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A SPATIAL NOISE DISTRIBUTION MAP

Y. Nii

KUMM, 6-7-26-203, 658-0001, Kobe, Japan

Tel.: +81-78-441-2165 / Fax: +81-78-441-2165 / Email: khc05723@nifty.ne.jp

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ABSTRACT
This paper summarizes a comprehensive method of road traffic noise estimation and its three dimensional visualization in urban area. The idea of obtaining a spatial noise distribution map in city planning from existing road traffic census data and its application in locating public facilities. The technique combined here are cross sectional noise estimation based on traffic data set, spatial noise configuration, analytic tools, and computer graphic tools including three dimensional rendering tools all combined in a city map as a central metaphor. This technology makes city planners successfully take spatial noise distribution into account during the procedure of locating facilities especially public buildings and multistory apartments in downtown areas.

1 - WHY A SPATIAL MAP?

Traditionally, road noise effect on residential and office areas is evaluated on surface basis. Only ground level noise is evaluated and vertical noise distribution would not be considered in evaluation procedure. But this is not efficient enough for locating multistory buildings. Without any information on vertical noise distribution, it is difficult to determine where to locate and how to design inside of the building. (ground floor for shops and offices ... and upper floors for residents ... thought to be correct traditionally, but .... is that true?). So, not only evaluate noise distribution on the ground level but also in vertical will be very important for city planning. Thus, it must be spatial ... three dimensional analysis.

2 - FLOW OF ANALYSIS

The procedure of three dimensional noise evaluation is as follows.

Data sets

- geographical information within the area,
- road traffic data (number of traffic, car/truck ratio etc.)

Calculation

- According to the location of each roads within the area and its traffic data, emitted energy of noise is calculated for each observation cells in the three dimensional area.
- (number of cells for the example case here is up to 125000(50*50*50)
- Summation of energy in each cell (observation points) gives L_{Aeq}. (ASJ model 98)

Visualization

- Based on the three dimensional matrix data set, contours of equivalent sound pressure level are given for area wide evaluation. Cross sectional figures are also given for precise evaluation at the building location.

3 - EXAMPLES

Following example is a case study carried out in downtown. Fig-1 shows the geographical data of the study area. Two trunk roads within the area has different traffic characters as shown in table-1 (some rounded data).

Road A	Number (/hour)	Avg. Speed (km/h)
Car (day)	1200	40
truck (day)	100	40
Car (night)	200	70
Truck (night)	10	60
Road B	Number	Avg. Speed
Car (day)	1500	30
truck (day)	200	30
Car (night)	100	70
Truck (night)	200	50

Table 1: Traffic data.

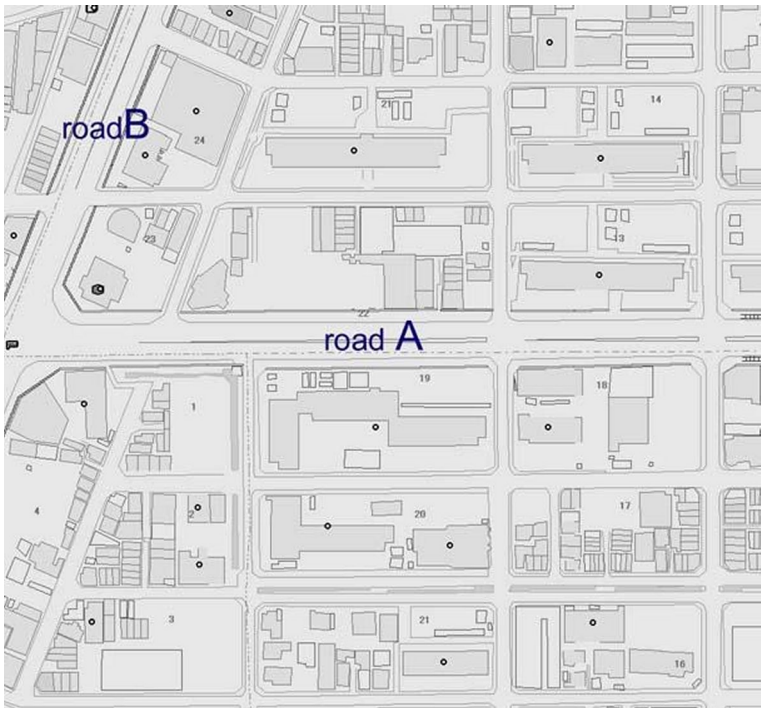

Figure 1: Map of the study area.

