

**NOISE MAP PREPARATION  
FOR CENTRAL CAMPUS OF YILDIZ TECHNICAL UNIVERSITY  
AND SURROUNDING AREA**

**AVSAR, Y.**

Research Assistant in Yildiz Technical University  
Environmental Engineering Department  
80750 Besiktas Istanbul TURKEY

**GONULLU, M.T.**

Associated Professor in Yildiz Technical University  
Environmental Engineering Department  
80750 Besiktas Istanbul TURKEY

**ARSLANKAYA, E.**

Research Assistant in Yildiz Technical University  
Environmental Engineering Department  
80750 Besiktas Istanbul TURKEY

**EAR BEATING NOISE IN CLASSROOM**

Noise, which is called polluted, or undesirable sound is one of the threatening factors for our health. Attenuation of polluted sounds is really so difficult. The best choice to eliminate harmful sound is to realize noise control at source by using some sound decrease or sound diffusion prevention measures. [1]

Classroom is a kind of room having a suitable level of acoustical quality. In general, teachers want to say everything in his mind to students, without getting tired. Meanwhile students intend to understand everything what teacher says. Therefore, background noise level in a classroom should be obtained for high acoustical standards in terms of noise criteria values. There is considerable amount of studies on the affects of traffic noise on classroom ambient. [2]

In this study, a survey to investigate the affect of traffic noise on a university campus area is made, in order to develop a noise map for that area.

## **MATERIALS and METHODS**

Central campus of Yildiz Technical University, which is located on the Barbaros Boulevard in Besiktas district of Istanbul, has 15.000 students capacity. In the university, there are two education periods in a day, two shifts, day and evening classes. Total area of central campus square is near 30 acres. The Barbaros Boulevard is one of the most crowded main roads of Istanbul. There is also a connection highway to the First Bosphorus Bridge, which connects the European side to Asian side of Istanbul and is just beside of the central campus. As can be seen, the campus is located on crowded ways connecting commercial parts to residential parts of Istanbul.

In this study, to develop a meaningful noise map for the subject area, total 22 noise measurement points stating influences of various noise sources were dotted on the map. These measurement points dotted in Figure 1 were including both of the inner side and near surrounding area of the campus.

The measurement studies were carried out for a period of five-months'. The period was consisting from months of August, September, October, November and December in 1997. Measurements were made for two days a month during the study. 16 points in first days and 6 points in second days in the months were measured. At all points,

measurements in a day were made for five time intervals as: 06.00-08.00 a.m., 10.00-12.00 a.m., 14.00-16.00 p.m., 18.00-20.00 p.m. and 24.00-02.00 a.m. By this way, it was tried to get idea about noise level fluctuations during whole day.

During the study, a Turkish Standard dealing with acoustic measurement techniques, which was published by Turkish Standards Institute Numbered TS 9315 and entitled “Determination and Measurement of Acoustic Environmental Noise” were used to determine noise levels in the campus area.

For all these out-door acoustic measurements, taking into consideration almost similar local meteorological conditions such as wind velocity, wind direction, temperature and humidity has been a governing factor to get meaningful measurement data. All the measurements were performed while there was not any precipitation like rain or snow. Daily meteorological parameters were obtained from Istanbul Division of State Meteorological Works Department by telephone.

According to the measurement standard, a measurement point must be far away at least 1 meter from reflective surface to prevent interference of sound waves. Therefore, while we were measuring the noise level on a point being close to a reflective building or materials, a distance at least 1 meter from those was kept.

On the other hand, out of the campus, at Barbaros Boulevard and other surrounding roads, because noise was mainly originated from vehicle traffic, another related Turkish Standard numbered TS 10713 entitled “ Traffic Noise and The Measures for It’s Prevention “ and TS 9315 “Acoustics-Description and Measurement of Environmental Noise Part 1-Basic Quantities and Procedures “were used. According to the standard, noise measurement points should be 3.5m far from road, and height of the microphone of the equipment should be 1.20 to 1.50m. [3], [4]

During all the work, Measuring time for each point was min 5 minutes. Noise level determinations were realized by using HD 9019 Sound Level Meter.

