An Experimental Study to Improve Measurement Reliability
for the Airborne Sound Insulation Performance by Laboratory Test

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Key Words : Airborne Sound Insulation(), Sound Reduction Index(), Measurement Reliability(), Flanking Transmission()

ABSTRACT

Sound pressure levels in the receiving room while testing airborne sound insulation performance are varied by the measuring points. This may increase the measurement error, then decrease the measurement reliability. With this reason the research has carried out on the method to reduce deviations of sound pressure level in the ISO type rectangular laboratory focusing on the measurement of airborne sound insulation performance. Tests were made to see the effect of sound absorption in the receiving room, loudspeaker locations, microphones locations and flanking transmission path. Consequently, it was resulted that sound absorption in the receiving room and the loudspeaker location have influence on the sound level deviations especially in the low frequency. The microphone location was very important to get measurement reliability. The effective measuring point, which the sound level difference with average sound pressure level is within 2 dB, could yield most reliable average sound pressure level. Therefore it is necessary to find the effective measuring points in the receiving room. Flanking transmission path should be sealed using sound absorber or magnet etc. to prevent from lowering the sound insulation performance.

1. 가 ,
(24910
14
).
가 가

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(1) ,
가 ,
(2)
(standing wave)가 ISO 10140-2:2010⁽⁴⁾ KS F 2808:2011⁽⁵⁾ , 가 ISO 717-1:2013⁽⁶⁾
Fig. 1
(3)
가 , 57.0 m³, 51.3 m³ ,
ISO 140-1 가
10 %
Table 1

2.2
(1)
2.1
(7) ISO
200 mm 140-1 (T)
(R_w, STC) 59 dB (V)
(1)
(flanking sound)
 $1 s \leq T \leq 2 (V/50)^{2/3} s$ (1)

Table 1 Specification of test room

Test room	L(m)	W(m)	H(m)	Volume (m ³)	Surface area(m ²)
Source room	5.0	3.8	3.0	57.0	90.5
Receiving room	4.5	3.8	3.0	51.3	84.1

가 ,
가
가
3.
3.1
가 3 (2 , 1)
ISO 140-1
Fig. 3
10
가 , ISO 140-1
1 ~2
가

Fig. 2

(3)

(flanking sound)

(Fig. 4).

Fig. 3 Reverberation time according to install acoustic absorbent

Fig. 2 Locations of microphones and speakers

(Fig. 5) 100
 Hz 가 5.3 dB 3.7
 dB 1.6 dB ,
 (sound reduction index, SRI) 1.2 dB
 (Fig. 6).

가 ,
 (reverberation) ,

Fig. 4 Change of sound pressure level in receiving room by sound absorber installation

(a) Without sound absorber (b) With sound absorber

Fig. 5 Distribution of sound pressure level in receiving room with and without sound absorber

가

가

가

가

가

. Fig.

100~315

7

Hz

가

가

R_w

STC

2 dB

가

Fig. 6 Standard deviation of sound pressure level in receiving room before and after sound absorber installation

Fig. 7 Sound reduction index according to install acoustic absorbent

Fig. 9

3 ()
가
가

3.2

가 가

100~250 Hz

가

1 , 2

Fig. 10

가 , 가 (R_w , STC)

3
(Fig. 8).
가

Fig. 8 Average sound pressure level in source room(Src. Rm : Source Room, Spk : loud Speaker)

Fig. 9 Standard deviation of sound pressure level in source room(STDEV : STandard DEVIation)

가
200 Hz 가 3
() 4 dB
가
(

Fig. 10 Average sound reduction index by each speaker position

3.3

가

가

(E-Avg)

Fig. 11

Fig. 12

100~315 Hz

5~15 dB

가

Fig. 13

Max. Min.

가

가

, 100 Hz

14 dB

가

R_w 56~60 dB, STC 53~60 dB

4 dB

(Fig. 14).

, ISO 140-3

KS F 2808

0.7 m

5

가

가

Fig. 11 Sound pressure level in source room (speaker position #1)

Fig. 15

Fig. 12 Sound pressure level in receiving room (speaker position #1)

Fig. 13 Sound reduction index (speaker position #1)

Fig. 14 Distribution chart of R_w & STC

가 , 5 , 6
가 . 5 (Table 2).
가
(90
) 2 dB
1
, 17 , 15 ,
2 , 18 , 12 ,
3 , 15
, 8 20
, 1 >
2 > 3 가 .
1 , 2 , 3
, 2 ,
1 , 2 ()
가 ,

Fig. 16

Fig. 17

Table 2 Effective measurement positions by speaker position

Test room	Each			Common	
	Pt #1	Pt #2	Pt #3	Pt #1, #2	Pt #1, #2, #3
Source room	17	18	15	5	2
Receiving room	15	12	8	6	1

Fig. 15 Deviation of sound pressure level(speaker position #1)

Fig. 16 Common effective measurement positions (speaker position #1, #2)

Fig. 17 Sound reduction index at effective measurement positions

가 가

(90)

(Fig. 19).

Fig. 20

315~500 Hz 500 Hz
가 6.1 dB
R_w 가 1 dB

3.4

0.5~2.0 bar 4 (2)
Fig. 18
가 0.5 dB

가 가
가

(1)

가

Fig. 19 Example of attaching rubber magnet in the source room

Fig. 18 Sound reduction index according to air pressure of sealing tube

Fig. 20 Sound reduction index according to application of rubber magnet(Nothing : without rubber, R. Rm : Receiving Room, S. Rm : Source Room)

Fig. 21 Sound reduction index according to application of polyester(PE Mat : PloyEster Mat)

Fig. 22 Sound reduction index according to application of polyester and rubber magnet

Fig. 22

315~500 Hz
(dip)
가 R_w 가 1 dB, STC 가
5 dB
4.

ISO type

47 (,)

(1) ISO
1~2 가 100 Hz

(2) 가

(3) 90
ISO 5~6

5

Fig. 21

315~500 Hz
dB
dB
(3)
1~2
 R_w 가 1 (4) 가
5 dB
, 2가

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Buildings & Naval.

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