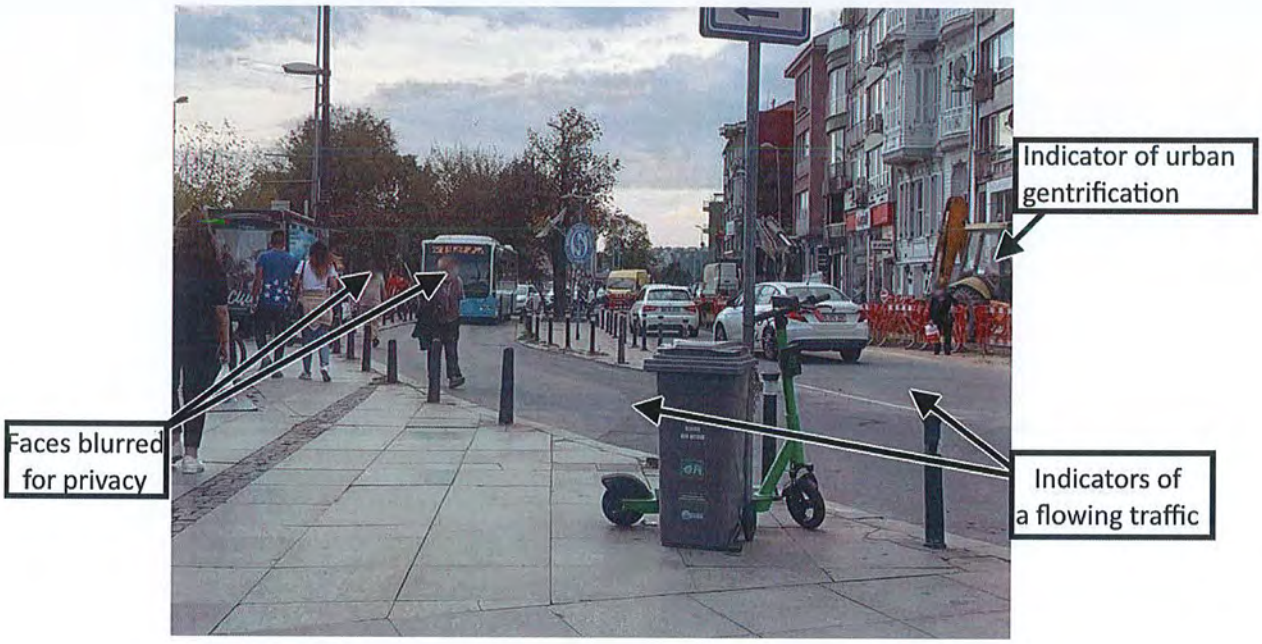

Figure 14: Photo of traffic congestion in location 3 (self-taken photograph)

3.3.2 Noise

	Noise Survey			
Site № (i)	**Distance from CBD (m) (x_i)**	**Recorded Minimum (dB)**	**Recorded Maximum (dB)**	**Recorded Average (y_i) (dB)**
1	410	53.2	77.8	62.9
2	412	58.5	77.3	67.9
3	340	80.8	92.5	87.8
4	306	43.0	67.2	60.4
5	293	42.2	72.3	57.3
6	213	52	63.5	54.8
7	221	51.2	80.8	63.8
8	224	11	59	36
9	54	21	105	45
10	12	15	65	39

Mean Distance (m)
248.5

Mean of Average
57.49

R	R^2
0.6908	**0.4772**

Table 4: Noise Survey Pearson Correlation Test graph

The same process for the calculation of R and R^2 from the Traffic survey was repeated. The values were found to be 0.6908 and 0.4772 respectively.