Noise map developing process for subject area was made by Spyglass 3.0 software, a Mac Operating System version.

## **NOISE MEASUREMENT RESULTS AND EVALUATION**

Noise level values measured through 5 months at the 22 points are given in Table 2. Table also includes averages of the five months' Leq values in dBA. Since the physical character of each noise measurement point is not same, measured noise levels obtained for each point are different from other points. This variety is obviously related in being closer to the Barbaros Boulevard for each point. First 5 points having the highest noise levels in Table 2 are near or quite close to the Boulevard. On the contrary, last 6 points in Table 2 are inside of the campus and the quietest part of the campus. At these points, there is not any educational activity, and there are only trees and plants to rest after lessons, as obtained the lowest values. At point 12 that is just inside of the campus near to the boulevard, noise values are quite high as remarkable. Figure 2 indicates max, mean and min values for each measurement point, and describes above explanations much more clearly.

Data in Table 2, in order to develop noise map of the central campus, were used. Noise map developed is as presented in Figure 3. Traffic originated noise propagation in the university campus area can be seen clearly from the noise map. The highest noise contour is on the boulevard upto 78 dBA, just near to side of the university. The noise from the boulevard effects buildings of classrooms, kindergarten, library and engineering faculty negatively.

Table 3 also gives additional measured data that shows noise variations through 24hrs of the area. These data explain the affect of traffic jam on subject points measured. Especially early day times are much more silent. After beginning working hours, noise values are getting increased. The highest values were measured between 6 and 8 p.m. It is too clear, but it seems that evening traffic makes more noise than morning traffic. This is due to positioning of

Bosphorus Bridge to the University. In the morning, there is a hardened traffic at Asian side of the bridge. Besides that evening times traffic is in front of the University that is prior to the bridge. Another cause of higher evening noise level is surely from changing between 4-6% slope of the Boulevard, increasing to the University from Besiktas.

## **RECOMMENDATIONS**

Obtained quite higher noise measurement results are not acceptable for a university and other type educational areas.

According to the Turkish Noise Control Regulation, acceptable of outdoor noise levels at this type of areas, for daytime and evening time are 65 and 60 dBA respectively. By comparison with these outdoor standards, noise levels that traffic originated in majority, at the central campus of the University are not acceptable. [5]

To make safe from the high noises reaching to the campus area, some recommendations that should be applied all or most of them depending on requirement have been given as below:

- Border walls of the central campus should be risen.
- Trees between Barbaros Boulevard and the central campus should be planted.
- Dimensions of the windows at the boulevard side of the university can be made smaller.
- Double windowpanes for these windows can be used. In the central campus of the university, there is an open-air car park so this parking activity causes also a noise problem. To attenuate this noise cause, underground level-flatted parking lots being inside of the campus should be constructed. [6]

## REFERENCES

1. Young R.A.&Cheremisinoff N.P. 1975 Pollution Engineering Practice Handbook Volume 3, Ann Arbor Science Publisher
2. J.W Sargent, et al 1980 Journal of Sound and Vibration **70**(4), 557-572. “The disturbance caused to school teachers by noise” Norton M.P. 1989 Fundamentals of Noise and Vibration Analysis for Engineering Practice Handbook, Cambridge University Press
3. Turkish Standards Institute 1993 “Traffic Noise and The Measures for It’s Prevention“, Standard #10713
4. Turkish Standards Institute 1991 “Acoustics-Description and Measurement of Environmental Noise Part 1-Basic Quantities and Procedures“, Standard # 9315
5. Noise Control Regulation of Turkish Republic 1986

6. Avsar, Y. 1998 M Sc Thesis Yildiz Technical University. "Noise Map Preparation For Central Campus of Yildiz Technical University and Surrounding Area"(in Turkish)

