Investigating Traffic Noise Levels Using FWHA Traffic Prediction Model In the Streets of Quezon[1]

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Abstract

The potential of the Traffic Noise Model version 2.5 (TFNv2.5) in simulating and predicting traffic noise pollution levels on major streets of Quezon City is explored. The TFNv2.5, supported by a scientifically founded and experimentally calibrated acoustic computation methodology, was applied to three (3) sites within Quezon City, chosen due to their key locations and different urban environments, namely: educational, hospital and residential. To identify the traffic noise impact, traffic volume count at these selected sites of the city were obtained from pertinent government data and the results are compared against World Health Organization standards. The study further explores mitigation of unacceptable noise level results through the incorporation of reasonable and feasible measures available in the same software, such as attenuation over/through rows of buildings or dense vegetation, or noise barrier design vis-à-vis realistic possibilities in each case study's unique context.

Keywords: Traffic, Noise, Prediction, Software, FHWA, Quezon City

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I. Introduction

Two of the current trends affecting the design and construction development in the Philippines are climate change awareness and disaster preparedness; various steps are taken to address air, water and land pollution and alternative material innovations are now focused on strength, resiliency and cost efficiency. However, there has been little effort to address the compelling need to mitigate noise pollution in terms of building construction and design. And as our cities develop an uncontrolled growth through urbanization and in-migration, our problem with noise will only continue to aggravate.

According to World Health Organization Guidelines, annual average night exposure should not exceed forty (40dB) decibels. People exposed to higher levels over the year can suffer mild health effects, such as sleep

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disturbance and insomnia. Long-term average exposure to levels above 55dB can trigger elevated blood pressure, stroke and heart attacks. Studies show that for every 10dB of added noise on a person exposed from 42dB up to 84dB, there is a 12% increase in the risk of having a heart attack. It has been medically proven that prolonged exposure to noise levels around 80dB can cause permanent hearing loss. Thus, the dangers posed by noise pollution must not be ignored.[1]

The national standards for a residential area is 60dB during the day and 50dB at night. However, many residential areas in Metro Manila averages at 80dB from six in the morning up to seven in the evening, and 65dB from ten in the evening up to four in the morning. One of the main noise contributors according to a study conducted by Asian Development Bank are the two and three-wheeled vehicles that produces as high as 97dB up to 110dB for areas densely populated by tricycles.[2]

Section 5 of the Philippine Environment Code (PD 1152) promulgated in 1977 states that, with regard to community noise standards,—appropriate standards for community noise levels shall be established considering, among others, location, zoning and land use classification.

Stress-related health problems such as stroke and heart disease are today being linked to traffic noise. On a research conducted by Michelle Brandt of Stanford Medicine in June 2012, that is been tracked for an average of 10 years starting 1993; It is determined that for every 10dB of added traffic noise on persons exposed from anywhere from 42dB of traffic noise—considered ambient noise—to 84dB, there's a 12 percent increase in heart attack risk.[3]

Another research titled The Effect of Road Traffic Noise at Hospitals in Baghdad City by Zeena T. Jaleel from the University of Technology Building & Construction Eng. Department, states that the noise impact to mental and physical health affects sleep, conversation, perception of annoyance, hearing loss and cardiovascular problems as well as task performance.[4]

A multi-year survey of 5,075 people living in and around Stockholm conducted at the Institute of Environmental Medicine in Sweden showed that traffic noise exposed all surveyed participants to diabetes risk factors.[5]

FWHA Software

The Federal Highway Administration (FHWA) has developed the FHWA Traffic Noise Model (FHWA TNM), a state-of-the-art computer program for predicting noise levels in the vicinity of highways.[6]

The FHWA TNM calculates sound levels for locations with and without noise barriers. The FHWA TNM allows for analyses of noise from constant-flow and interrupted-flow traffic and determines the effects on noise levels of different pavement types, graded roadways, rows of buildings, dense vegetation, and parallel noise barriers.