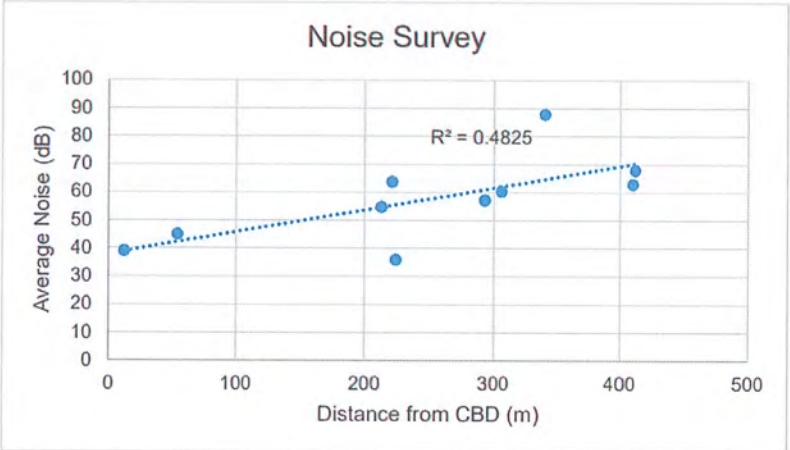

Figure 15: Noise Survey results and Pearson test result

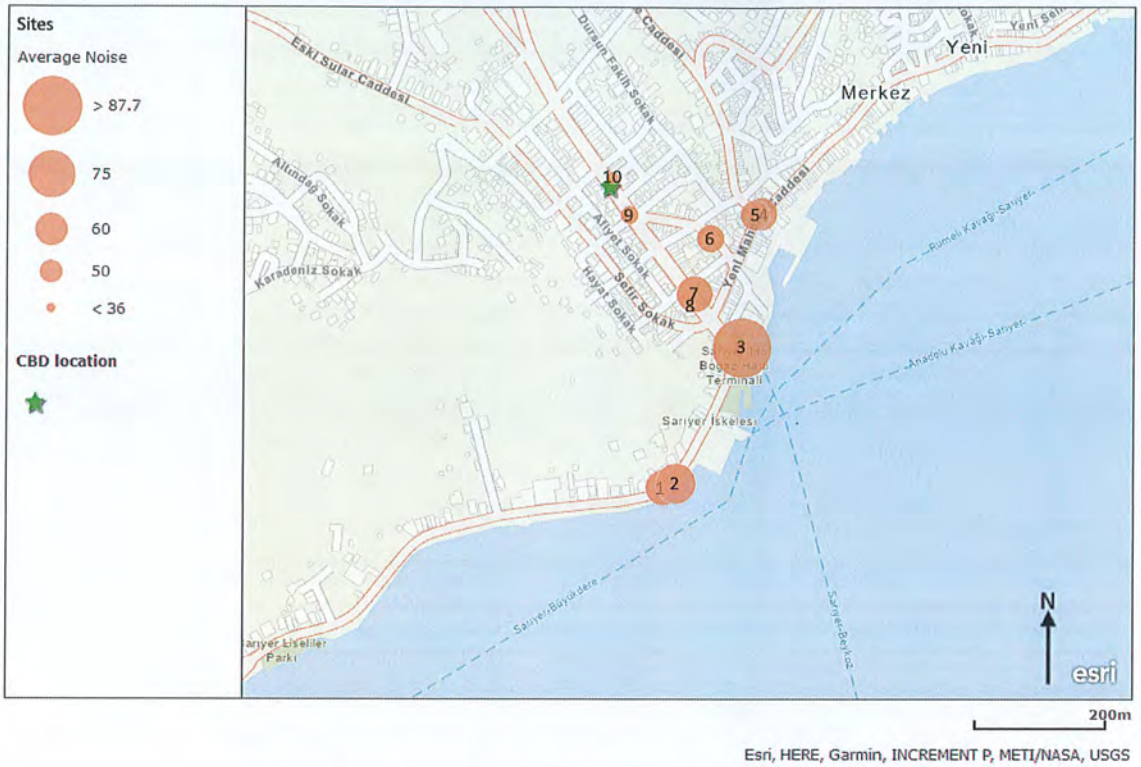

Figure 16: Map of results for Noise survey (Esri, n.d.)

The Pearson test shows that there is a medium-strong positive correlation of 0.6908, suggesting that as one moves further away from the CBD, the noise increases. The cause of this positive correlation is likely to be in correlation with congestion of traffic. Cars are unable to move in the central locations of the CBD, implying they do not create noise pollution. Consequently, further from the CBD, the cars are less congested. This results in more noise pollution as they are able to roam. Furthermore, it is also possible that the recorded high values for sites 1, 2, and 3 with recorded numbers of 62.9, 67.9 and 87.8dB respectively is caused by their proximity to the sea. The sea is a source of loud noise in these sites as a result of crushing waves and increased presence of birds e.g. seagulls. Site 3's extraordinary average recorded loudness may also be a result of urban gentrification works seen in figure 14.

3.3.3 Litter

	Litter Survey	
Site № (i)	**Distance from CBD (m) (x_i)**	**Assigned Value (y_i)**
1	410	6
2	412	4
3	340	5
4	306	3
5	293	4
6	213	3
7	221	3
8	224	4
9	54	5
10	12	6

Mean Distance (m)	**Mean Value**
248.5	4.3

R	R^2
-0.1763	**0.0311**

Table 5: Litter Survey results and Pearson test result

Similarly, obtaining the respective R and R^2 values above, we can once more plot the line of best fit to see the correlation graphically:

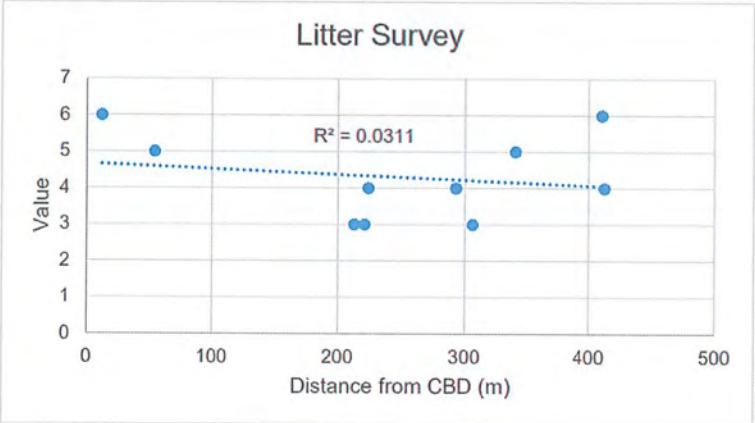

Figure 17: Litter Survey Pearson Correlation Test graph

The test result -0.1763 indicates that there is almost no correlation between litter presence and the distance from CBD. However, the high mean value of 4.3 indicates that the amount of litter found is consistent, implying a lack of litter cleaning throughout, a clear symptom of urban stress. This symptom is not linked with spatial distance from the CBD.