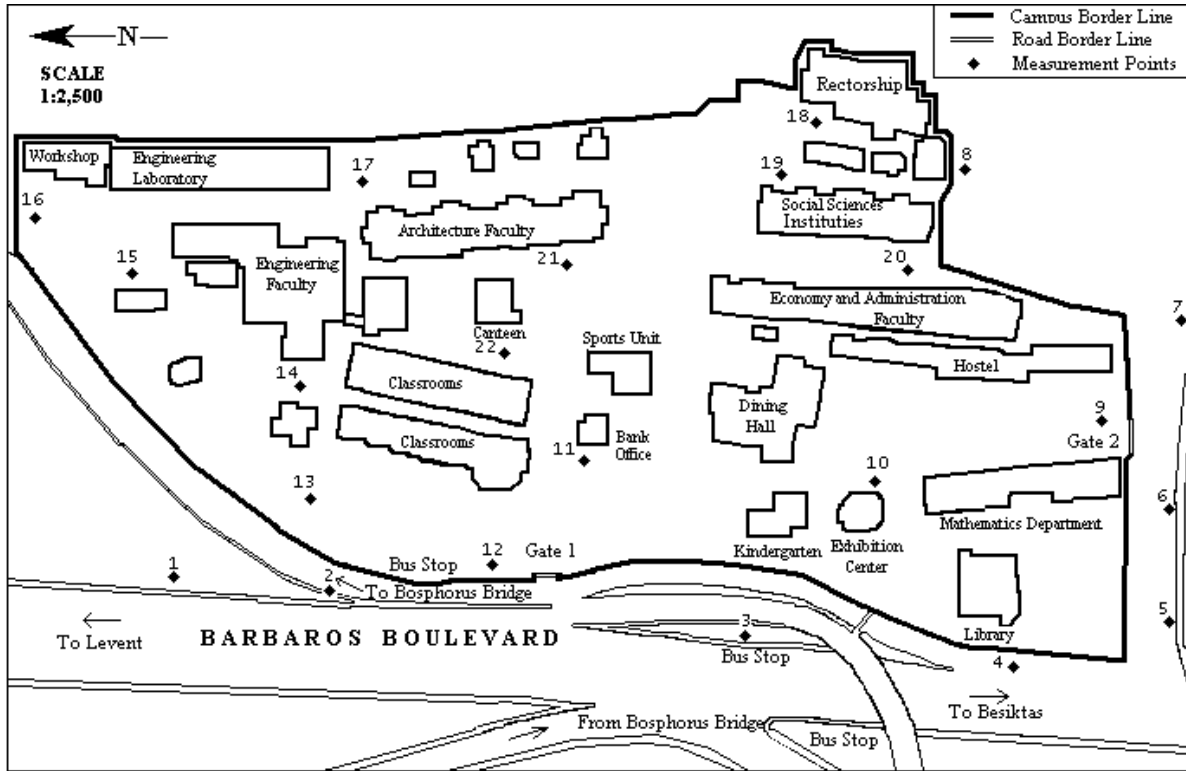


Figure 1. Map of Yıldız Technical University Campus and Noise Measurement Points

Table 2 Measurement results for five months as  $L_{eq}$  in dBA.

Point #	Average values of Leq for months (dBA)					Average of 5 months (dBA)
	August	September	October	November	December	
1	78.6	70.5	73.9	75.4	73.6	73.3
2	76.7	73.9	75.2	76.2	74.4	75.2
3	<b>80.3</b>	74.1	77.4	77.8	75.7	77.0
4	74.8	69.4	70.2	72.3	72.6	71.8
5	76.0	71.1	73.7	71.8	73.1	73.1
6	73.4	61.2	62.9	65.9	69.4	66.5
7	71.7	55.6	57.1	61.2	67.0	62.5
8	72.5	59.5	58.5	61.3	67.7	63.8
9	74.5	59.2	62.7	67.2	69.9	66.6
10	73.0	55.8	60.9	65.8	69.6	65.0
11	73.7	64.2	66.5	66.9	69.3	68.1
12	76.6	68.3	71.5	70.3	71.7	71.6
13	75.1	61.3	64.0	64.4	71.6	67.2
14	70.7	53.6	56.5	59.8	66.7	61.4
15	72.6	58.7	56.5	58.6	67.3	62.7
16	73.0	55.9	58.1	60.2	66.5	62.7
17	60.3	<b>45.6</b>	50.0	48.5	49.7	50.8
18	61.9	46.6	49.5	53.9	52.5	52.7
19	60.6	51.1	50.9	53.5	53.6	54.0
20	59.2	49.6	47.2	49.9	50.5	51.2
21	58.9	49.7	46.5	50.6	53.1	51.7
22	59.7	49.8	48.2	50.9	51.4	52.0