This software will be used to investigate the traffic noise levels on the streets of Quezon City.

II. Methodology

a. A Google Map image was used as a basis to create a scaled AutoCAD file projecting building boundaries, streets, open areas, and landscape of three different locations, having a 250-meter radius each in Quezon City. The chosen locations were specific to residential, health, and institutional areas. For a higher degree of accuracy, actual measurements were taken on site such as road and sidewalk widths, building frontage, and the like.

b. The generated map was used in the TNM v2.5 software and was then subjected to five standard vehicle types, including automobiles, medium trucks, heavy trucks, buses, and motorcycles, as well as user-defined vehicles on constant-flow and interrupted-flow of traffic using the most current field measured data base from DPWH

c. Multiple target receivers were strategically placed in locations with varying height and distance from the road to predict the traffic noise exposure sound levels and attenuation over/through rows of buildings and dense vegetation based on a one-third octave-band data base and algorithms.

d. TNM v2.5 features such as multiple diffraction analysis, parallel noise design barrier analysis, contour analysis, including sound level contours, barrier insertion loss contours, and sound level difference contours were optimized to come up with recommendations to mitigate or at least reduce the documented traffic noise pollution.

III. Case Studies

A. Residential: New Manila

For Manila's upper- and middle-class families during the American colonial period in the Philippines, particularly during the 1920's-1930's, the country's capital city Manila was experiencing unprecedented progress and commercial expansion which brought out much stress that they consider moving to Manila's outskirts or suburbs instead. Part of this development became what was known as New Manila, a vast area of lush greenery with elevated topography and a hilly terrain. However, in recent years, a new wave of development has begun in New Manila as property developers scrambled anew in developing the district, with a number of them putting up condominiums or residential high-rises standing out in this once-quaint district, not to mention the rise of low-level developments like townhouses. With all these changes, the district has nonetheless maintained its residential image.

Eulogio A. Rodriguez Sr. Avenue (popularly called E-Rod today) is one of the major thoroughfares bordering New Manila's residential zone. Over the years, it has become highly commercialized with restaurants, mini-malls, groceries, and shops sprouting along its length, not to mention high density places such as high-rise condominiums, schools, and sports clubs. The jeepney and tricycle are the main mode of public transportation, along with private vehicles and trucks, make E-Rod a very busy road, hence, the focus of this study.[7]

B. Health: The Lung Center of the Philippines

The Lung Center of the Philippines (LCP) is a government owned and controlled corporation established to provide the Filipino people state-of-the-art specialized care for lung and other chest diseases. It is located along Manuel L. Quezon Avenue (popularly called Q-Av) where a few other hospitals are located such as the National Kidney and Transplant Institute (within the LCP compound) and the Philippine Children's Medical Center (PCMC). [9]

Quezon Avenue is different from other roadways in Quezon City in that it is heavily tree-lined on both sides including the center island, not to mention the 22.7-hectare Ninoy Aquino Parks and Wildlife right across which becomes a botanical and zoological barrier to air and noise pollution.

C. Educational: University of the Philippines, Diliman Campus

The University of the Philippines Diliman (UPD) is the biggest campus and the physical seat of the UP System (UPS) Administration. Every year, thousands of people from across the nation and around the world visit the 493-hectare UP Diliman Campus, which prides itself on several sites of interest and other cultural sites such as museums and performance spaces, 63 hectares of which encompasses parks, open spaces, and protected forest areas. As of April 2016, the university has enrolled 23,757 students and has an active faculty of 1526 teachers.[8]

The main entrance to the University of the Philippines at Diliman, therefore the busiest, is University Avenue—about 800 meters long of two four-car lanes—which is the focus of the study. It admits private vehicles, delivery vans, and the quintessential jeepney which becomes the preferred public utility transport in and out of the university other than the tricycle.

