SPECTRUM VARIATIONS DUE TO ARCHITECTURAL TREATMENT AND ITS RELATION TO NOISE CONTROL

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ABSTRACT

Exterior fcades have a great influence on the noise transfer inside buildings. The aim of this paper is to highlight the influence of a certain kind of facade treatment, usually used as sun protection devices, which is the vertical louvers.

INTRODUCTION

A previous paper [1] reviewed different viewpoints of researchers [2, 3, 4, 5, 6,7, 8], and the results concerning the effect of facades in noise control problems. The correlation between different architectural treatments in the buildings' facades and the road traffic noise level was also presented [1]. That study was conducted on El Horreya Avenue, the main artery in the city of Alexandria, which runs through nearly 80% of this linear city. The facades chosen were simple, solid and void; a french window overlooking a balcony, then a loggia, windows with vertical louvers, glass cladding, glazed aluminum framed facade and then a window unparallel to the main road and others. In this paper the spectral analysis of the noise inside and outside the building is presented.

SITE DESCRIPTION AND MEASUREMENTS

Three sites out of the previous sites were chosen. They occupied the second floor of three different buildings Figure (1). Site (1) is a window provided with a rolling shutter, existing in a facade making 30 degrees with the road. The facade has facing bricks in the solid part, while the sill beneath the void has a plaster finish. Site (2) has three windows with rolling shutters, separated by vertical concrete louvres. Each window consists of two parts, the lower being fixed. Site (3) is a typical, solid of void, facade with a wooden framed window. The measurements were carried out simultaneously on two points in each site using in each point a precise SLM and a tape recorder. The first point lies outside the window on the sill, fixing a height of 0.90 m, while the second point lies inside the room maintaining the same height and at a perpendicular distance of 1.40 m from the windows. The two points lie on the center line of the window.

RESULTS AND DISCUSSION

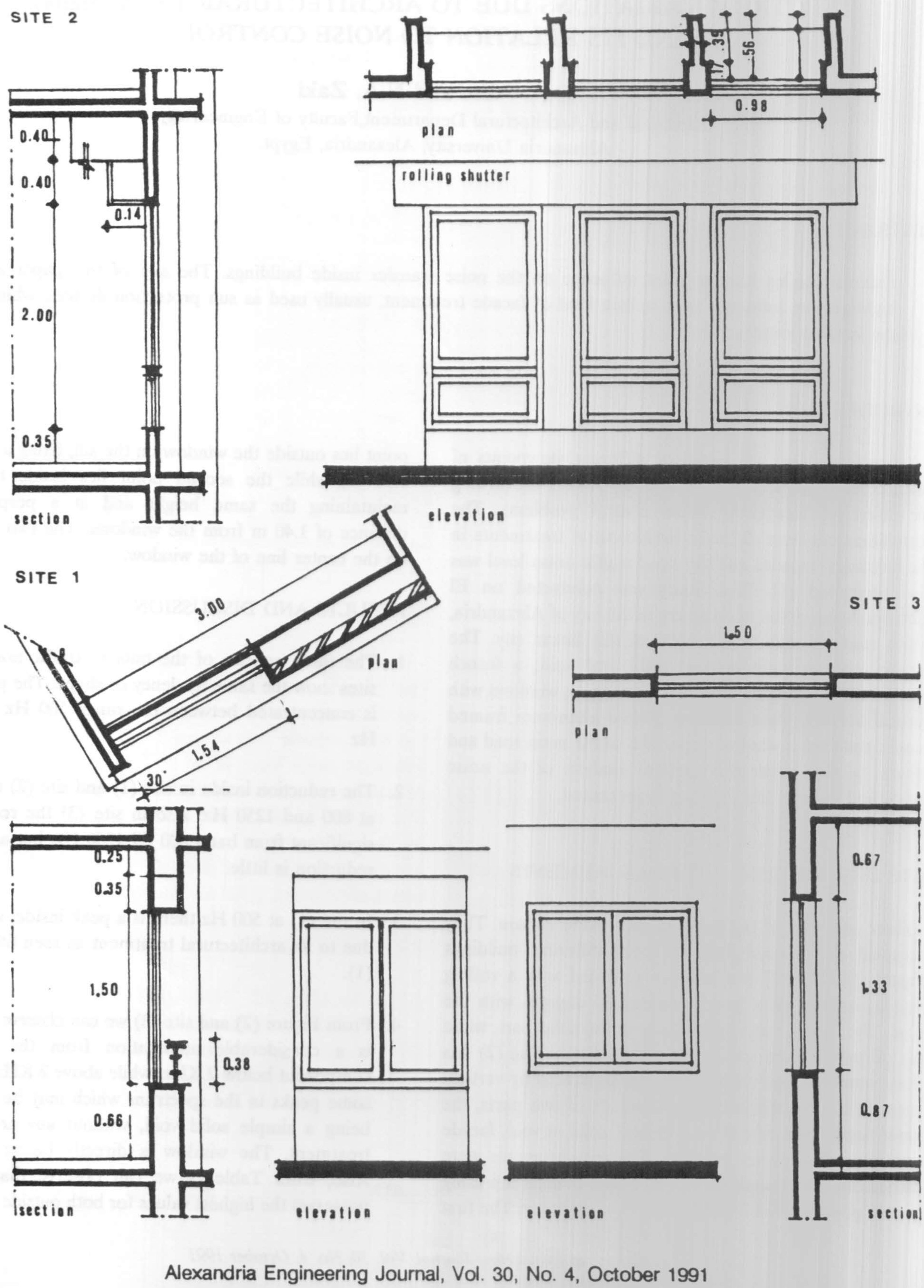
1. The three spectra of the outside traffic noise in the sites show the same tendency or shape. The peak value is concentrated between the range 500 Hz and 1600 Hz.