Table 3. Averages for 5 months of day's 5 different time slices

Measurement Point #	Measurement time intervals				
	06.00-08.00 a.m.	10.00-12.00 a.m.	02.00-04.00 p.m.	06.00-08.00 p.m.	00.00-02.00 a.m.
1	74.2	75.4	75.4	73.3	73.2
2	68.0	75.2	76.6	78.0	75.4
3	67.2	78.0	77.9	<b>79.4</b>	73.7
4	65.0	73.1	74.0	72.9	71.3
5	69.6	74.6	75.3	74.1	70.8
6	66.0	66.4	70.4	68.4	62.4
7	66.8	62.5	62.7	65.5	62.3
8	66.3	64.0	66.0	68.9	60.9
9	63.3	68.8	69.3	68.8	61.8
10	62.9	66.0	65.6	67.3	62.0
11	65.1	69.8	70.1	69.6	66.1
12	70.4	72.5	72.4	74.4	66.9
13	66.8	66.6	67.2	71.4	64.1
14	65.8	61.8	61.8	64.7	60.7
15	61.3	63.5	58.9	66.1	61.1
16	62.5	62.2	62.8	65.2	60.6
17	<b>48.9</b>	53.0	52.4	51.1	51.0
18	51.0	54.5	54.7	52.3	52.7
19	50.3	52.0	56.4	55.8	52.1
20	49.6	50.1	53.4	52.7	50.4
21	<b>48.9</b>	51.3	54.9	51.8	51.2
22	49.0	52.3	53.6	52.3	51.6