3.3.4 Bipolar

		Bipolar Survey							
		Quality			Presence				
Site № (i)	Distance from CBD (m)(x_i)	Road (y_i)	Sidewalk (z_i)	Building (α_i)	Rubbish Bins (β_i)	Public Seating (γ_i)	Public Restrooms (ζ_i)	Police or Security (δ_i)	Personal Safety (ϵ_i)
1	410	5	5	4	4	4	0	1	5
2	412	5	5	3	5	5	0	3	5
3	340	3	4	4	5	5	0	3	5
4	306	2	4	2	0	0	0	0	2
5	293	4	4	3	3	4	0	4	5
6	213	3	3	2	1	0	0	1	2
7	221	3	3	3	3	2	0	0	2
8	224	4	4	2	0	1	0	1	3
9	54	4	3	2	1	0	0	1	2
10	12	3	4	3	0	2	0	2	3

Table 6: Bipolar survey results table

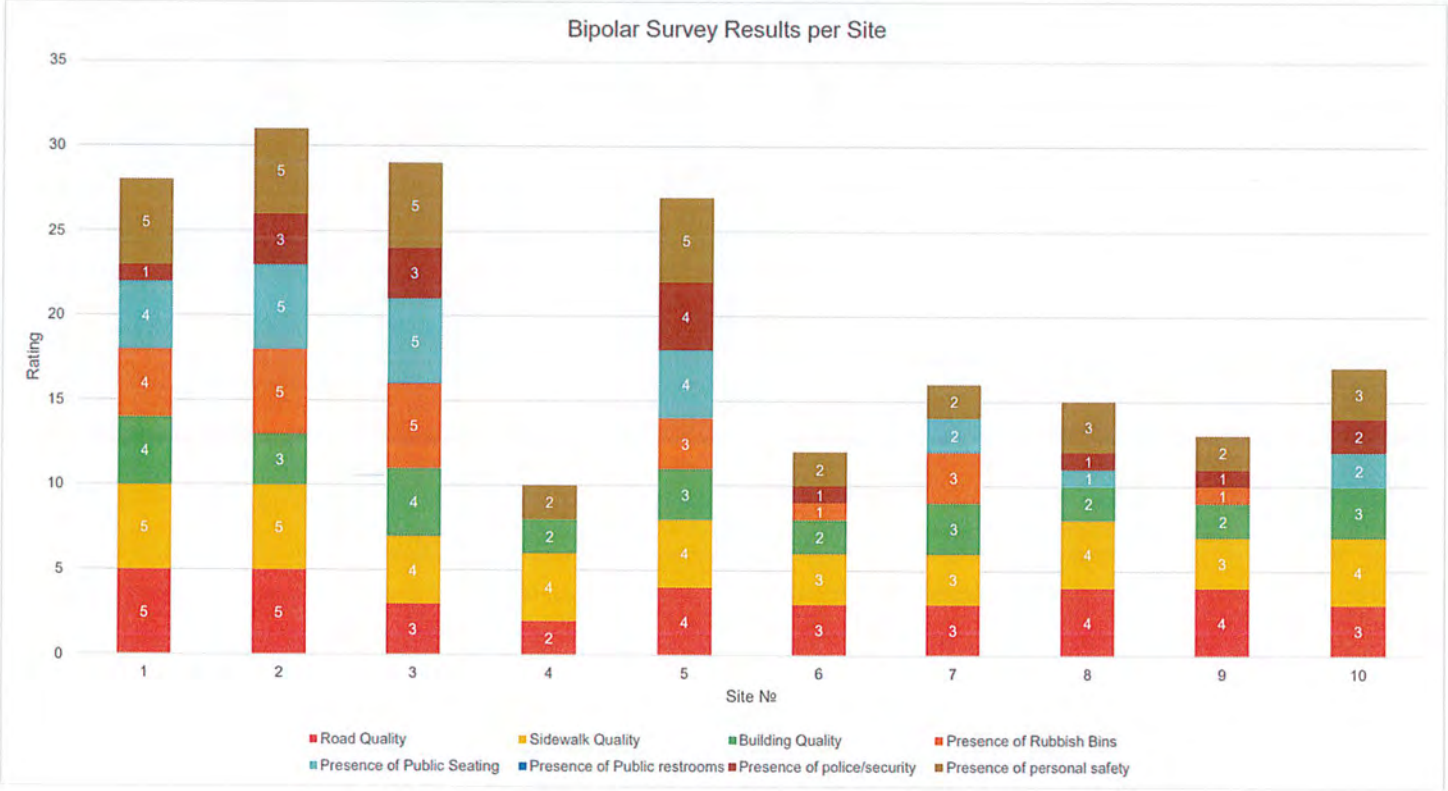

Figure 18: Bipolar survey results per Site

We can observe a general decrease in total quality as the site number increases. Similarly, sites 1 and 3 have $330 + m$ distance from the CBD have a total rating of 28 and 29 respectively, whilst sites such as 9

and 10 with distance less than $100m$ have total ratings of 13 and 17 respectively, a significantly lower result which suggest a general positive correlation with proximity of CBD and total rating. Mapping our results:

Figure 19: Total Bipolar survey results map

The difference in ratings of sites 4 and 5 which approximately 10 metres apart is 17, suggesting an anomaly. This could be a result of the ambiguity of the bipolar survey, which is based upon the "judgment" of the observer in the site, greatly dependent on opinion rather than a clear criteria. Testing out the correlation for each category quantitively using Pearson Correlation:

