# SoundMicro®

www.soundmicro.com

*Creating you a safe, quiet and comfortable life space !*

## Acoustic aluminum panel

綠建材 Green Building Material 高性能 High-performance

CKM

# Content

CKM SoundMicro

# 1.History

- Numerous countries had started dedicating to studies in acoustic filed since Doctor Ma released his Micro-hole theory back in 1972.
- OWA German put it commercialized and merchandized in market (NRC 0.45-0.50)
- Cheng-Kung university and CKM was accessing to further stage of research and development in micro-hole acoustically in the year of 2005 (NRC 0.6-0.7)
- CKM successfully dished out overwhelmingly-functional SoundMicro panels in 2009 (tilting and geometrical surfacing finish of acoustic aluminum panel)
- and was firstly certificated and merchandized in public with metal categorized segment for its highly-valued in acoustics and green materials aspects (NRC 0.85)
- Fully applications and adoptions in variously major infrastructures from 2009 to 2012 sited as outdoor-acoustic sound barrier in Taiwan Electricity Company, Taipei Metro station(7 stations and its subway shopping area) ; Noise-improvement project in Wen-Hu line Taipei Metro, National Palace Museum, schools, County Theater Concert Hall, hospital, Fire Service, Department of Justice, 18-metre-high acoustic wall at CPC refinery factory, national exhibition centre, and so on. (NRC 0.95)

# 2.Theory

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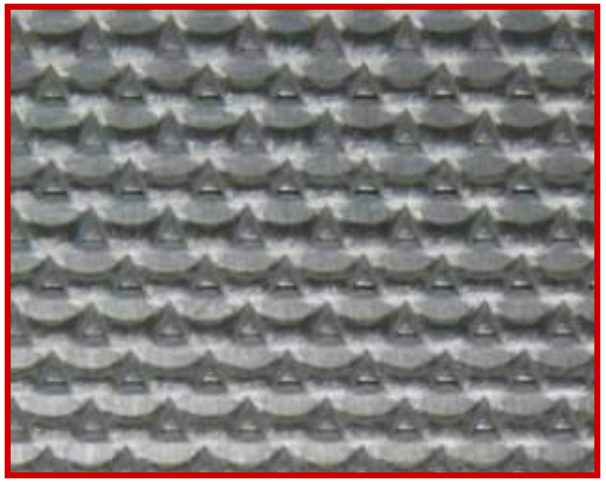
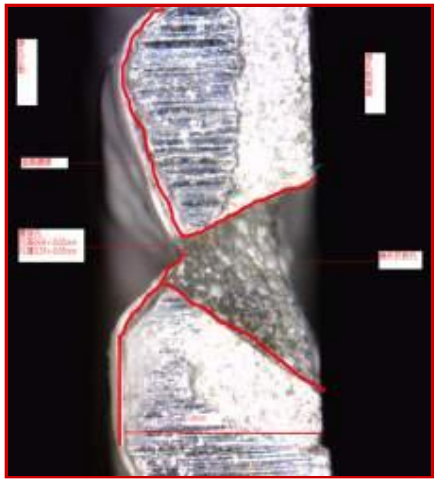
- Obtaining a fine effect of sound-absorption via the tortuous side inside the micro holes advancing the levels of viscosity and heat-spreading for sound waves. Obtain a fine effect of sound-absorption via rough side inside the micro holes advancing the levels of viscosity and heat-spreading for sound waves.
- While air particles come through micro holes and leads to co-vibration effect in air space caused by remaining particles after penetration attached and scattering backside of the panel holed up to 400,000 units per square meter with result to diminishing on-going energy.

Side of major holes



Side of minor holes



Side-look

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# 3. Characteristic A

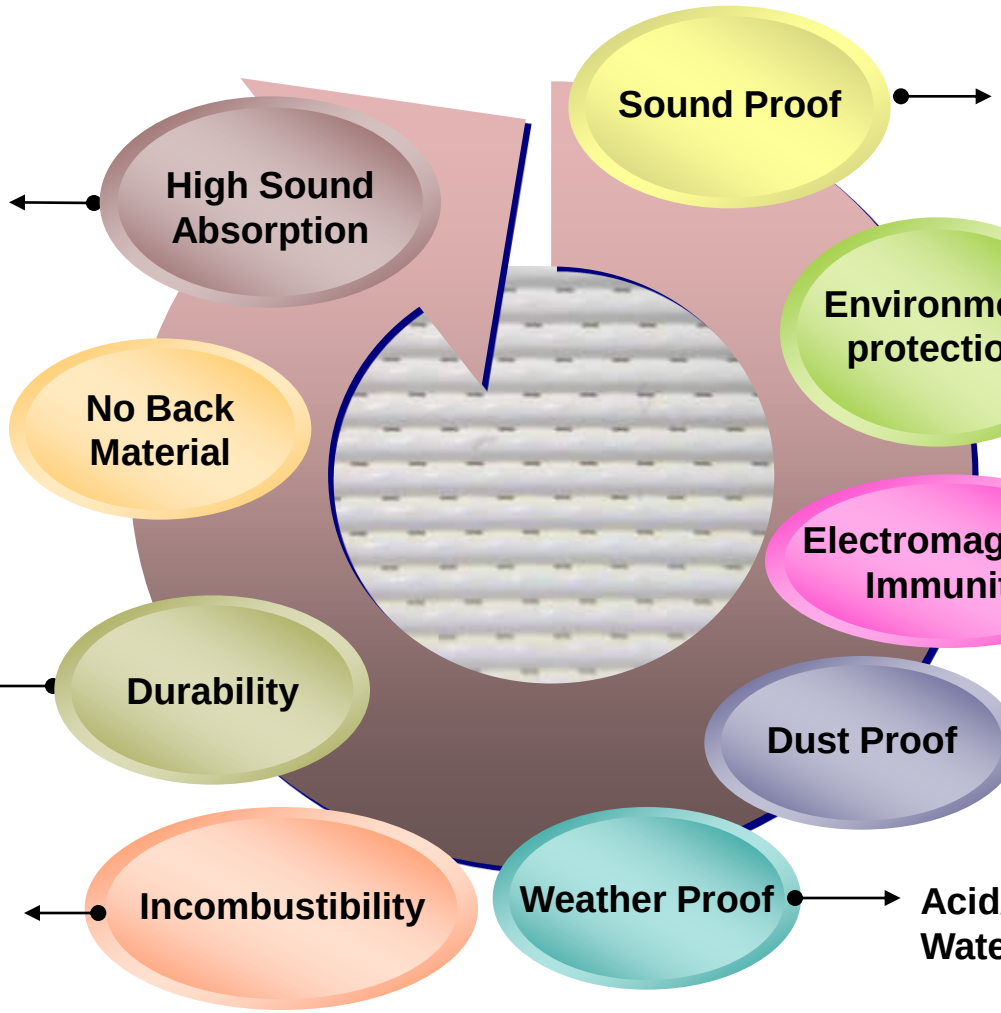
★ Air-space co-vibration absorption effect, need for being attached on the back of SOUNDMICRO with any sound-absorbing material.