III. Gathered Data

A. Traffic Data Summary

The Department of Public Works and Highways (DPWH) has generated a report in its 2012 Atlas the Annual Average Daily Traffic which reveals the total number of vehicles per vehicle type *(Table 1)*. All three case studies fall under the Quezon City 2nd District Engineering Office. [10] However, TNM v2.5 groups vehicles into five (5) major types which requires the DPWH vehicle types to be reclassified to match.

Table 1. Traffic Data Summary from DPWH 2012 Atlas reclassified for TNM v2.5

Case Study	University Avenue	Quezon Avenue	E. Rod Avenue
Motorcycle	128	89	168
Automotive	48,009	119,332	35,468
Large Bus	95	2,727	257
Medium Truck	6,616	4,261	673
Heavy Truck	700	406	32

Moreover, the software only needs an hourly vehicle count *(Table 2)* which only requires simple mathematics to get. The study assumes that there are no peak hours.

Table 2. Hourly Vehicle Count for TNM v2.5

Case Study	University Avenue	Quezon Avenue	E. Rod Avenue
Motorcycle	5	4	7
Automotive	2,000	4,972	1,478
Large Bus	4	114	11
Medium Truck	276	178	28
Heavy Truck	29	17	1

B. Input Data Summary

E. Rodriguez, Sr. Avenue. The area of focus for purposes of this study is the residential zone within a 200-meter radius from the intersection of E. Rodriguez Avenue and Victoria Avenue where a cluster of townhouses are on one side of Victoria Avenue and large residential lots with dense landscaping occupy the other side *(Fig. 1)*. Victoria Avenue divides the two types of residential clusters.

The westward lane E. Rodriguez Sr. Avenue heads towards the city of Manila, while the eastward lane goes further into Quezon City.

The baseline readings (Receivers 9-10 and 13-15) are those along the avenue itself which is fronted by low-rise commercial buildings around 7 meters in height.

The western side of Victoria Avenue plays host to several subdivisions of townhouses, namely Alpha Victoria (Receivers 1-2) and Galleria New Manila (Receivers 8 and 16) among others. The eastern side remains the original New Manila residential models characterized by large lots of at least 1000 square meters and heavily landscaped (Receivers 3-5). *(Fig. 1)*

Lung Center of the Philippines, Quezon Avenue. The area of focus for this paper's study is within the 250-meter radius from the main entrance point of the Lung Center of the Philippines. Ten (10) receivers were laid out: two (2) along the roadways, two (2) along building rows, and three (3) at tree zones *(Fig. 2)*.

The two roads plotted represent Quezon Avenue's east and westbound directions. Roadway 2 is eastbound while Roadway 3 is westbound.

The two buildings plotted represent the Lung Center of the Philippines, designated as building row 1, and the Kidney Institute of the Philippines, designated as building row 2.

The first tree zone represents the greeneries around the wildlife park area, the second tree zone represents the island or the greeneries in the middle of the highway, and lastly, the third zone represents the greeneries around the vicinity of the Lung Center of the Philippines and Kidney Institute of the Philippines. *(Fig. 2)*

University Avenue, University of the Philippines Diliman Campus. The area of focus is the whole stretch of University Avenue from its entry from Commonwealth Avenue up to its termination fronting Quezon Hall, the university's central administration building *(Fig. 3)*.

University Avenue consists of the eastward lane (Receivers 38-42 and 45-46) heading into the campus, and the westward lane (Receivers 20-24 and 51-53) heading outward into Commonwealth Avenue.

The nearest buildings on the northern part of the avenue, those likely to be affected by the traffic noise along University Avenue are the National College of Public Administration, UP Institute for Small-scale Studies (Receivers 30 and 64), UP College of Social Work and Community, and the UP Film Institute Media Center (Receivers 65 and 69). Within the southern part is the Commission on Higher Education (Receivers 76-78). At the end of the avenue is Quezon Hall (Receivers 71-74), the node wherein vehicles enter and exit.