	Topic	Mean Rating	Mean Distance	R	R^2
Quality	Road	3.6	248.5	0.3574	0.1277
	Sidewalk	3.9	248.5	0.6521	0.4252
	Building	2.8	248.5	0.4712	0.2220
Presence	Rubish Bins	2.2	248.5	0.7040	0.4956
	Public Seating	2.3	248.5	0.6209	0.3855
	Public Restrooms	0	248.5	N/A	N/A
	Police or Security	1.6	248.5	0.2307	0.0532
	Personal Safety	3.4	248.5	0.6482	0.4202
	Total Rating	19.8	248.5	0.6432	0.4137

Table 7: Pearson correlation test results for each symptom

The coefficient results for individual bipolar categories are mostly weak-medium to strong, ranging from 0.0532 to 0.4956. Overall results imply a medium positive correlation with the total rating of bipolar survey, with $R = 0.6432$. Exceptional sites include public restrooms and police or security with coefficients N/A and 0.0532 respectively. However, public restrooms held a consistent rating of 0 across all sites, leading to a not-applicable result for Pearson analysis. Furthermore, the no-correlation or not-applicable Pearson results for the presences of both Police or Security and Public Restrooms do not indicate that lack of symptoms for these categories. In particular, these categories have shown a consistent scarce presence between all sites[6], indicating that the symptoms are not correlated with spatial distance, but are consistent in presence throughout. One of the possible reasons of the lack of observed police is due to the high presence of hidden police, a common practice in Turkey. However, this is not widely known, therefore this fact will not be taken into account with final judgment when summarising using theory 1.5.1.

Explanation

[6] As seen in figure 18

3.3.5 Pedestrian

	Pedestrian Survey			
Site № (i)	**Distance from CBD (m) (x_i)**	**Towards Zek**	**Away from Zek**	**Average (y_i)**
1	410	34	29	31.5
2	412	55	50	52.5
3	340	47	49	48
4	306	15	49	32
5	293	65	85	75
6	213	6	12	9
7	221	25	50	37.5
8	224	13	45	29
9	54	38	32	35
10	12	51	33	42

Mean Distance (m)
248.5

Mean Average
39.15

R	R^2
0.212	**0.0449**

Table 8: Pedestrian Survey results and Pearson test result

For this subsection, only "Away from Zek" and "Towards Zek" were analysed. This is because some locations, such as sites 1 and 2, do not have distinguishable roads between "Sariyer CBD" "away from CBD towards Maslak" and "Away from Zek", "Towards Zek" respectively, since these roads are the same. Site 6 is an anomaly with the average pedestrian count of 9. It is possible that this low count could be a result of recent urban gentrification work in the area[7], which the limited the recording of pedestrians due to blocked roads and sidewalks. Site 4 and 5 are also 32 and 75 respectively, with a difference of 43 despite being very close in proximity. The high difference in pedestrian count in these sites could potentially be explained by the idea that pedestrians are likely to go North-West or South-East roads which lead to the CBD, whilst Site 4 pedestrian road only leads to housing found in North-Eastern side of CBD, making site 5 sidewalk more desirable.

[7]The photo of urban gentrification is found in Figure 24

explanation

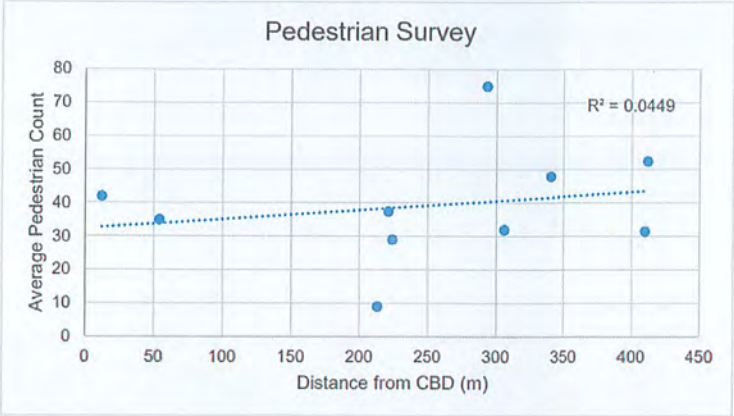

Figure 20: Pedestrian Survey Pearson Correlation Test graph

The Pearson correlation result of 0.212 indicates that there is almost no correlation. However, the average pedestrian count is approximately a constant, with a mean of 39.15. Therefore, no significant congestion of humans was observed in all sites. Whilst this does indicate that there is no human congestion symptom in Sarıyer Merkez, it is possible that it is a side effect of COVID-19 pandemic and not representative of the real scenario. People are less likely to join crowded areas or leave their houses, therefore the observed numbers are not high.