★ Apply to widest frequency range.

★ The surface of SoundMicro is applied with the adoption of specific Fluorocarbon Baking Varnish and water-proof varnish which both jam micro holes in no way. Light in weight, innocuous, fire-proof, anti-salinity, water-proof, high quality of sound-absorption and anti-pollution, long-term usage, a variety of color-choosing and easy-cutting with no harm the environment are all presented by this Aluminum panel certificated by the test report issued from the high-efficiency and green building material items.

★ Application in such areas of high temperature and moisture, high-speed airflow and extremely tranquility like sub-way, tunnels, natatoriums, hospitals, factories, sound-absorbing air-conditioning system, Transportation, sound-absorbing walls, acoustic design in building…….and so on.

# 3. Characteristic B




SoundMicro Aluminum panel+1.6 mm steel material matchup resulted in STC 38 dB/ single layer of 1.6mm steel material with STC 25 dB

NRC
0.70-0.95
Wide frequency range

Non-toxic
Recyclable
Easy cutting

40%↑ than general Aluminum

10+ Years

Incombustibility
Class A

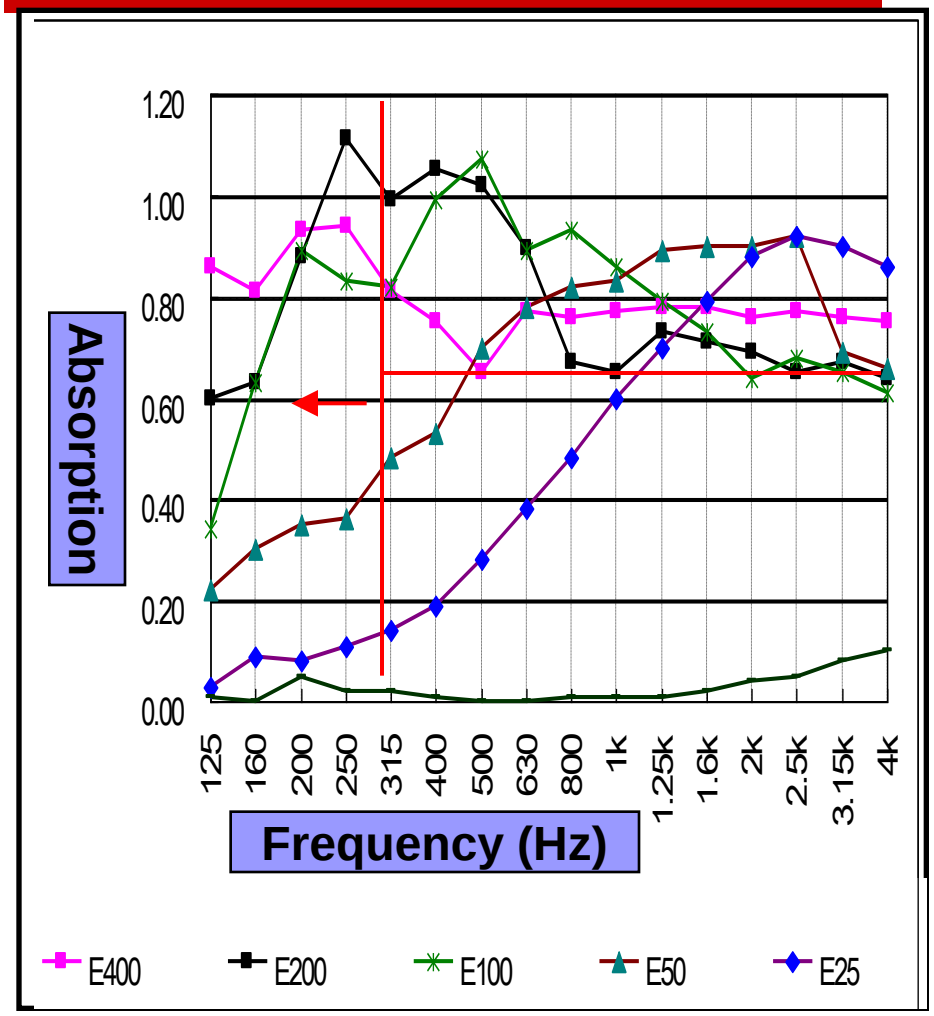
Acid/Alkali Resist
Water-Tolerant

# 4. NRC Test Reports

CKM SoundMicro

| SoundMicro A11 / Cert. Organization | Baffle type | Clip in type | Wall panel |
|---|---|---|---|
| China Architecture & Building Research Institute | -- | E200 -- NRC0.85 | -- |
| Singapore TUV PSB | Vertical baffle -- NRC 0.70 Box baffle -- NRC 0.75 | E90 -- NRC0.70 | -- |
| Chicago Riverbank Audio Lab | -- | E400 -- NRC0.80 | -- |
