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Mapping of Residential Noise Levels Along Railway Lines: A Case Study of Jl. Haur Jaya, Bogor City

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ABSTRACT

The occurrence of urban sprawl is caused by the need to accommodate the increasing urban population, many workers work in cities and have a place to live and other living space needs. They travel across districts and cities, the majority of workers, they choose to become commuter workers[3] . If seen from the commuter data from Bogor Regency, it is ranked 4th, the public transportation means that commuters consider the most effective is the train. Then the discussion of this writing is more about the mapping of residential noise that intersects with the tracks from the railroad tracks on Jl Haur Jaya, and Jl. Bubulak, Bogor City. Sampling measurements at the location using the SANFIX type WT85B Sound Level Meter instrument with a measurement time of 24 hours were carried out in 4 times at 4 measurement points, for 10 minutes with an interval of 5 seconds so that 120 data were produced, then entered into the analysis stage the data was processed to obtain data equivalent noise level using the following formula: Leq = 10 log 1/n ∑Tn.100.1 Ln dB(A), Nearly 50% of the noise level in 2 settlement points must be reduced to achieve a noise level of 55.0 dBA. It is recommended to reduce noise levels by using artificial barriers or plant barriers so that the health of settlements in this area becomes of higher quality.

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1. INTRODUCTION

Urban sprawl, or urban expansion, occurs due to the need to accommodate the increasing urban population. Many workers work in metropolitan areas and desire housing and other living space. Consequently, cities with smaller populations around the city center develop to accommodate the needs of the city center. [1] As we know, this is happening in Indonesia's capital, DKI Jakarta. Jakarta's rapid expansion has led to many workers becoming commuters. Commuting is a term for someone who routinely travels across districts or cities from their place of residence and back within the same day. [2].

Those who travel across districts and cities are mostly workers, they choose to become commuter workers because there are no job opportunities that support their educational background, then there are also many students who become commuter students because the schools they go to are in the city center, they are willing to travel a long time to get a more satisfying income and still spend time with their families after work or on weekends [3]. Because these activities are carried out routinely every day, there are times when there is a surge in human movement from one location to the next. The means used for this movement are both private and public transportation. This is where the role of the transportation system becomes a major focus in running the wheels of a region's economy, especially land transportation which includes private vehicles, intercity and interdistrict buses, public transportation, and trains. [4] The problem that arises is that with the population trend continuing to rise, the number of private vehicles, such as motorbikes and cars, exceeds road capacity, resulting in extraordinary traffic jams every day when people leave for work and when they return home. [5] This is a challenge for commuters who choose to use private vehicles for their travel. Due to cost and time efficiency, many commuters choose public transportation for their daily commute. They feel that improving public transportation services, a key agenda of the Indonesian government, makes them more comfortable using public land transportation.

Train is one of the alternative modes of transportation used by the people of Bogor city and district to travel to the capital city of Jakarta for work or college, on the other hand, many residents of Jakarta or outside Jakarta choose to use the commuter train transportation mode to reach the destination of Bogor City because of the short travel time compared to using private vehicles, Improving the integration of this commuter line system needs to be reviewed again to improve facilities at Bogor station which is the busiest station in West Java. Departures and arrivals for the Commuter Line Train towards Jakarta and vice versa are every 10 minutes from 04.00 to 00.30 WIB [3], [6], [7] with this already quite busy schedule, the train crosses between cities and districts with an interval of 10 minutes, one of which is a residential area. The discussion of this writing is more about mapping the noise of settlements that intersect with the railway line, the infrastructure of this railway is equivalent to the railway line that should be implemented by the city government in order to create a comfortable environment from noise, but the area that should be a noise dampener was built by residents for them to live, this not only has an impact on the residents of the house but also has an impact on the environment around the area.