2. The reduction inside in site (1) and site (2) is greatest at 800 and 1250 Hz; also in site (3) the reduction is significant from band 800 till 1250 Hz, but at 2500 the reduction is little.

3. In site (1) at 500 Hz there is a peak inside; it could be due to its architectural treatment as seen from Figure (1).

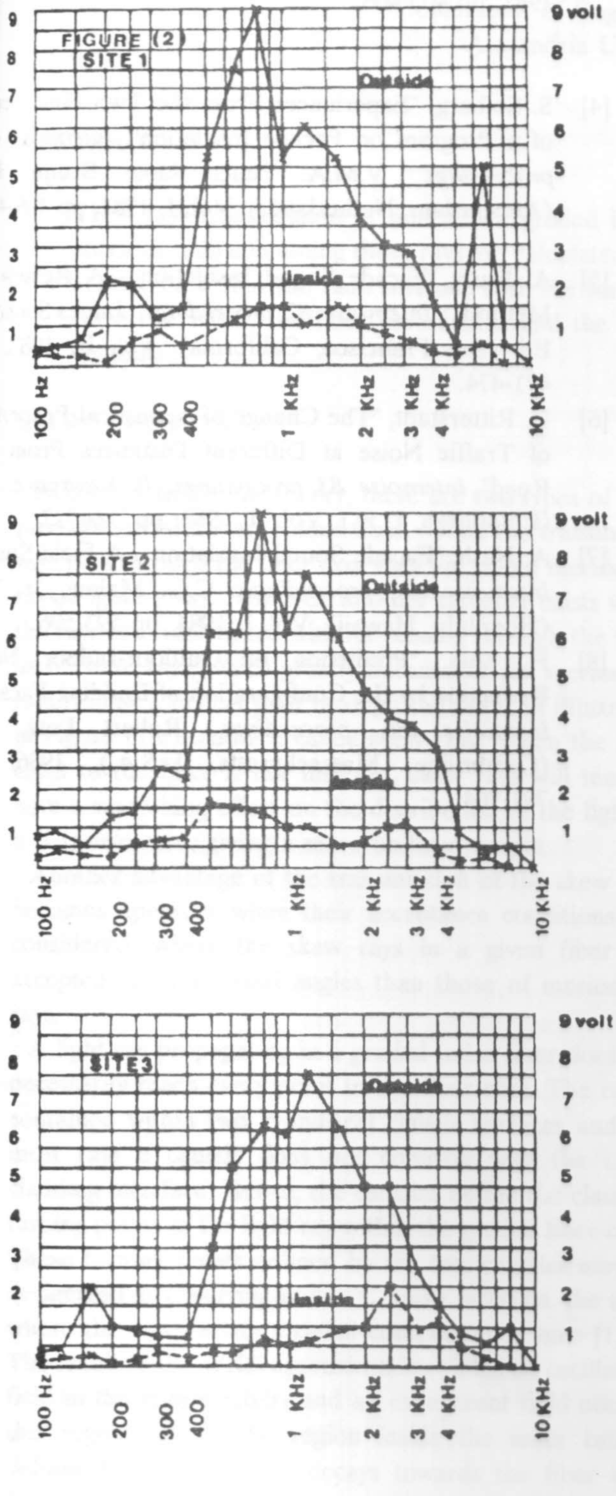
4. From Figure (2) and site (3) we can observe that there is a considerable attenuation from the frequency component below 2 KHz, while above 2 KHz there are some peaks in the spectrum which may be due to its being a simple solid void, without any architectural treatment. The window is directly facing the road. Also, from Table(1) we can observe that this site possesses the highest values for both outside and inside