| USA OWENSCORNING Lab | -- | E25 -- NRC0.45 | -- |
| Taiwan Ocean University Audio Lab | -- | E100 -- NRC 0.85 | E100 double panels --NRC 0.95 |
| Taiwan ChenKung University Audio Lab | -- | E100 -- NRC 0.85 | E200 double panels --NRC 0.95 |
| China Tongij University Lab | -- | E200 -- NRC0.90 | -- |

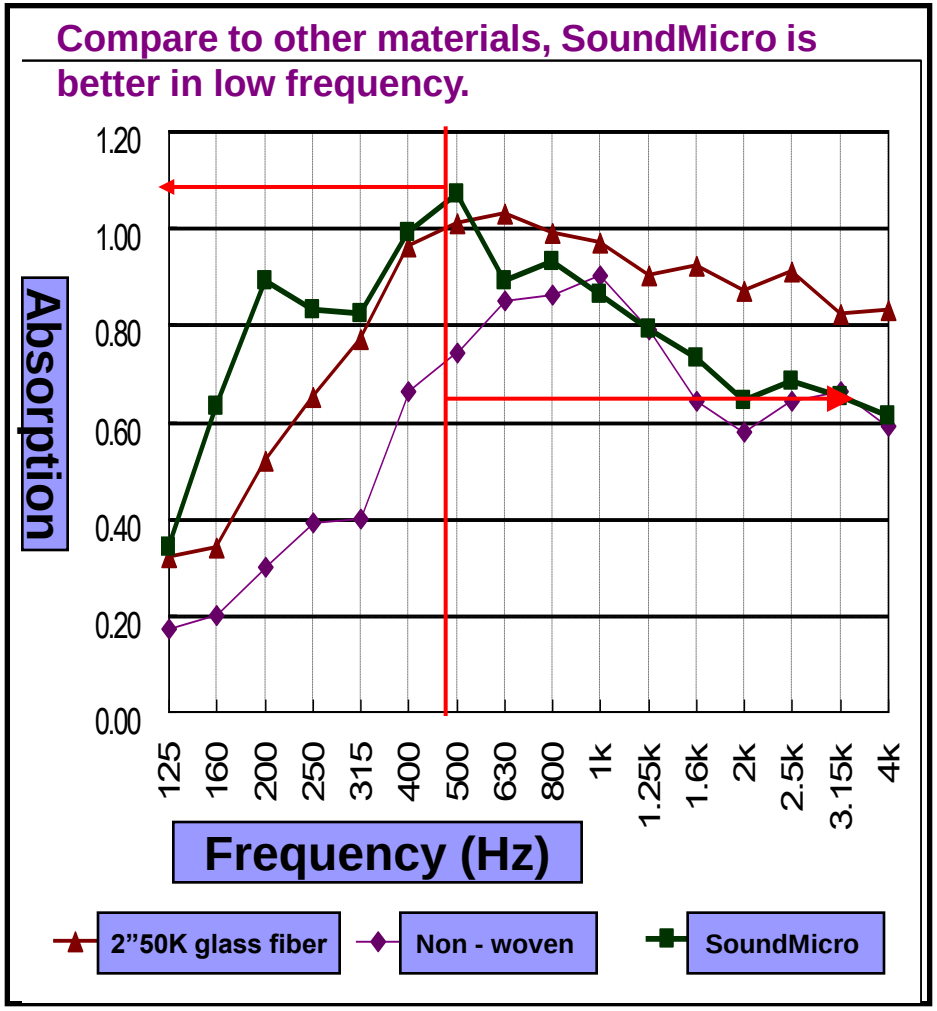
# 4.1 Airspace VS NRC




| AIR SPACE | E0 | E25 | E50 | E100 | E200 | E400 |
|---|---|---|---|---|---|---|
| Center Hz | Absorption | | | | | |
| (Hz) | (1/3)Octave | | | | | |
| 125 | 0.01 | 0.03 | 0.22 | 0.34 | 0.60 | 0.86 |
| 160 | 0.00 | 0.09 | 0.30 | 0.63 | 0.63 | 0.81 |
| 200 | 0.05 | 0.08 | 0.35 | 0.89 | 0.88 | 0.93 |
| **250** | **0.02** | **0.11** | **0.36** | **0.83** | **1.11** | **0.94** |
| 315 | 0.02 | 0.14 | 0.48 | 0.82 | 0.99 | 0.81 |
| 400 | **0.01** | **0.19** | 0.53 | 0.99 | **1.05** | **0.75** |
| **500** | **0.00** | **0.28** | **0.70** | **1.07** | **1.02** | **0.65** |
| 630 | 0.00 | 0.38 | 0.78 | 0.89 | 0.89 | 0.77 |
| 800 | 0.01 | 0.48 | 0.82 | **0.93** | 0.67 | 0.76 |
| **1k** | **0.01** | **0.60** | **0.83** | **0.86** | **0.65** | **0.77** |
| 1.25k | 0.01 | 0.70 | 0.89 | 0.79 | 0.73 | 0.78 |
| 1.6k | 0.02 | 0.79 | 0.90 | 0.73 | 0.71 | 0.78 |
| **2k** | **0.04** | **0.88** | **0.90** | **0.64** | **0.69** | **0.76** |
| 2.5k | 0.05 | 0.92 | 0.92 | 0.68 | 0.65 | 0.77 |
| 3.15k | 0.08 | 0.90 | 0.69 | 0.65 | 0.67 | 0.76 |
| 4k | 0.10 | 0.86 | 0.66 | **0.61** | 0.64 | 0.75 |
| **NRC** | **0.00** | **0.45** | **0.70** | **0.85** | **0.85** | **0.80** |