3.3.6 The Web of Deprivation, Despair and Decline Model

Now gaining the knowledge of how observed symptoms depend on the spatial distance to the inner CBD, I can plot them using theory 1.5.1 to summarise the results:

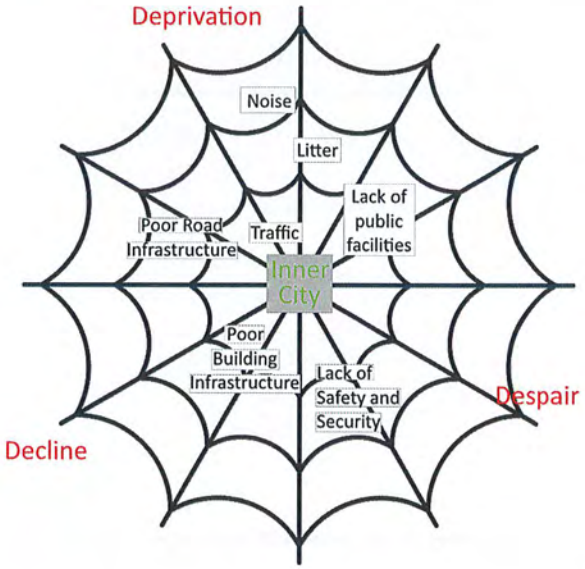

Figure 21: The web of deprivation, despair and decline model of Sarıyer Merkez

3.4 Testing Hypothesis 2

Using data from Appendix B gives us the following map:

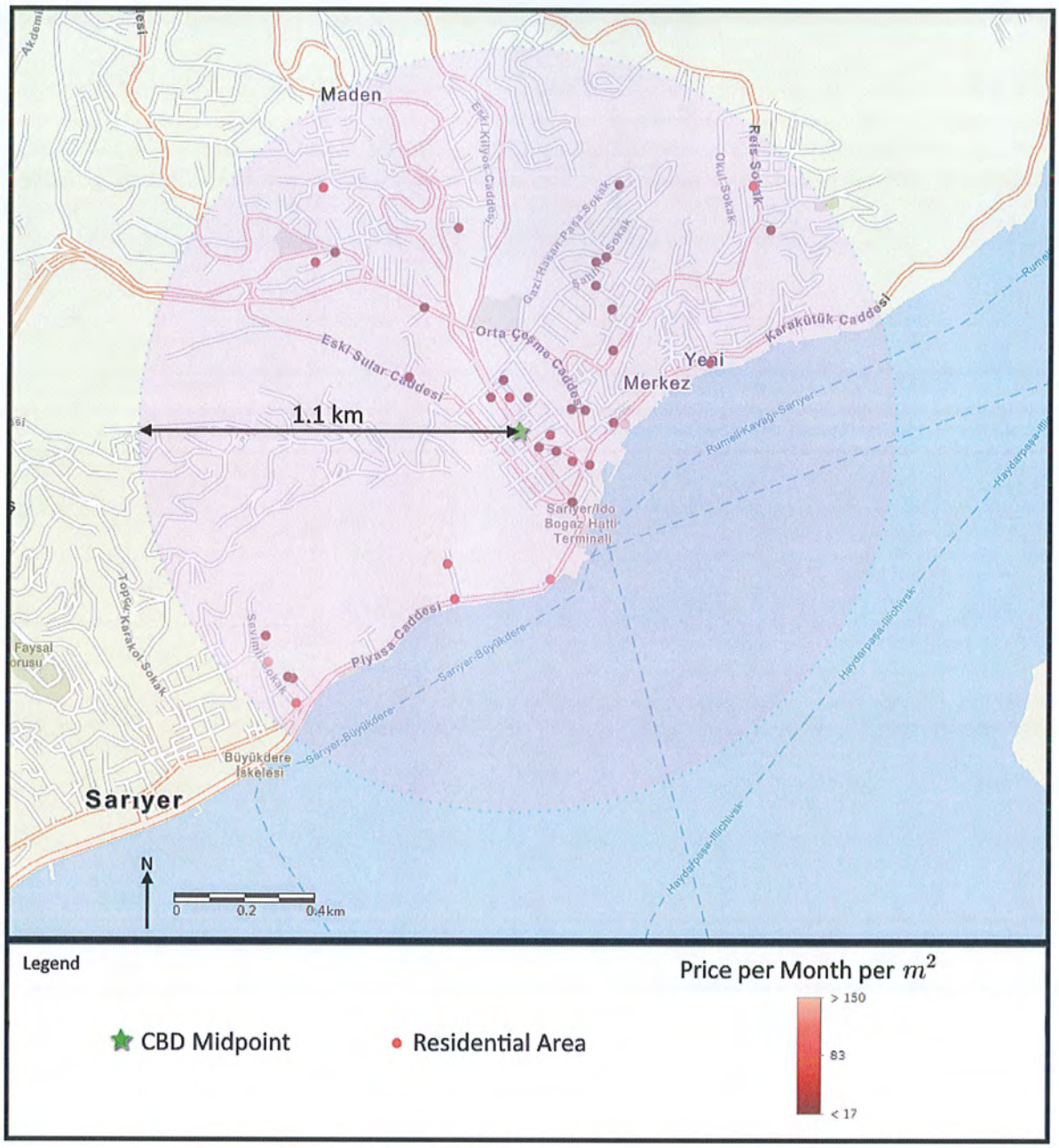

Figure 22: Map of rental prices within the scanned radius of 1.1km circle(Esri, n.d.)