All other receivers are spread across the trees and wide fields between the avenue and the nearest buildings from it. *(Fig. 3)*

IV. Simulation Results

A. Summary of Relevant Receiver Data

For brevity, this paper selected only the 10 relevant of the many receiver data calculated by the software.

E. Rodriguez, Sr. Avenue

Among the 16 receivers spread across the test area, 10 of which represent the relevant data for the study *(Table 3)*. These are those closest to E. Rodriguez, Sr. Avenue and those which fall within the property of both the townhouses and the private single-detached residences.

Table 3. Relevant Receiver Data for E. Rodriguez Avenue (with and without mitigation)

Receiver Number	Relevant Receiver Locations	dB	dB (w/ Mit)
9	E. Rodriguez, Sr. Commercial	66.8	NA
10	E. Rodriguez, Sr. Commercial	66.0	NA
13	E. Rodriguez, Sr. Commercial	65.6	NA
14	E. Rodriguez, Sr. Commercial	66.1	NA
2	Alpha Victoria (75 meters from road)	57.0	45
1	Galleria New Manila (25 meters from road)	61.0	45
8	Galleria New Manila (80 meters from road)	56.1	45
4	Private Residential Property (30 meters from road)	62.5	45
5	Private Residential Property (50 meters from road)	60.9	45
3	Private Residential Property (60 meters from the road)	57.8	45

Lung Center of the Philippines, Quezon Avenue

The 10 receivers listed below *(Table 5)* represent the most relevant receivers fronting the Lung Center of the Philippines and those areas adjacent to it such as the National Kidney Institute and the Ninoy Aquino Parks and Wildlife. Refer to Figure # for the actual data results.

Table 4. Relevant Receiver Data for Quezon Avenue (without mitigation)

Receiver Number	Relevant Receiver Locations	dB
1	Roundabout	65.3
2	Lung Center, ground floor	59.9
3	Lung Center, second floor	57.8
4	Lung Center, third floor	58.3
5	Lung Center, rear	47.3
6	National Kidney Institute, ground floor	47.3
7	National Kidney Institute, second floor	47.1
8	Parking Area	52.2
9	Wildlife Park (10 meters from the road)	67.7
10	Wildlife Park (30 meters from the road)	56.7

University Avenue, University of the Philippines Diliman Campus

Among the 78 receivers spread across the test area, 10 of which represent the relevant data for the study *(Table 4)*. Of great importance are those receivers that are located at colleges and offices, namely Receivers 91, 92, 30, and 64 (National College of Public Administration), Receivers 65 and 69 (UP Institute for Small-scale Industries), Receivers 80 and 81 (UP School of Urban and Regional Planning), and Receivers 66 and 67 (College of Mass Communication).

The uniformity of the receiver data is owed to the fact that all subject buildings are equidistant from University Avenue and that the density of foliage are, more or less, equal as well.

Table 5. Relevant Receiver Data for University Avenue (with and without mitigation)

Receiver Number	Relevant Receiver Locations	dB	dB (w/ Mit)
30	National College of Public Administration	66	40
64	National College of Public Administration	66	40
90	National College of Public Administration	66	40
91	National College of Public Administration	66	40
65	UP Institute of Small-scale Studies	66	40
69	UP Institute of Small-scale Studies	66	40
80	UP School of Urban and Regional Planning	66	40
81	UP School of Urban and Regional Planning	66	40
60	College of Mass Communication	66	40
67	College of Mass Communication	66	40

B. Mitigation

TNM v2.5 allows for some noise pollution mitigating measures through noise barrier design such as walls or buildings, or landscape features such as trees or berms. Each case study, however, requires a different realistic approach depending on the location, present condition, city ordinance, and other circumstances.