***To get the best absorption request , we suggest that airspace is more than 96mm.***

# 4.2 NRC of Different Materials




| Material | SoundMicro | Non-woven | 2"50K glass fiber |
|---|---|---|---|
| airspace | E100 | | |
| Center Hz | Absorption | | |
| (Hz) | (1/3)Octave | | |
| 125 | 0.34 | 0.17 | 0.32 |
| 160 | 0.63 | 0.20 | 0.34 |
| 200 | 0.89 | 0.30 | 0.52 |
| **250** | **0.83** | **0.39** | **0.65** |
| 315 | 0.82 | 0.40 | 0.77 |
| 400 | 0.99 | 0.66 | 0.96 |
| **500** | **1.07** | **0.74** | **1.01** |
| 630 | 0.89 | 0.85 | 1.03 |
| 800 | 0.93 | 0.86 | 0.99 |
| **1k** | **0.86** | **0.90** | **0.97** |
| 1.25k | 0.79 | 0.79 | 0.90 |
| 1.6k | 0.73 | 0.64 | 0.92 |
| **2k** | **0.64** | **0.58** | **0.87** |
| 2.5k | 0.68 | 0.64 | 0.91 |
| 3.15k | 0.65 | 0.66 | 0.82 |
| 4k | 0.61 | 0.59 | 0.83 |
| **NRC** | **0.85** | **0.65** | **0.90** |

# 5. Interior Applications

Taipei MRT Station
Zhongshan Metro Mall

TYPE-Lay In 、 Clip In
Adv : noise-absorbing, water-proof, dust-proof

# 5.1 Echo Time Test A

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## T30 Test at Taipei MRT Technology Building Station

| | Point | Before /after | Frequency (Hz) | | | | | | | Avg (Sec.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| ( Ticket Gate 1 ) | 1 | after | 0.705 | 0.859 | 1.031 | 1.114 | 1.093 | 0.999 | 0.785 | **0.941** |
| ( Ticket Gate 2 ) | 2 | after | 0.630 | 0.870 | 0.903 | 1.000 | 1.011 | 0.994 | 0.792 | **0.886** |
| ( Platform ) | 3 | after | 0.872 | 0.805 | 0.799 | 0.894 | 0.829 | 0.856 | 0.676 | **0.819** |
| ( Information Desk ) | 4 | after | 0.785 | 0.744 | 0.831 | 0.882 | 0.873 | 0.950 | 0.735 | **0.829** |
| ( Ticket Vendors ) | 5 | after | 0.853 | 0.809 | 0.805 | 0.858 | 0.926 | 0.881 | 0.710 | **0.835** |
| ( 2F stair↓ ) | 6 | after | 0.745 | 0.746 | 0.586 | 0.810 | 0.886 | 0.948 | 0.774 | **0.785** |
| ( 1F↑- 2F↓ ) | 7 | after | 0.760 | 0.580 | 0.720 | 0.805 | 0.856 | 0.885 | 0.737 | **0.763** |
| ( 1F stair↑ ) | 8 | after | 0.596 | 0.580 | 0.720 | 0.805 | 0.856 | 0.885 | 0.737 | **0.740** |
| | | **Avg (Sec.)** | **0.7432** | **0.749** | **0.7994** | **0.896** | **0.916** | **0.925** | **0.743** | **0.825** |