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2. METHODOLOGY

The study was conducted in several stages of work to map noise levels in residential areas around the railway on Jl. Haur Jaya, Bogor City, namely ;

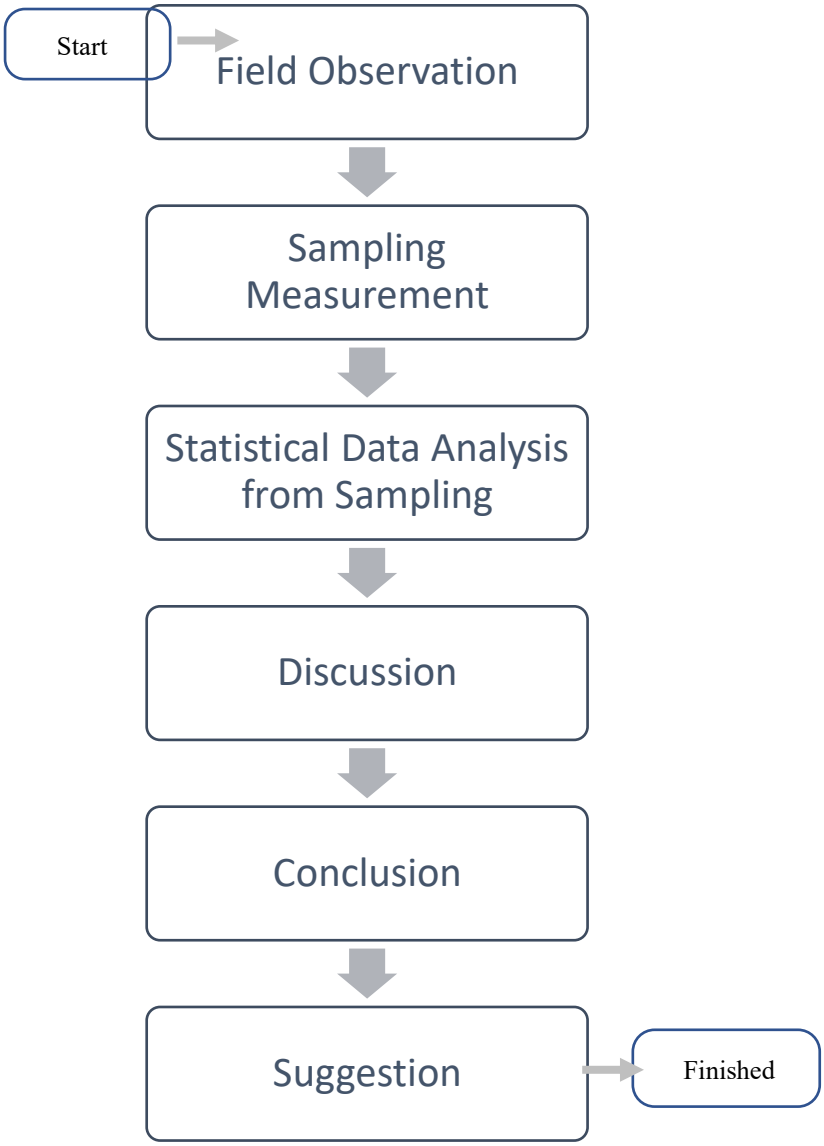

Figure 1. Water Diagram of Research Methods

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The diagram above shows the stages that will be carried out in this study, starting from field observation by determining the location points where the noise level will be measured, assisted by the Google Earth application. Then sampling measurements were carried out at previously planned locations using the SANFIX Sound Level Meter type WT85B instrument with a measurement time of 24 hours carried out in 4 times at 4 measurement points, morning at 05.00-08.00, afternoon 11.00-13.00, evening 16.00-18.00, and night 21.00-23.00 for 10 minutes with an interval of 5 seconds so that 120 data were produced, then entered the data analysis stage with calculations In statistics, "frequency" contains the meaning: numbers (numbers) that indicate how many times a variable (symbolized by the numbers) appears in the series of numbers. Then the data is processed to obtain equivalent noise level data using the following formula: Leq = 10 log 1/n ∑Tn.100.1 Ln dB(A), Then the Leq results are compared with the quality standards according to the Decree of the Minister of Environment No. Kep-48/KEP/XI/1996 concerning Noise Level Standards in residential areas, which results in a conclusion about whether the noise in the area has met the standardization or has not met the standardization of noise level standards.