According to the traffic data observed, three dimensional L_{Aeq} data set is calculated for daytime and nighttime. Fig-2 shows the equivalent sound pressure level surface in the study area based on daytime traffic figures. These two surfaces are nearly the same shape but 65dB contour is above the 60dB contour. And both are "V" shaped in the single road section but have pretty complicated shape in crossing roads area. This clearly shows that:

- the noise level tends to raise in upper floors.
- noise distribution above road crossing area is complicated and need to be evaluated precisely.

Fig-3 shows the contours of 60dB equivalent sound pressure level surfaces in the area. Orange colored is the contour of daytime noise propagation and blue colored is for the nighttime. Again, noise distribution above road crossing area is complicated and need to be evaluated precisely. For this purpose, the graphics is easily rotated in any direction as shown in Fig-4.
These graphics show the significant difference between day/night and also the difference of traffic characteristics between two roads in the area. Planners will be aware of characteristics of environmental

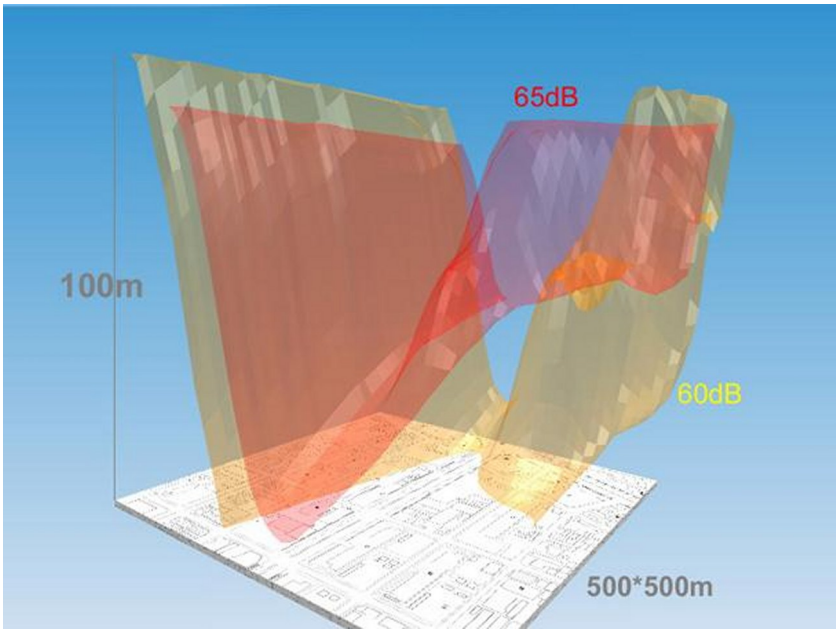

Figure 2: Equivalent sound pressure level surface.

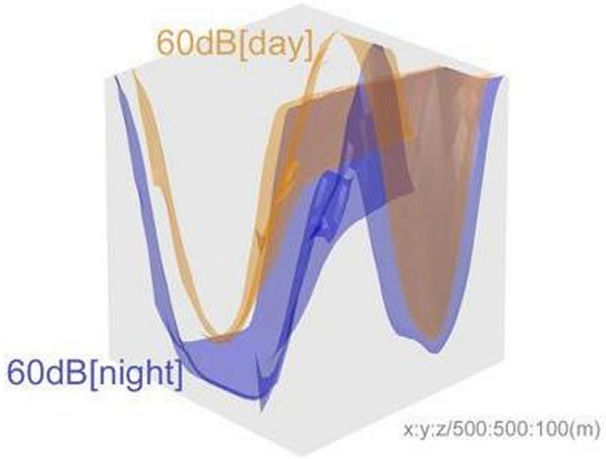

Figure 3: 60dB contours in day/night.

noise within the area, and can easily find the building location. Also readily select the floors for suitable purposes.