# 5.2 Open Area – Baffle type

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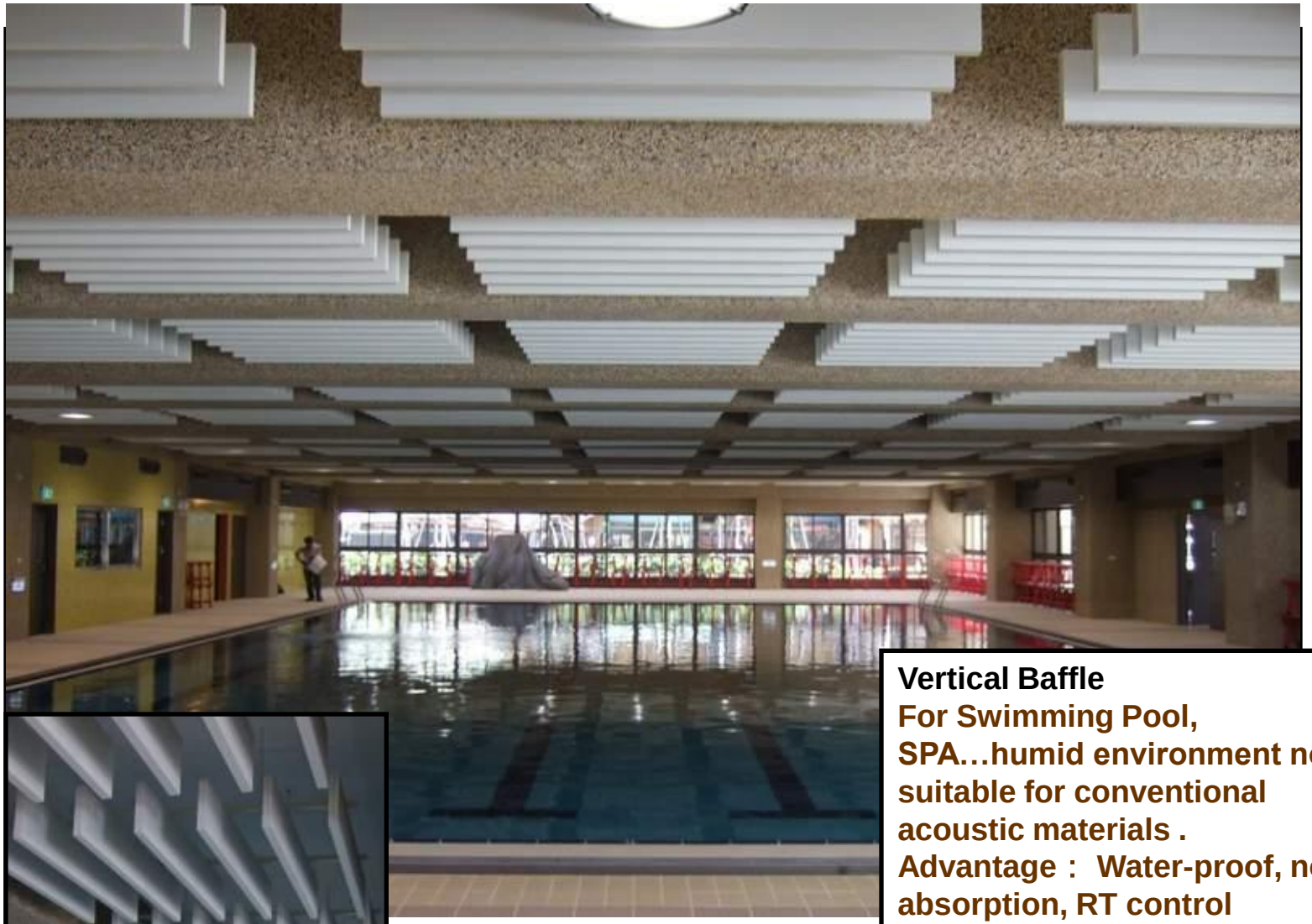

**Vertical Baffle**
**For Swimming Pool, SPA…humid environment not suitable for conventional acoustic materials .**
**Advantage： Water-proof, noise-absorption, RT control**

# 5.3 Echo Time Test B

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**T30 Test at swimming pool in Chingshin elementary school.**
**SoundMicro installation area：36.9%**

| Point | Frequency (Hz) | | | | | | | Avg. |
|---|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| 1 | 3.086 | 3.119 | 2.26 | 1.758 | 1.461 | 1.44 | 1.175 | **2.043** |
| 2 | 3.319 | 3.231 | 2.337 | 1.812 | 1.526 | 1.427 | 0.918 | **2.081** |
| 3 | 3.118 | 2.782 | 2.127 | 1.69 | 1.357 | 1.353 | 1.143 | **1.939** |
| 4 | 2.788 | 2.64 | 2.238 | 1.701 | 1.382 | 1.318 | 1.124 | **1.884** |
| 5 | 3.389 | 3.101 | 2.196 | 1.832 | 1.502 | 1.408 | 1.18 | **2.087** |
| 6 | 3.498 | 3.106 | 2.306 | 1.859 | 1.493 | 1.488 | 1.767 | **2.217** |
| 7 | 3.049 | 3.088 | 2.373 | 1.796 | 1.312 | 1.334 | 1.163 | **2.016** |
| 8 | 3.13 | 3.043 | 2.376 | 1.663 | 1.297 | 1.261 | 1.028 | **1.971** |
| 9 | 3.186 | 3.174 | 2.348 | 1.84 | 1.478 | 1.388 | 1.242 | **2.094** |
| **After** | **3.174** | **3.032** | **2.285** | **1.772** | **1.423** | **1.380** | **1.193** | **2.037** |
| **Before** | **7.151** | **12.55** | **7.242** | **8.052** | **6.861** | **5.070** | **4.653** | **7.368** |