Seen

Plotting our values in a with distance from CBD against price per month per meter:

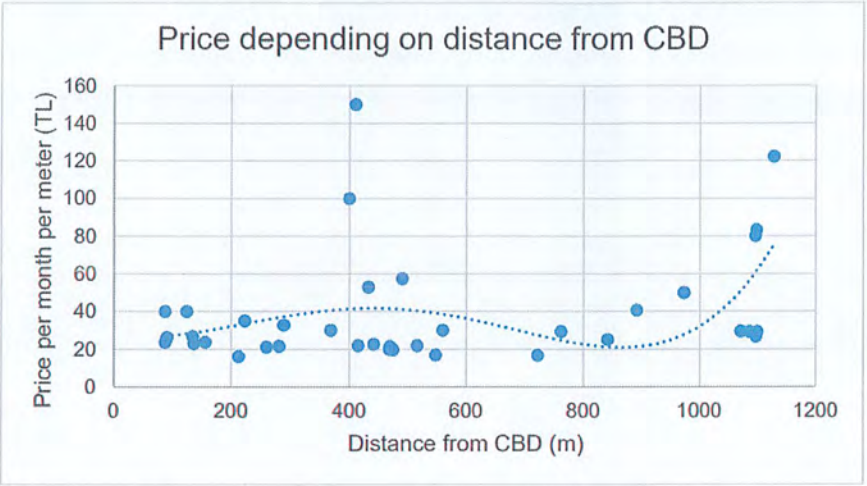

Figure 23: Price depending in distance from CBD with polynomial of best fit

Plotting a polynomial of best fit of fifth degree shows a substantial increase in the price as one moves further. Even though the data does not indicate a rapid decrease in price of residential area as after a peak assumed in hypothesis 1.6.2, this data is sufficient to show that there exists such a peak. Furthermore, there are 2 anomalous points found in approximately distance of $400m$, with prices of $100TL$ per m^2 and $150TL$ per m^2. These 2 points are in fact residential places called "yalı"[8], resulting in very expensive housing. Nevertheless, however, having a high amount of points diminishes the importance of this rare housing due to high sample size.

Explanation.

[8]homes with almost no distance between the Bosphorus and the ground

4 Conclusion (195 words)

To conclude, I accept hypothesis 1.6.1. Rigorous statistical tests show that most of urban stresses become more prevalent as one tends closer to the CBD. This is evidently seen when the results are compared using theory 1.5.1 by summarising the results from our statistical analyses, highlighting that symptoms are more prevalent in the inner city. The only extreme anomaly is noise, however, this can be explained by the traffic congestion and car flow, i.e. due to deadlock traffic, less noise pollution is created from vehicles.

I also accept hypothesis 1.6.2 as a peak is evident in Figure 23. However, further research is needed to conclude that the increase in price with the distance from CBD is substantial and will decrease as expected in Figure 8. The peak's existence is likely caused by the high prevalence of urban stress within spatial distance of inner CBD, reducing the prices of residential areas and buildings substantially.

Hence the answer to the field question is to a "greater extent", as shown with both hypotheses. Multiple symptoms of urban stress are demonstrated within hypothesis 1.6.1 in a close spatial distance to the CBD. Hypothesis 1.6.2 is an extraordinary symptom of urban stress which further demonstrates this extent.

Seen

5 Evaluation (331 words)

5.1 Limitations and Improvements

Limitation	Improvement
Ratings of Bipolar survey subjective, lacking standardisation	Create a system of ranking 1-10 with each value having a clear criterion. This would make it more valid and fair by avoiding opinion and perception for recordings
The primary data only allowed for a limited amount of urban stress symptoms	Conduct further primary and secondary studies to take in account more symptoms. For example, obtaining crime rates in the CBD by contacting the local police. This would make our final analysis using theory 1.5.1 more holistic and acccurate for hypothesis 1.6.1.
The timings of the surveys were inconsistent due to COVID-19	Ensure more safe sites for systematic sampling to avoid selective sampling from associated control measures. This would allow us to have consistent timings too, reducing error for all results.
The prices of rent fluctuate often due to economical factors	To ensure that our hypothesis 1.6.2 is not caused by random error data from various dates need to be analysed
The locations of the sites were inconsistent as a result of COVID-19 measurements taken real-time	Ensure careful planning for safety by analysing the usual human congestion of places using Google Earth which would ensure systematic sampling for more accurate results
Lack of sites on the North-Eastern region of CBD	For a more valid analysis, these sites must be distributed in a uniform manner with more sites to consider more directions. This has especially affected the noise survey, as the sites far from CBD were near a coast. These are also the only sites that represent far distances from CBD, skewing true results.

Table 9: Limitations and improvements table

seen

5.2 Modified Fieldwork Question

The current fieldwork question aimed at spotting out the urban stress of Sarıyer. A more comprehensive study would include the study of urban gentrification and rejuvenation schemes and their effectiveness. Some rejuvenation through restoration and re-construction was evident in sites.

Figure 24: Road Improvement Construction in Site 9 (self-taken photograph)

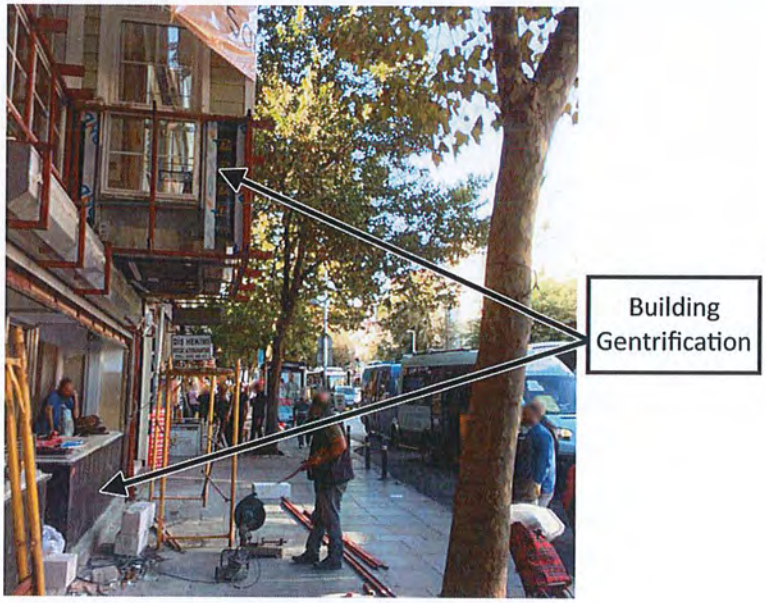

Figure 25: Building Rejuvenation in Site 10 (self-taken photograph)