3. RESULTS AND DISCUSSION

If we look at the commuter data originating from Bogor Regency in table 1, it is ranked 4th. This is a high number every day for the mobility of people going to DKI. Jakarta and returning to Bogor within a 24-hour period, and the data is in-line with table 2 where 100% of Bogor Regency commuters travel to DKI. Jakarta. Currently, trains are a widely used mode of transportation. Integration of transportation services at Bogor City Station is one of the urgent steps to be implemented, considering that Bogor City Station is the busiest station because it is crossed by long-distance trains from Jakarta to various destinations in Java. Currently, Bogor City Station serves + 51,675 commuter passengers every day with destinations around Jakarta and vice versa.[8]

Table 1. Bodetabek Commuters Whose Main Activity is in DKI Jakarta by Place of Residence, Main Commuting Activity in 2019

Residence	Main Commuter Activities			Amount
	Work	School	Course	
Kab. Bogor	132.781	16.237	-	149.018
Kota Bogor	16.858	1.245	-	18.103
Depok	226.667	68.505	1.316	296.488
Kab. Tangerang	66.563	3.230	-	69.793
Kota Tangerang	139.022	32.769	619	172.410
Kota Tangerang Selatan	137.015	22.009	-	159.024
Kab. Bekasi	97.485	16.216	-	113.701
Kota Bekasi	226.558	50.676	-	277.234
Amount	**1.042.949**	**210.887**	**1.935**	**1.255.771**

Source : [9]

Table 2. Bogor Regency Commuters Whose Main Activities Are Outside Bogor Regency According to Commuter Activity Location, Main Commuter Activity (2019)

Residence	Main Commuter Activities			Amount
	Work	School	Course	
DKI Jakarta	132.781	16.237	-	149.018
Kota Bogor	61.805	36.288	-	93.093
Depok	33.889	20.701	-	54.590
Kab. Tangerang	10.761	-	-	10.761

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Kota Tangerang	8.2655	3.038	-	11.303
Kota Tangerang Selatan	23.694	4.172	-	27.866
Kab. Bekasi	15.876	8.148	-	24.024
Kota Bekasi	15.641	11.446	-	27.087
Kab/Kota Lainnya	4.271	1.761	-	6.132
Amount	**307.083**	**101.791**	**-**	**408.874**

Source : [9]

And if we look at table 3 which shows an upward trend in graph 1, making public transportation facilities that are considered the most effective by commuters for traveling will continue to be improved by PT KAI to support government programs that encourage people to use public transportation rather than using private vehicles. Seeing the increasing demand for new lines then developed by PT. KAI, namely the Bogor - Sukabumi Railway double track line, more than 2,000 buildings were affected by evictions because they were standing on the edge of the railway line [10] buildings that were deliberately built on the edge of the railway line will have a negative impact on their owners, especially if they are used for residential homes, the noise standardization is at level 55dB(A) for residential areas, while buildings that are on the edge of the building tracks are at a noise level of 62-79.02dB(A) [11], Then the effects of this noise on humans themselves are numerous, such as damage to ruptured eardrums, then buildings close to the railway tracks are also vulnerable to damage due to vibrations from the trains which pass by almost every 10 minutes, not to mention there is the possibility of the train derailing and destroying houses as happened in Magersari, Surabaya in 2015 [12].

