

Evaluation of noise characteristics of elevators in apartment houses

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ABSTRACT

The noise of elevator in apartments inhibits the comfortable and quite sounds of residents. Many residents who are suffered from discomfort can't sleep or use the noisy room as a warehouse or even consider moving out. In this study, we tried to closely grasp the characteristics of the elevator noise transmitted to inside of the apartment house. In fact, we conducted field measurements in total 8 households of elevator noise complaints subject 2 households and apartment house reconstruction site 6 households. All 8 households are adjacent to the elevator hoist way. The adjacent room consists of a bedroom and a living room. As a result of measurement, it showed a low value of less than 35dB(A) equivalent noise level between operating section. For the maximum value, it showed 40dB(A) level. The results of the frequency analysis between 0.1 seconds representing the maximum value showed that the influence is high in the 31.5 Hz, 50 Hz, and 250 Hz bands. It showed that there is no influence in the above 500Hz band.

Keywords: Noise, Elevator, Apartment House

I-INCE Classification of Subject Number: 41

1. INTRODUCTION

Apartment houses are now Korea's representative residential style. The trend is becoming more and more high-rise. In such apartment houses, elevators are essential equipment. In the structure of the apartment house where the wall, the floor and the

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elevator core are structurally connected, the noise generated when the elevator is operated is transmitted to inside the room and is subject to complaints from residents. Currently, however, there is no standard for elevator noise in Korea. Recently, studies are being conducted to prepare standards for elevator noise. Many prior studies have been done, but they have all focused on reduction methods or standards. In this study, we tried to grasp the characteristics of elevator noise by measuring the elevator noise in total 8 households of 2 households which were suffering from the elevator noise, and 6 households which were adjacent to elevator. The results of this study can be used as the most basic data to derive not only elevator noise standard but also measurement method, evaluation method and further effective reduction method.

2. STUDY METHOD AND SUBJECT





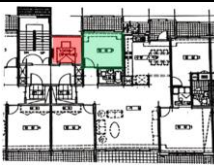


2.1 study method

We measured the elevator noise in total 8 households of 2 households which were suffering from the elevator noise, and 6 households which were adjacent to elevator hoistway and households. First, we measured the whole process from the start of the elevator operation till the moment when the door is opened and closed. Second, we performed the frequency analysis for 0.1 second which indicates the highest level of the whole process measurement. Based on the results, we tried to grasp the sound pressure level and characteristics of elevator noise.

2.2 Subject households outline

2 households which were suffering from the elevator noise, are the apartment houses located in Gwangju Metropolitan City and Mokpo City. Both apartment houses are existing apartments that have been for more than 10 years after completion. It is a structure that 2 households share 1 elevator. W apartment of Gwangju Metropolitan City is adjacent to the living room. I apartment of Mokpo City is adjacent to the bedroom.

Table 1 – Measurement Information

Info.	Mokpo I APT.	Gwangju W APT.	Seoul W APT.1	Seoul W APT.2
Field				
Plan		-		
Floor	7F	8F	1F, 8F, 14F	1F, 8F, 15F
Area	Bed Room	Living Room	Bed Room	Living Room
Move	1F → 7F(40sec)	1F → 8F(40sec)	14F → 1F(55sec) 1F → 8F(35sec) 1F → 14F(55sec)	15F → 1F(55sec) 1F → 8F(35sec) 1F → 15F(55sec)

They are W apartment located in Seoul city. They are not the subjects for noise complaints. They are all 6 households, which are 3 households adjacent to the living room in the ground, middle, and top floors, and 3 households adjacent to the bedroom in the ground, middle, and top floors. It was not confirmed whether the complaint was filed for the reconstruction apartment. We confirmed the level that could fully perceive the noise during the pre-survey.

3. RESULT AND ALAYSIS

3.1 Results of operation whole section measurement

As a result of the measurements of 8 households, the equivalent noise level of the whole section was not exceeded 35dBA. The maximum level value between the measurement section was 40dBA. In the same elevator hoistway, top floor was 5 ~ 7dBA higher than the ground floor. This is considered to be due to the influence of the solid sound transmitted from the machine room.

Table 2 – Measurement Result (unit:dBA)

	Mokpo I APT.	Gwangju W APT.	Seoul W APT.1			Seoul W APT.2		
			1F	8F	14F	1F	8F	15F
L_{eq}	35	37	28	32	35	30	28	35
L_{max}	45	40	41	40	44	40	41	43

3.2 Analysis of frequency characteristics at maximum level

We conducted the frequency analysis for sound pressure level of 0.1 second, which represents the highest level of the whole section measurement. The common feature of all 8 households is that there was no influence on elevator noise in 500Hz or higher frequency band. It showed that 31.5Hz, 63Hz, and 250Hz were the major factors depending on the type of elevator noise. This frequency characteristics of the elevator noise can be applied as a major factor to suggest the measurement method and an evaluation method of the elevator noise in the future. It is considered to be also applied to prepare effective reduction measures.

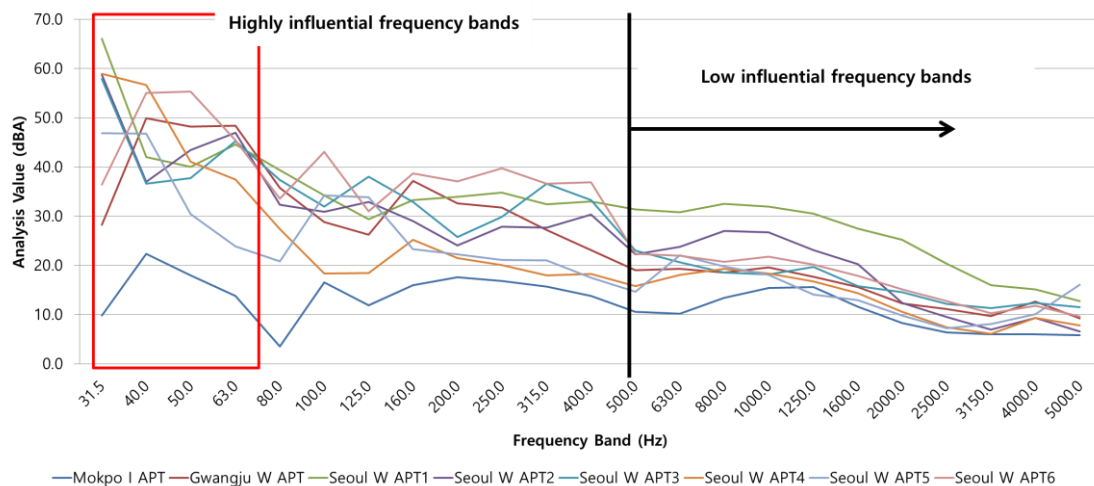


Fig 1 – Influence by frequency band through frequency analysis

4. CONCLUSIONS

Standards, evaluation methods, and measurement methods for elevator noise are not clear. In this study, we identified the sound pressure level through the elevator noise measurement in various situations of 8 households and the influence by frequency band through frequency analysis. It was confirmed that the elevator noise was low level of 40dBA at the maximum value and the low frequency band of 500Hz or less was the main noise characteristic. In future study, more objective measurement and evaluation method of elevator noise will be proposed through many additional measurements, and it will be possible to prepare a more reasonable elevator noise standard.

5. ACKNOWLEDGEMENTS

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