[9]This arises a new field work question to compare current results and future results of urban stress symptoms, leading the question "To what extent is the gentrification of Sarıyer Merkez successful in reducing urban stress?"

[9]Gentrification was also evident in site 3 from figure 14

References

1. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/38954-951

10. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/120274-21

11. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-yeni-kiralik/daire/107582-1048

12. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/yali/2525-12563

13. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/107582-1202

14. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/17993-39820

15. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/38954-945

16. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/0-36216691

17. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-maden-kiralik/daire/0-1591342

18. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-maden-kiralik/daire/89502-675

19. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/17798-306

2. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/119720-7

20. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/120274-16

21. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/77176-469

22. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-zekeriyakoy-kiralik/daire/31514-3766

23. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/4245-3737

24. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/38942-1668

25. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/villa/2022-67881

26. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/9599-531

27. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/120274-6

28. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/9599-529

29. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/17993-39995

3. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/yali/54358-100

30. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-yeni-kiralik/daire/45760-2706

31. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/38954-942

32. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-yeni-kiralik/villa/7204-23165

33. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-yeni-kiralik/bina/109249-411

34. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/120274-9

35. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/17798-307

36. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-maden-kiralik/daire/38954-944

37. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-maden-kiralik/daire/89502-636

4. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/67104-1422

5. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/45760-2713

6. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/120274-23

7. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-buyukdere-kiralik/daire/120274-13

8. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/38954-907

9. (2020). *Hürriyet Emlak* [Online]. Retrieved 2020-11-21, from https://www.hurriyetemlak.com/istanbul-sariyer-merkez-kiralik/daire/120274-18

Alonso, W. (1964). [Online]. Oxford University Press. Retrieved 2020-2-25, from https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095504805

Bid rent theory [Encyclopedia]. (2020). Retrieved 2020-11-12, from https://en.wikipedia.org/wiki/Bid_rent_theory

Casio. (2020). *Distance between two places on the earth Calculator* [Online]. Retrieved 2020-11-14, from https://keisan.casio.com/exec/system/1224587128

Emlak, H. (2021). *Rental Map* [Map]. Retrieved 2021-3-1, from https://wordcounter.net/

Enders, F. B. (n.d.). *Coefficient of determination* [Encyclopedia]. Retrieved 2020-2-27, from https://www.britannica.com/science/coefficient-of-determination

Esri. (n.d.). *ArcGIS Online Webmap* [Online]. Retrieved 2020-11-09, from https://www.arcgis.com/home/webmap/ (ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit www.esri.com.)

Garrett Nagle, B. C. (2017). *Geography course companion* [Book]. Oxford University Press.

Kaptanoğlu, p., & Mıhçıoğlu Bilgi, E. (2019, 01). Conservation of historic sarıyer district in istanbul: Improving sustainability and energy efficiency of a bosphorus village. , *14*. doi: 10.5505/megaron.2018.43256

Nagle, G. (2002). *Geofile Online: Urban and Rural Deprivation in the UK* [Journal]. Oxford University Press.

National Geographic Mapmaker Interactive [Online]. (n.d.). Retrieved 2020-09-22, from https://

mapmaker.nationalgeographic.org/

Neal, A. (2018). *Sound Meter* [Software]. Retrieved from https://apps.apple.com/jp/app/%E9%9F%B3%E9%87%8F%E6%B8%AC%E5%AE%9A%E5%99%A8/id1373636871

Appendices

A Survey Format

Type 1	Type 2	Type 3	Type 4	Type 5
Passenger Vehicles - coupe, sedan, SUV etc. These cars are non-commercial vehicles.	Motorbike or Motorcycle	Public minibus, taxi or city bus	Taxi (vehicles holds up to 5 people) / Ride or other Taxi service	Lorry truck or van (large or small)
Tally Count:	Tally Count:	Tally Count:	Tally Count:	Tally Count:
Total:	**Total:**	**Total:**	**Total:**	**Total:**

Table 10: The Traffic Scale Survey from the survey sheet used in the field work

Congestion Scale - circle the description of the traffic flow that best fits what you observe in the 5 minute recording period.			
Gridlock - vehicles do not move for the 5 minute period	Unstable flow of traffic - traffic is moving very slowly and often stops for a period of time. No gaps to manoeuvre between lanes.	Stable flow of traffic - large numbers of vehicles are moving continuously, limited ability to move between lanes	Free flow of traffic - vehicles are able to move continuously with plenty of space to move between lanes
Other notes at this site (Accidents? Important Features?)			

Table 11: The Congestion Scale Survey from the survey sheet used in the field work

Direction A: Towards Zekeriyaköy	Direction B: Away from Zekeriyaköy
Tally:	**Tally:**
Total:	**Total:**
Notes:	

Table 12: The Pedestrian survey from the survey sheet used in the field work (Zekeriyaköy directions).