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# 6. Exterior Applications




**TYPE-System**
**Place : Wall panels around MRT、Railroad, Highway, Substation, Factory…**

**Adv : Noise reduction : 38dB NRC: 0.85**

# 6.1 NRC characteristic of E100 wall panel

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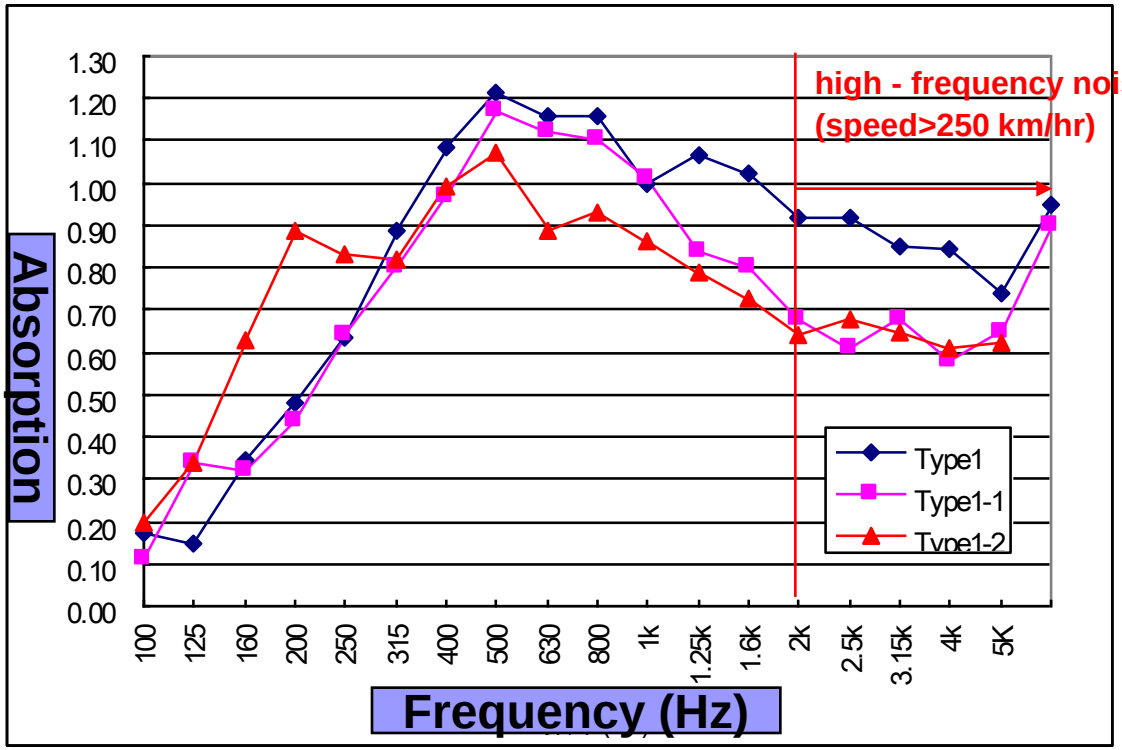
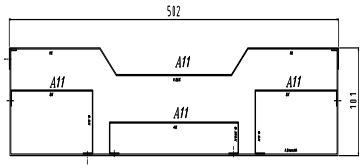
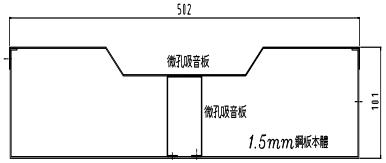


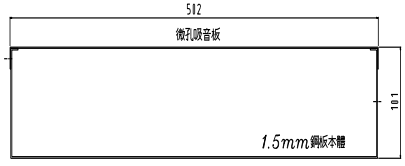

| Type | Type1 | Type1-1 | Type1-2 |
|---|---|---|---|
| Center Hz | Absorption | | |
| (Hz) | (1/3)Octave | | |
| 100 | 0.17 | 0.11 | 0.20 |
| 125 | 0.15 | 0.34 | 0.34 |
| 160 | 0.34 | 0.32 | 0.63 |
| 200 | 0.48 | 0.44 | 0.89 |
| **250** | **0.63** | **0.64** | **0.83** |
| 315 | 0.89 | 0.80 | 0.82 |
| 400 | 1.08 | 0.97 | 0.99 |
| **500** | **1.21** | **1.17** | **1.07** |
| 630 | 1.16 | 1.12 | 0.89 |
| 800 | 1.16 | 1.10 | **0.93** |
| **1k** | **1.00** | **1.01** | **0.86** |
| 1.25k | 1.07 | 0.84 | 0.79 |
| 1.6k | 1.02 | 0.80 | 0.73 |
| **2k** | **0.92** | **0.68** | **0.64** |
| 2.5k | 0.92 | 0.61 | 0.68 |
| 3.15k | 0.85 | 0.68 | 0.65 |
| 4k | 0.84 | 0.58 | **0.61** |
| 5K | 0.74 | 0.65 | **0.62** |
| **NRC** | 0.95 | 0.90 | **0.85** |




TYPE 1 A11微孔吸音牆板(孔徑0.04mm)




TYPE 1-1 A11微孔吸音牆板(孔徑0.04mm)




TYPE 1-2 A11微孔吸音牆板(孔徑0.04mm)

※Type 1 for high speed railway usage (changeable airspace)