4 - FURTHER RESEARCH ISSUES

This research may help evaluation procedure with more precautional planning styles using the new computing environment. It is expected that the assessment process could be more precise using these tools. The noise estimation procedure should hereafter take effects of existing buildings into account for more accuracy.

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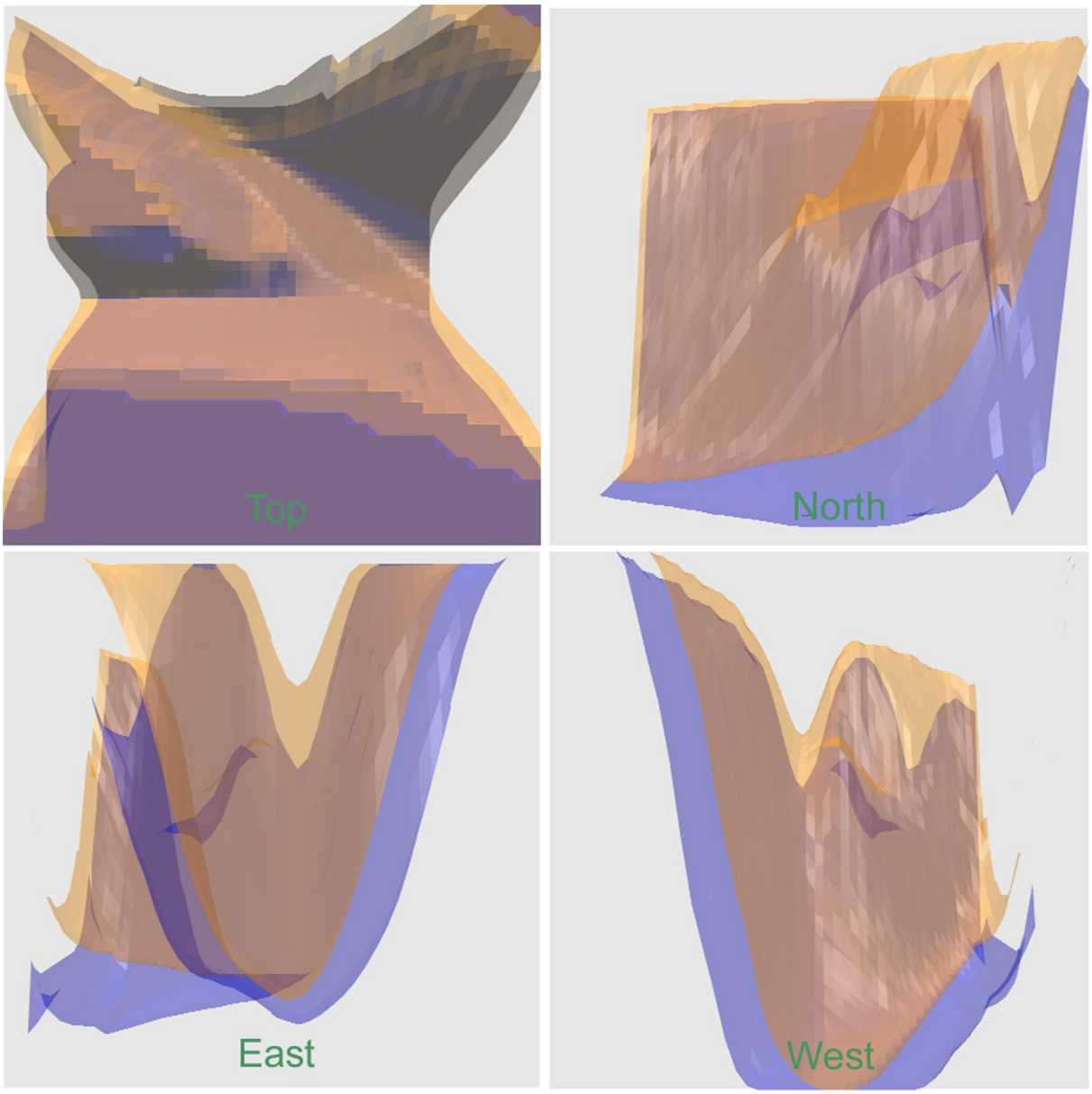

Figure 4: Rotated graphics.

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