E. Rodriguez Sr. Avenue

The entire length of E. Rodriguez Sr. Avenue accommodates offices, institutional, and commercial. In recent years, the site of the case study has gone increasingly commercial, yet the city government has not made improvements on infrastructure. The 1.50-meter sidewalk runs adjacent to the street on one side and immediately the property line of the commercial buildings on the other where vehicular parking also begins. There are no provisions for green strips, nor could there ever be, unless the landowners provide it themselves. The most realistic mitigating measure for this case study is a noise barrier such as a building. In fact, more and more high-rise condominiums have been towering along E. Rodriguez, Sr. Avenue these past years.

While high-rise residential condominiums along E. Rodriguez, Sr. Avenue have reached heights of 100 meters, a row of at least 40-meter high (medium-rise) buildings, side by side, along the avenue should be able to uniformly reduce the noise levels down to 45 dB one block in, which is an acceptable daytime noise level *(Table 3)*. Additional trees within the single-detached private properties, should the property allow it, can still reduce noise levels down to another decibel or two.

Lung Center of the Philippines, Quezon Avenue

The stretch of Quezon Avenue where the Lung Center of the Philippines is located is heavily-tree-lined on both sides and the center island. The compound of the Lung Center is in itself lush with landscaping. One possible solution to mitigate the high noise levels assessed by the software is the use of barriers. The graph below *(Fig. 4)* shows that the decrease in noise levels is dependent on the increase in the height of the barrier.

The testing for this specific case study has been, in terms of mitigation, interestingly difficult—requiring several tests as to barrier design, specifically, wall height. Receivers one (1), two (2) and eight (8) in the simulation, having a 1.5-meter barrier, seemed to have decreased 3 to 4 dB from its original noise levels of 62.5dB, 54.6dB and 51.3dB, respectively. While the 3m-barrier decreased the noise levels of Receivers 1, 2, 3, 5, and 8 by 4dB to 10dB. The pattern shows that there is an average decrease of 2dB to 4db at every 3m increase on the barrier's height. However, upon reaching the height of 15m, the average decrease in noise level at every 3m increase on the barrier went down to 1dB.

For the results to be in accordance with the recommendations of WHO, having noise levels of no more than 35 dBA in rooms where persons are treated and observed, and no more than 30dBA in ward rooms, the needed height of the barrier that will be effective for receivers 2,3,4, 6,7 should be 24 meters which is not possible along Quezon Avenue.

University Avenue, University of the Philippines, Diliman Campus

The University of the Philippines has always maintained University Avenue and its immediate environs to be an expansive park which makes the travel into the campus most impressive, not to mention the center island lined with sunflowers that become the main attraction every summer. Buildings are set back far from the avenue which emphasizes the large open space. Therefore, the best mitigating measure for this case study is the addition of landscape features such as trees, shrubbery, and berms.

The mitigation test that yielded successful results *(Table 4)* is that which used architectural treatment on the buildings with a Noise Reduction Coefficient (NRC) between 0.28 and 0.45. This means that the material facing University Avenue should be at least 45% reflective to achieve ambient noise acceptable to educational standards. The addition of trees and other greenery could not lower the noise to those acceptable levels.

IV. Conclusion

University Avenue, University of the Philippines, Diliman Campus

High levels of traffic noise are registered at roadside along the whole stretch of University Avenue, averaging at 71.4dB, which is unacceptable for educational zones. However, since the buildings are at least 100 meters from the avenue, traffic noise is greatly diminished, the highest of which is 55.2dB for colleges and 56.8dB for offices. The tree cluster that buffers noise to the building has proven to be effective by reducing noise by at least 6dB. In fact, even an open field has reduced levels by as much as 13.8dB on one receiver.

After experimenting on different landscaping options in front of buildings facing University Avenue, using materials with NRCs between 0.00 and 0.45 on the façades of buildings should create a suitable interior environment for educational or business (office) purposes. Moreover, the northern and southern fields flanking University Avenue are already tree-lined which, as the results present, noise reduction as an effect of additional trees would be minimal, if not negligible.