# 6.2 NRC characteristic of E200 wall panel

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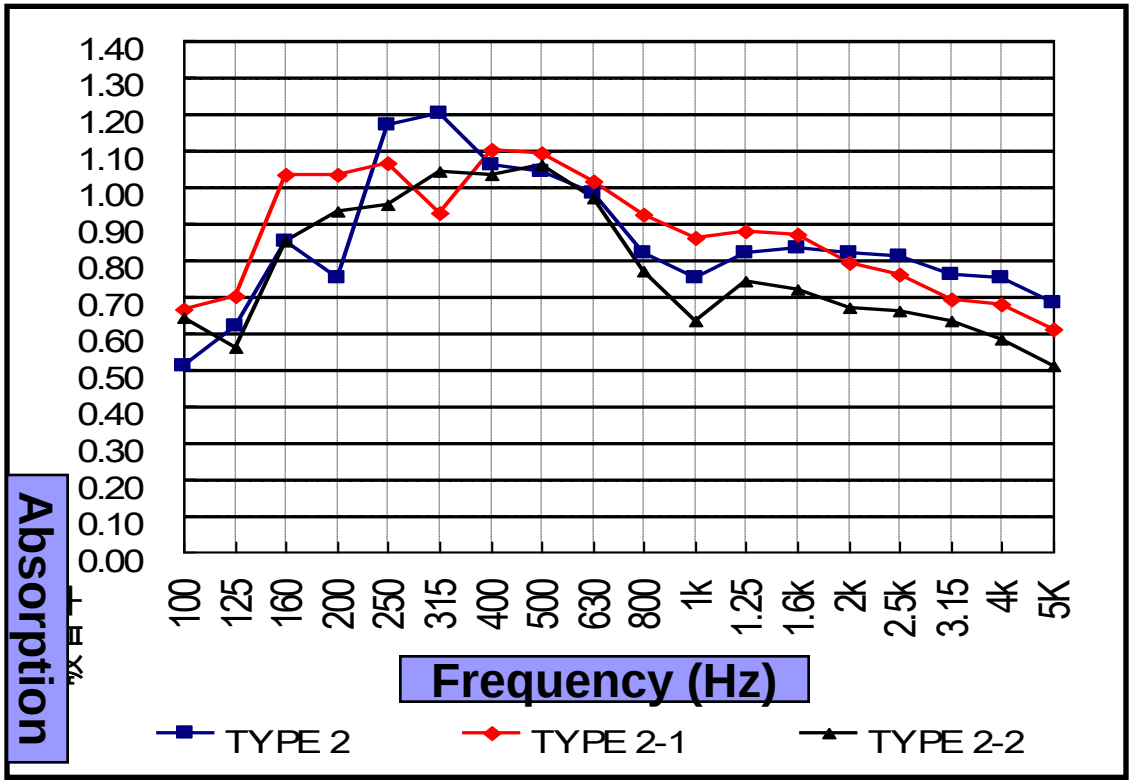
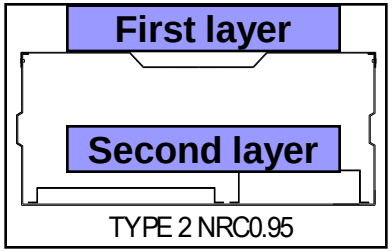
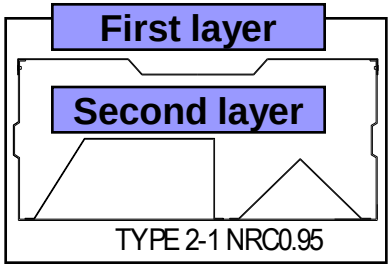
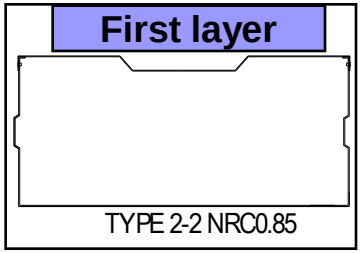



| Type | TYPE 2 | TYPE 2-1 | TYPE 2-2 |
|---|---|---|---|
| Center Hz | Absorption | | |
| (Hz) | (1/3)yOctave | | |
| 100 | 0.51 | 0.66 | 0.64 |
| 125 | 0.62 | 0.70 | 0.56 |
| 160 | 0.85 | 1.03 | 0.85 |
| 200 | 0.75 | 1.03 | 0.93 |
| 250 | 1.17 | 1.06 | 0.95 |
| 315 | 1.20 | 0.93 | 1.04 |
| 400 | 1.06 | 1.10 | 1.03 |
| 500 | 1.04 | 1.09 | 1.06 |
| 630 | 0.98 | 1.02 | 0.97 |
| 800 | 0.82 | 0.92 | 0.77 |
| 1k | 0.75 | 0.86 | 0.63 |
| 1.25k | 0.82 | 0.88 | 0.74 |
| 1.6k | 0.83 | 0.87 | 0.72 |
| 2k | 0.82 | 0.79 | 0.67 |
| 2.5k | 0.81 | 0.76 | 0.66 |
| 3.15k | 0.76 | 0.69 | 0.63 |
| 4k | 0.75 | 0.68 | 0.58 |
| 5K | 0.68 | 0.61 | 0.51 |
| NRC | 0.95 | 0.95 | 0.85 |
| SAA | 0.92 | 0.94 | 0.85 |

# 6.3 Exterior - STC

1. test of date : 2010.6.17 , temperature :25℃, humidity 83%

2 1/3 octave band transmission loss (TL):

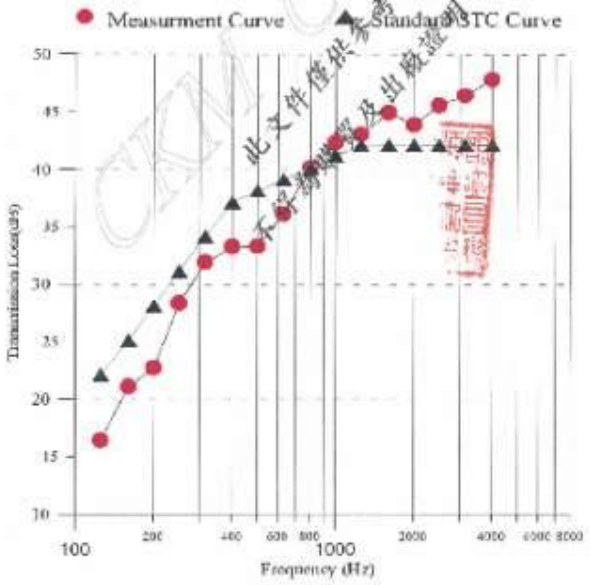
| frequency(Hz) | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 |
|---|---|---|---|---|---|---|---|---|---|
| TL(dB) | 17.33 | 16.42 | 21.09 | 22.74 | 28.33 | 31.90 | 33.25 | 33.28 | 36.10 |

| frequency(Hz) | 800 | 1000 | 1250 | 1600 | 2000 | 2500 | 3150 | 4000 | 5000 |
|---|---|---|---|---|---|---|---|---|---|
| TL(dB) | 40.14 | 42.32 | 43.02 | 44.94 | 43.85 | 45.58 | 46.43 | 47.82 | 51.23 |