Direction A: Sarıyer CBD	Direction B: Away from CBD towards Maslak
Tally:	**Tally:**
Total:	**Total:**
Notes:	

Table 13: The Pedestrian survey from the survey sheet used in the field work (CBD Directions).

Category and Criteria	0	1	2	4	3	5	Comment
Infrastructure, Built Environment and Services							
Road Quality (0 = poor)							
Side walk Quality (0 = poor)							
Presence of Rubbish Bins (0 = not present)							
Presence of Public Seating (0 = not present)							
Presence of Public Restrooms (0 = not present)							
Presence of Green areas (0 = not present)							
	Category Total:						**Category Average:**

Category and Criteria	0	1	2	3	4	5	Comment
Safety/Security							
Presence of Police/Security (0 = not present)							
Sense of Personal Safety (0 = feels very unsafe)							
	Category Total:						**Category Average:**

Table 14: The Bipolar survey from the survey sheet used in the field work.

Value	Descriptor
1	Extremely dirty, many large pieces of trash are present in the area.
2	Very dirty, large pieces of trash are present in the area.
3	Dirty, some pieces of large trash present in the area
4	Somewhat dirty, infrequent pieces of large trash and small trash are present in the area.
5	Somewhat clean, some pieces of small litter.
6	Clean, rare pieces of small litter.
7	Very clean, almost no litter.
8	Extremely clean, no litter present.

Table 15: The Litter survey from the survey sheet used in the field work.

Type	Tally Count	Final Count
Hawkers		
Panhandlers		
Notes/Observations		

Table 16: The Informal Activity survey from the survey sheet used in the field work.

Minimum noise level	Maximum noise level	Average noise level

Table 17: The Noise survey from the survey sheet used in the field work.

B Detailed Results of Rental Prices

Location	Citation Number to Source	Distance from CBD (m)	Price per Month (TL)	Area (m^2)	Price per month per m^2 (TL)	Intersection (True or False)
41.169432, 29.056163	(1, 2020)	125	2200	55	40.0	F
41.168753, 29.056920	(2, 2020)	223	2000	57	35.1	F
41.165701, 29.056215	(3, 2020)	400	150000	1500	100.0	F
41.166093, 29.052652	(4, 2020)	432	4500	85	52.9	F
41.163102, 29.047276	(5, 2020)	1071	2500	85	29.4	F
41.163138, 29.047085	(6, 2020)	1086	1900	65	29.2	F
41.164228, 29.046352	(7, 2020)	1100	3500	120	29.2	F
41.170423, 29.054746	(8, 2020)	88	2200	55	40.0	F
41.170415, 29.055379	(9, 2020)	88	2000	85	23.5	F
41.170131, 29.056902	(10, 2020)	213	2250	140	16.1	F
41.169778, 29.058348	(11, 2020)	368	6000	200	30.0	F
41.169727, 29.058730	(12, 2020)	410	90000	600	150	F
41.171644, 29.058317	(13, 2020)	415	3500	160	21.9	F
41.173319, 29.057697	(14, 2020)	468	2200	110	20.0	F
41.173924, 29.057718	(15, 2020)	516	1750	80	21.9	F
41.175951, 29.058469	(16, 2020)	723	2250	135	16.7	F
41.174822, 29.052951	(17, 2020)	560	3300	110	30.0	F
41.173905, 29.047971	(18, 2020)	893	7500	185	40.5	F
41.169111, 29.055754	(19, 2020)	91	2100	80	26.3	T
41.169024, 29.056365	(20, 2020)	156	2500	105	23.8	T

Table 18: Rent price data (1/2) (Some links may be unavailable because the rental places have been bought)

Location	Citation Number to Source	Distance from CBD (m)	Price per Month (TL)	Area (m^2)	Price per month per m^2 (TL)	Intersection (True or False)
41.168657, 29.057513	(21, 2020)	289	2200	67	32.8	T
41.167688, 29.056950	(22, 2020)	281	2800	130	21.5	T
41.165184, 29.052911	(23, 2020)	490	6900	120	57.5	T
41.162471, 29.047417	(24, 2020)	1096	20000	250	80.0	T
41.163541, 29.046407	(25, 2020)	1128	55000	450	122.2	T
41.170423, 29.054086	(26, 2020)	135	2800	105	26.7	T
41.170880, 29.054551	(27, 2020)	137	1950	85	22.9	T
41.170081, 29.057345	(28, 2020)	260	2000	95	21.1	T
41.172716, 29.058255	(29, 2020)	469	3000	140	21.4	T
41.171332, 29.061727	(30, 2020)	762	2350	80	29.4	T
41.174053, 29.058051	(31, 2020)	548	2200	130	16.9	T
41.174772, 29.063801	(32, 2020)	1097	8000	300	26.7	T
41.175917, 29.063215	(33, 2020)	1098	25000	300	83.3	T
41.170939, 29.05123	(34, 2020)	441	1800	80	22.5	T
41.172726, 29.051786	(35, 2020)	475	2750	140	19.6	T
41.174176, 29.048644	(36, 2020)	841	2500	100	25.0	T
41.175855, 29.048225	(37, 2020)	974	10000	200	50.0	T

Table 19: Rent price data (2/2) (Some links may be unavailable because the rental places have been bought)