Lung Center of the Philippines, Quezon Avenue

One out of the two hospitals within the 250m radius from the entrance of the Lung Center of the Philippines did not meet the World Health Organization's (WHO) recommended noise levels of no more than 35dBA in rooms where patients are treated or observed and no more than 30dBA in ward rooms.

Receivers on higher locations seemed to be experiencing higher noise levels as compared to receivers situated on the lower floors. The 20m tree belt reduced the traffic noise sound level by 7dB. Building rows having 3-4 storeys that are approximately 40-60m in width greatly decreases the traffic noise sound level by 20-30dB.

Due to structural limitations and reasons of practicality, a 24-meter high barrier is neither advisable nor realistic. The effect of the barrier in mitigating the high noise levels, however, is expected to change depending on its thickness, design and material. But since the said considerations were restricted to the predetermined input by the software, these were no longer explored.

E. Rodriguez Sr. Avenue

The traffic noise emitted by vehicles traversing the length of E. Rodriguez Sr. Avenue registers an average of 66.1dB —slightly high based on international standards of 65dB - 70dB for commercial zones. The residential zone, which begins from within one block of the avenue, registers sound levels between 56.1dB up to 62.5dB—quite high for residential zones which should have a maximum sound level, according to internationally-accepted standards, of 55dB during the day and 40dB at night.

However, the experiment on a row of medium-rise buildings, as a realistic mitigating measure, was able to drop noise pollution to daytime levels of 45dB.

At this present condition, and considering that private vehicles and public utility vehicles and its passengers will continue to increase over the years, the sound levels will only continue to rise exponentially, making the living conditions inside New Manila more unbearable, at least one block in.

IV. Recommendations and Software Review

The software does not let its user define exactly the length and width of buildings making it hard for irregularly shaped buildings to be modeled; it also does not identify the building's openings and fenestrations, nor the type and specification of trees or the tree belt around it. Thus, the results from the simulation are not exact.

Software programs performing acoustic simulations and measurements on building interiors, such as CATT-Acoustic used in churches, are starting to emerge. However, software programs that focus on a larger scale of development are almost non-existent. These types of simulations will open up doors in and out the academe on the exploration of more innovative approaches and solutions that will help solve, or at least curb, noise pollution.

References

Aguilar, K. (2012, September 28). *The residences of New Manila.* The Urban Roamer.

http://www.theurbanroamer.com/residences-of-new-manila/

Bliss, L. (2015, May 26). *Exposure to traffic noise may raise your risk of obesity.* City Lab. https://www.citylab.com/transportation/015/05/exposure-to-traffic-noise-may-raise-your-risk-of-obesity/394103/

Brandt, M. (2012, June 21). *Stanford Medicine Study shows link between traffic noise and heart attack.* Stanford Medicine. http://scopeblog.stanford.edu/2012/06/21/study-shows-link-between-traffic-noise-heart-attack/

Department of Public Works and Highways. (2013). *CY 2012 Summary Traffic Data.* http://120.28.38.50/infrastructure/infra_stat/2012%20Atlas%20for%20viiewing/2012%20Atlas/ncr1.html/

Dulay, B. (2013, June 28). *DOTC, DENR should curb noise pollution.* Manila Times. http://www.manilatimes.net/dotc-denr-should-curb-noise-pollution/13924/

Federal Highway Administration Resource Center. *FHWA Traffic Noise Model Version 2.5.* https://fhwa.dot.gov/resourcecenter/teams/environ

Jaleel, Z. T. (2014, May). *The effect of road traffic noise at hospitals in Baghdad City. Journal of Engineering and Development*, *18* (3). https://www.iasj.net/iasj/download/f0828af652c25959

Lung Center of the Philippines. (n.d.) *About Us*. http://lcp.gov.ph/

Nepomuceno, J. (2010, September 2). *When noise is too much.* Philippine Council for Health Research and Development. http://www.pchrd.dost.gov.ph/index.php/news/library-health-news/1819-when-noiseis-too-much