Table 3. Number of Train Passengers (Thousand People) in the Greater Jakarta area in 2022

Month	Number (thousand people)
Januari	14.484
Februari	10.499
Maret	15.735
April	15.890
Mei	17.075
Juni	18.326
Juli	19.467
Agustus	19.388
September	20.587
Oktober	21.807

Source : [13]

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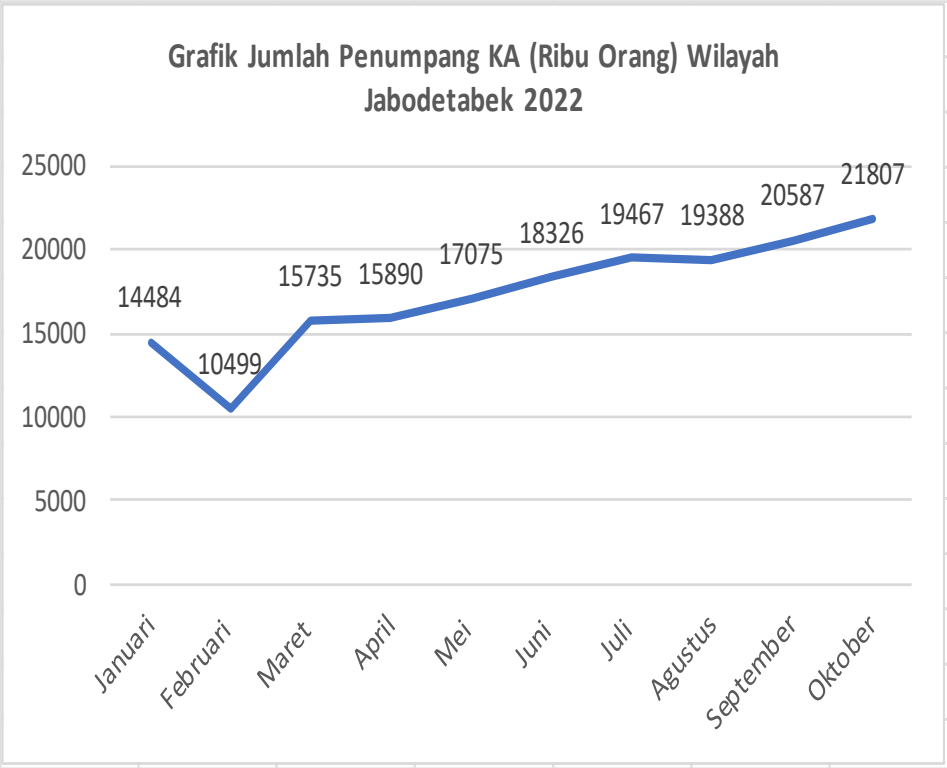

Chart 1. Trend of Increase in Passenger Numbers in Greater Jakarta in 2022
Source: [13]

Based on that, this study tries to find out whether the settlements around Jl. Haur Jaya have met the standards of the Ministry of Industry for noise standards in settlements. The location points to be observed can be seen in the mapping map in Figure 2, the measurement points will be carried out at 4 points, at point A (Figure 3) which is a settlement that stands on the railroad tracks with a land leveling of 300 cm, point B (Figure 5) which is a settlement that is outside the railroad tracks but the railroad tracks are built with illegal buildings, while point C (Figure 3) is the location across Jl. Haur Jaya, namely Jl. Bubulak, whose existing condition is 80 cm higher than the railroad tracks, while point D (Figure 7) is a noise measurement at the settlement closest to the railroad tracks.

Figure 2. Map of the Haur Jaya Railway Line, Bogor City

Source: [14]

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Figure 3. Photo of Differences in Land Leveling
Source : Dok. Pribadi

Figure 4. Photo of the Haur Jaya Street Residential Area
Source: Personal Document

Figure 5. Photo of the Haur Jaya Street Residential Area
Source: Personal Document

Figure 6. Photo of Jl Bubulak Settlement
Source: Doc. Personal

Figure 7. Photo of Settlement Jl. Bubulak
Source: Doc. Personal

Figure 8. Distance of Residential Areas on Jl. Haur Jaya
Source: Personal Document