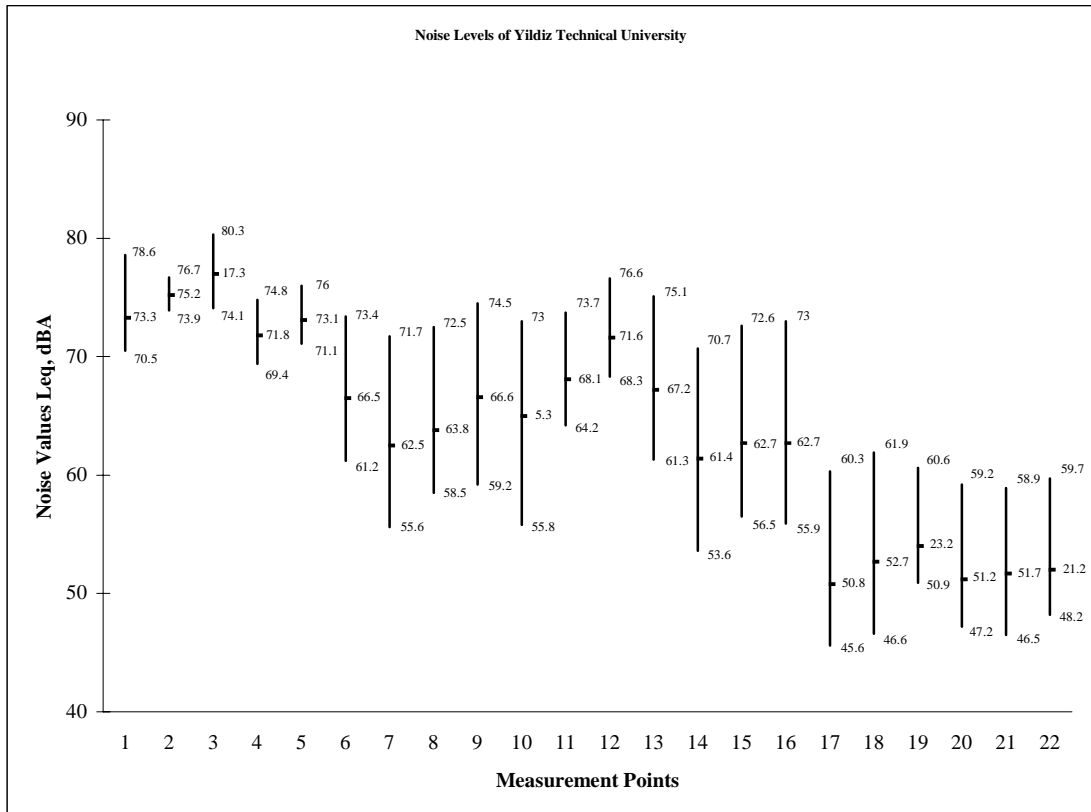


Figure 2. Max, min and average noise values of five months for each point.

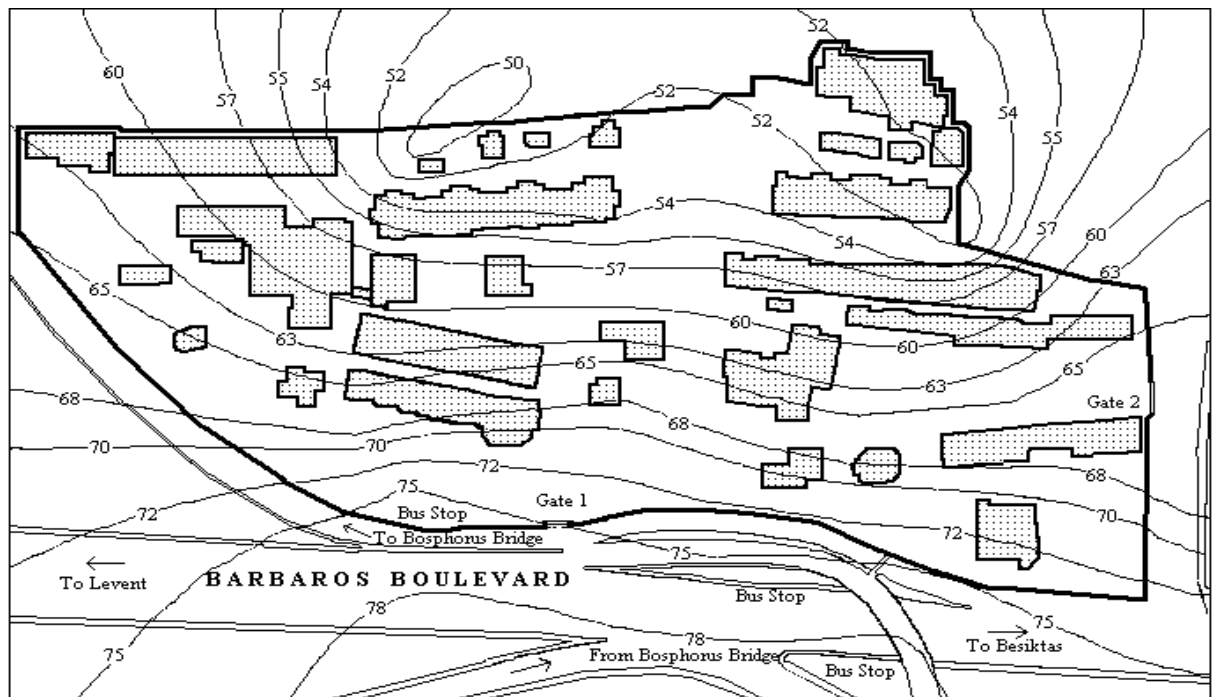


Figure 3. Noise contour map of the University.