University of the Philippines Diliman. (n.d.) *Facts at a glance.* http://upd.edu.ph/about/facts-at-a-glance/

Figure 1. Receiver Layout along E. Rodriguez and Sr. Avenue
Source: TNM v2.5 Simulation Results

Figure 2. Receiver Layout along Quezon Avenue
Source: TNM v2.5 Simulation Results

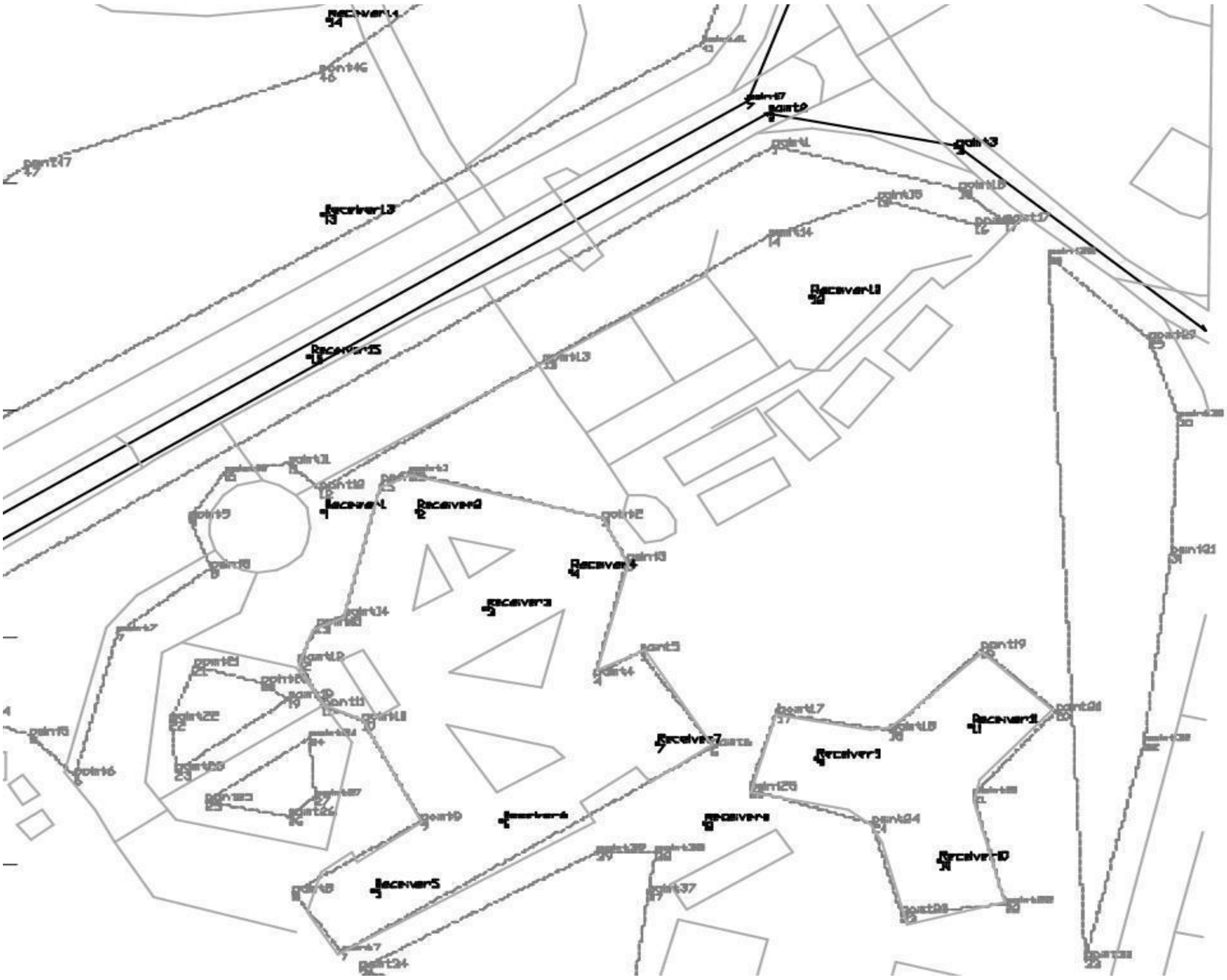
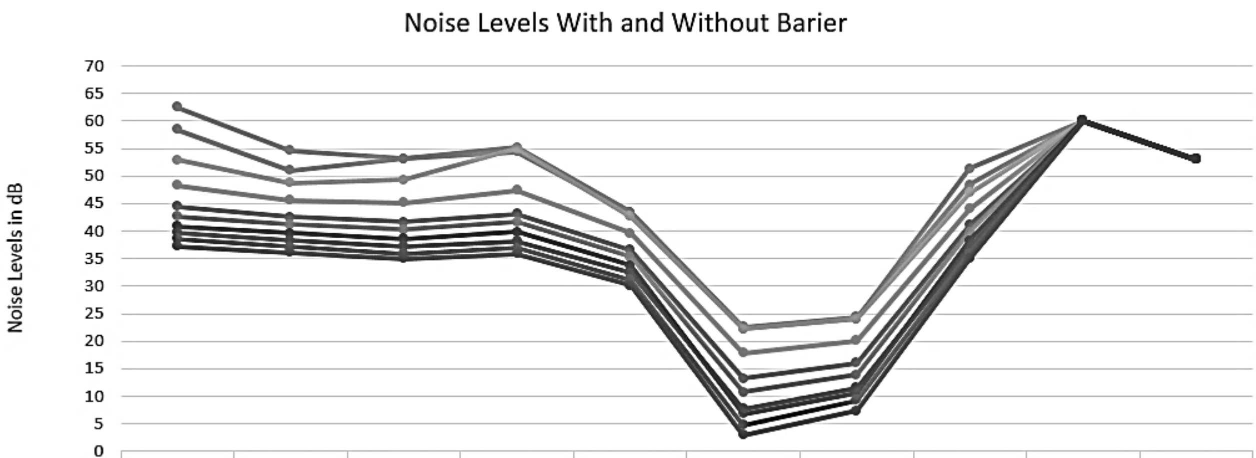