Figure 9. Distance to Settlements Jl. Bubulak
Source: Doc. Personal

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Sampling measurements will be divided into 4 times, Morning between 06.00-08.00, Noon at 11.00-13.00, Afternoon at 16.00-18.00, Night at 21.00-23.00, with a period of 10 minutes with an interval of 5 seconds, then at each time will get a sample of around 120 samples to find the average per time then from that time will be the basis for getting the average per day in the settlement how much noise level. The distance (Point B) of the measurement of the settlement at point B is 12.2 meters from the railroad boundary marker (Figure 8), and the distance (Point D) of the settlement on Jl Bubulak is 9.7 meters (Figure 9). The results of the calculation are that the average noise in this environment is 95.1 dBA, with the highest frequency in this environment being 101.7 dBA, and the lowest is 40.0 dBA, with the calculation of finding the Noise Leq value first looking for the range with the formula r = (Highest value minus the lowest value), then looking for the class to later be described to make a frequency distribution table with the formula k = 1 + 3.3logn after finding the frequency distribution table the formula Leq = 10 log 1 / n ∑Tn.100.1 Ln dB (A) is applied. The results of the measurements of 4 points at the location are listed in table 3, which shows that the Noise Leq per day at Point A is 99.0 dBA, at point B is 85.2 dBA, at point B 100.2 dBA, and point D is 96.0 dBA, this figure is a figure that is very far from the standard noise level which is 55.0 dBA.

Table 4. Results of Measurement and Calculation of Average Noise Level (Leq).

Measurement Time	**Jl. Haur Jaya (satuan dBA)**					
	Titik A			**Titik B**		
	Max	**Min**	**Leq**	**Max**	**Min**	**Leq**
05.00-08.00	94,0	47,2	97,2	73,1	40,6	81,7
11.00-13.00	96,1	45,6	100,2	72,1	43,2	80,8
16.00-18.00	94,9	49,7	100,8	80,0	44,0	88,7
21.00-23.00	96,5	48,4	97,6	75,6	44,8	89,6
Rata-rata	**95,4**	**47,7**	**99,0**	**75,2**	**43,2**	**85,2**

Measurement Time	**Jl. Bubulak (satuan dBA)**					
	Titik A			**Titik B**		
	Max	**Min**	**Leq**	**Max**	**Min**	**Leq**
05.00-08.00	96,0	45,6	100,2	86,8	45,6	84,6
11.00-13.00	101,7	40,0	103,1	81,6	44,4	103,3
16.00-18.00	99,1	45,8	97,0	84,7	44,6	102,0
21.00-23.00	94,0	41,4	100,4	84,7	43,8	93,9
Rata-rata	97,7	43,2	100,2	84,5	44,6	96,0
Max. Noise			101,7			
Min. Noise			40,0			
Average Environmental Noise			95,1			

Source : Dok. Pribadi

4. CONCLUSION

The results of the data above show that at point A there must be a noise reduction of 44.0 dBA, at point B of 30.2 dBA, point C of 55.2 dBA, and at point D of 41 dBA. Almost 50% of the noise level at points B and D must be reduced to achieve a noise level of 55.0 dBA, it can be concluded that at point D which applies railroad border facilities has a higher noise impact because at point B it benefits from the presence of illegal buildings but these illegal buildings are only able to reduce noise by 15 dBA, and are not able to reduce noise up to 55.0 dBA, then the view is not pleasant to look at because these illegal buildings are also built haphazardly without implementing the rules of proper house construction. According to those who have lived in this area, it is very uncomfortable to live in this area because the

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train passes this track from 4 am to 1 am, during rush hour the train passes this area twice every 10 minutes and sometimes sounds its horn, the quality of sleep in this location is very disturbed. Therefore, it is recommended to reduce the noise level by using artificial barriers or plant barriers so that the health of the residents in this area will be better.

REFERENCES

[1] U. States and W. W. Ii, "URBAN sprawl.," *Br. Med. J.*, vol. 2, no. 4794, pp. 1142–1143, 1952, doi: 10.4324/9781315663265-17.