FIG (1)



SITE 2
0.40
0.40
0.14
2.00
0.35
section
.39
.56
0.98
plan
rolling shutter
elevation
SITE 1
3.00
plan
1.54
30°
0.25
0.35
1.50
0.38
0.66
section
elevation
SITE 3
1.50
plan
0.67
1.33
0.87
elevation
section

measurements, 84 dbA, 61.3 dbA, respectively, for the same reason mentioned above .



. From Table (1), site (1) is showing the highest Δ Leq. This is due to the window being not parallel to the road and which causes an inclined incidence of the acoustic wave and results in a minimum transmission from outside to inside. The results obtained are still in good agreement with those in [1].

6. In site (2) the path difference between the directly incident wave and the other waves reflected from the vertical louvres at A and B are comparable to the value of $\lambda/2$ in the band from 800-1000 Hz ($\lambda = c/f$; where λ = wave length; c = velocity of sound and f = frequency; i.e. $\lambda = 340/800$ or $340/1000$), i.e. $\lambda/2$ = 17 & 21 cm, respectively). This may help in explaining the great value of attenuation for these frequencies as shown in Figure (2), site (2).

Table (1)

Site	Noise levels in dBA (inside)				Noise levels in dBA (outside)				
	L_5	L_{50}	L_{95}	L_{eq}	L_5	L_{50}	L_{95}	L_{eq}	ΔL_{eq}
1	64.0	56.0	48.0	58.6	91	79	71.5	82.5	23.9
2	66.0	58.0	51.0	60.2	86	78	72.5	79.8	19.6
3	67.5	58.5	51.5	61.3	95	80	72.5	84.0	22.7

CONCLUSION

1. The architect should be supplied with accurate measurement of the traffic noise in the road, especially main arteries, before designing his building.
2. Architects, when possible, could orient their windows so as not to be parallel to the road, as this causes a loss in the transmitted noise from outside to inside.
3. The simple, solid and void reduces the effectively transmitted acoustic wave inside the building.
4. The different dimensions of the vertical louvres chosen for a certain window should not only depend on solar angles to give the best solar protection, but it could be designed as an element which could give a sufficient attenuation to traffic noise in interiors. This could be achieved if the difference between the length AX and XY Figure (3), is in the range from 17 to 21 cm.
5. The variation in the value of the transmission loss at different frequencies from outside to inside may help

in explaining the reaction of the inhabitants due to the road traffic noise. This may be thoroughly explained by correlating subjective measurement with objective results.

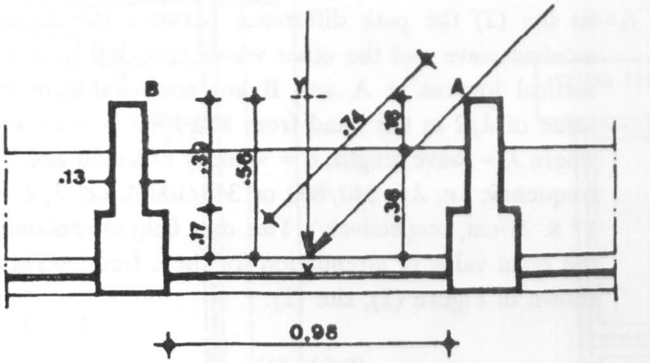


Figure 3.

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