Figure 3. Receiver Layout along University Avenue
Source: TNM v2.5 Simulation Results

Figure 4. Effect of Barrier with Varying Height on Noise Level
Source: TNM v2.5 Simulation Results



	Receiver 1	Receiver 2	Receiver 3	Receiver 4	Receiver 5	Receiver 6	Receiver 7	Receiver 8	Receiver 9	Receiver 10
0.0 M	62.5	54.6	53.1	54.4	43.3	22.2	24.1	51.3	60	53
1.5 M	58.4	51	53.2	55.2	43.5	22.6	24.4	48.4	60	53
3.0 M	52.9	48.8	49.3	55	42.7	22.2	24.1	46.9	60	53
6.0 M	48.3	45.6	45.1	47.4	39.6	17.8	20.1	44	60	53
9.0 M	44.5	42.5	41.7	43.1	36.6	13.2	16	41.1	60	53
12.0 M	42.7	41.2	40.3	41.6	35.3	10.7	13.9	39.9	60	53
15.0 M	40.9	39.6	38.6	39.8	33.7	6.8	10.6	38.3	60	53
18.0 M	39.7	38.3	37.2	38.2	32.4	7.7	11.5	37	60	53
21.0 M	38.6	37.1	35.9	36.9	31.2	4.8	9.3	36	60	53
24.0 M	37.3	36.1	35	35.9	30.1	3	7.4	35	60	53

0.0 M 1.5 M 3.0 M 6.0 M 9.0 M 12.0 M 15.0 M 18.0 M 21.0 M 24.0 M