[2] Badan Pusat Statistik DKI Jakarta, *STATISTIK KOMUTER JABODETABEK*, vol. 4, no. 1. 2014.

[3] S. Setyodhono, "Faktor yang Mempengaruhi Pekerja Komuter di Jabodetabek Menggunakan Moda Transportasi Utama," *War. Penelit. Perhub.*, vol. 29, no. 1, p. 21, 2017, doi: 10.25104/warlit.v29i1.326.

[4] Badan Pusat Statistik Jawa barat, *Statistik Transportasi Jawa Barat*, vol. 4, no. 1. BPS – Statistic of Jawa Barat Province, 2018.

[5] S. Aminah, "Jurnal Teknik Sipil Untan," *Tek. Sipil Untan*, vol. 12, no. DESEMBER, pp. 175–176, 2012, [Online]. Available: file:///C:/Users/Nur Ali Rahmatullah/Downloads/1435-4550-1-PB.pdf

[6] F. Azhima, "Analisis Sektor Ekonomi Potensial Sebagai Prioritas Pembangunan Wilayah Kabupaten Bogor Tahun 2015-2019," *Repository.Uinjkt.Ac.Id*, p. 121, 2020, [Online]. Available: http://repository.uinjkt.ac.id/dspace/handle/123456789/54479%0Ahttp://repository.uinjkt.ac.id/dspace/bitstream/123456789/54479/1/FAUZAN AZHIMA-FEB.pdf

[7] PT KAI, "Jadwal Bogor - Bojong Gede - Nambo - Depok - Manggarai - Jakarta Kota," 2022. https://www.krl.co.id/jadwalkrl/

[8] A. Malik, T. Murtejo, and A. Alimuddin, "Analisis Kebutuhan Fasilitas Integrasi Moda Krl Stasiun di Kawasan Kota Bogor," *J. Civronlit Unbari*, vol. 7, no. 1, p. 15, 2022, doi: 10.33087/civronlit.v7i1.94.

[9] Badan Pusat Statistik, *Statistik Komuter Jabodetabek 2019*, vol. 7, no. 2. 2019. [Online]. Available: https://www.bps.go.id/publication/2019/12/04/eab87d14d99459f4016bb057/statistik-komuter-jabodetabek-2019.html

[10] A. Sudarno, "2.000 Bangunan Kena Gusur Proyek Rel Ganda Bogor-Sukabumi," 2019. https://www.liputan6.com/bisnis/read/4065540/2000-bangunan-kena-gusur-proyek-rel-ganda-bogor-sukabumi (accessed Dec. 11, 2022).

[11] D. Prihatiningsih and S. Rahmawati, "Pemetaan Tingkat Kebisingan Di Pemukiman Sekitar Rel Kereta Api Kecamatan Gondokusuman Noise Level Mapping in Settlements Around the Railroad Tracks Gondokusuman Sub-District," 2018.

[12] C. D. Malahati, "MASYARAKAT DI PINGGIRAN REL KERETA API (Studi Kasus : Permukiman Lingkungan XII Jalan Arteri Ringroad Medan," 2015.

[13] P. K. PT KAI; Commuter Jabodetabek, "Jumlah Penumpang Kereta Api Jabodetabek 2022," 2022. https://www.bps.go.id/indicator/17/72/1/jumlah-penumpang-kereta-api.html (accessed Dec. 11, 2022).

[14] pro Google Earth, "Google Eart Pro." Bogor, 2023. [Online]. Available: https://earth.google.com/web/search/Jalan+Krisik,+RT.03%2FRW.07,+Kebon+Pedes,+Bogor+City,+West+Java/@-6.57847397,106.79284642,225.38326823a,956.0671661d,35y,86.98841163h,0.17547714t,-

0r/data=CqgBGn4SeAolMHgyZTY5YzQ0OWRiOTMyN2M3OjB4MmUyM2UwM2FmMzlhNDNjZhlI

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