3. Sound Transmission Class,STC is 38 dB.

STC=38dB

4. results



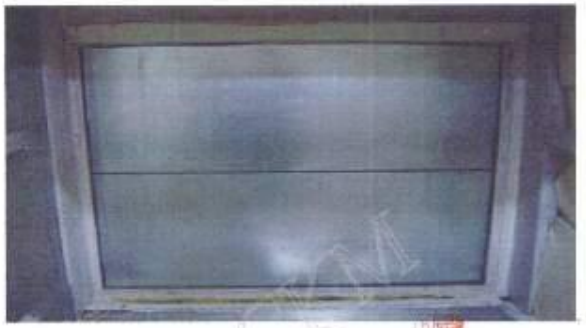



Figure 1 specimen（Anechoic room）

Figure 2 specimen（Reverberation room）

Note

**SoundMicro wall panel system**

**STC= 38dB**

# 6.4 SoundMicro VS Conventional

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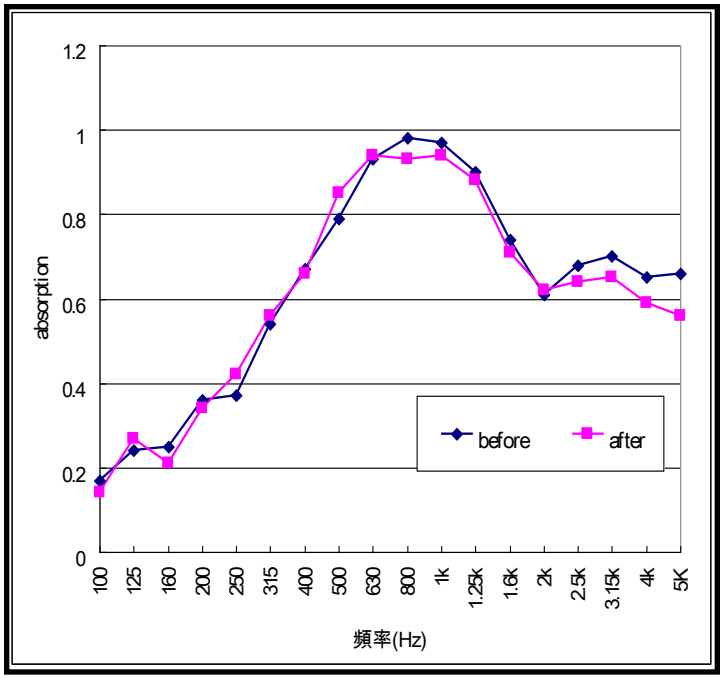
| Items | SoundMicro | Traditional perforated metal noise barriers |
|---|---|---|
| Component | Panel: 1.0t SoundMicro with < 0.1mm hole | Panel:1.0t Steel perforated panel, 2.5mm hole |
| | Back:1.5mm Galvanized Steel | Back:1.5mm Galvanized Steel |
| Backside Material | None ( Air-space 100mm ) Win | The surface of 100K rock wool should be covered with PVF or ETFE, and that will absorb water and reduce NRC figure |
| NRC | Reach 0.85 | NRC 0.6~0.9 |
| STC | STC 38dB Win | STC 25-37dB |
| Water Proof | Diameter 0.04±0.02mm None Seepage Win | Rockwool will absorb water and reduce the life of the noise barriers |
| Weather Proof | PTFE Finish, acid and alkali proof Win | Rockwool is not acid and alkali proof |
| Durability | Over 10 years Win | About 2 ~ 3 years |
| Functional | NRC is permanent Win | NRC declines gradually |

# 6.4 SoundMicro VS Conventional

CKM SoundMicro

| Items | SoundMicro | Traditional perforated metal noise barriers |
|---|---|---|
| Incombustibility | Incombustibility Classified A | Incombustibility Classified A |
| Dust Proof | The surface can be cleaned by rain Win | Dust will block the holes and make the surface hard to be cleaned |
| Appearance | Good Win | Some plants will grow from the rockwool back material |

# 7. Dust-proof Test V.S NRC




Before Raining

After Raining

Before

After

TUV test

| | before | after |
|---|---|---|
| ***AIR SPACE*** | ***90mm*** | |
| center Hz | absorption | |
| (Hz) | (1/3)Octave | |
| 100 | **0.17** | 0.14 |
| 125 | **0.24** | 0.27 |
| 160 | **0.25** | 0.21 |
| 200 | **0.36** | 0.34 |
| **250** | **0.37** | **0.42** |
| 315 | **0.54** | 0.56 |
| 400 | **0.67** | 0.66 |
| **500** | **0.79** | **0.85** |
| 630 | **0.93** | 0.94 |
| 800 | **0.98** | **0.93** |
| **1k** | **0.97** | **0.94** |
| 1.25k | **0.90** | 0.88 |
| 1.6k | **0.74** | 0.71 |
| **2k** | **0.61** | **0.62** |
| 2.5k | **0.68** | 0.64 |
| 3.15k | **0.70** | 0.65 |
| 4k | **0.65** | **0.59** |
| 5K | **0.66** | **0.56** |
| **NRC** | **0.70** | **0.70** |
| **SAA** | **0.71** | **0.71** |

# 7.1 Downside of Conventional Materials

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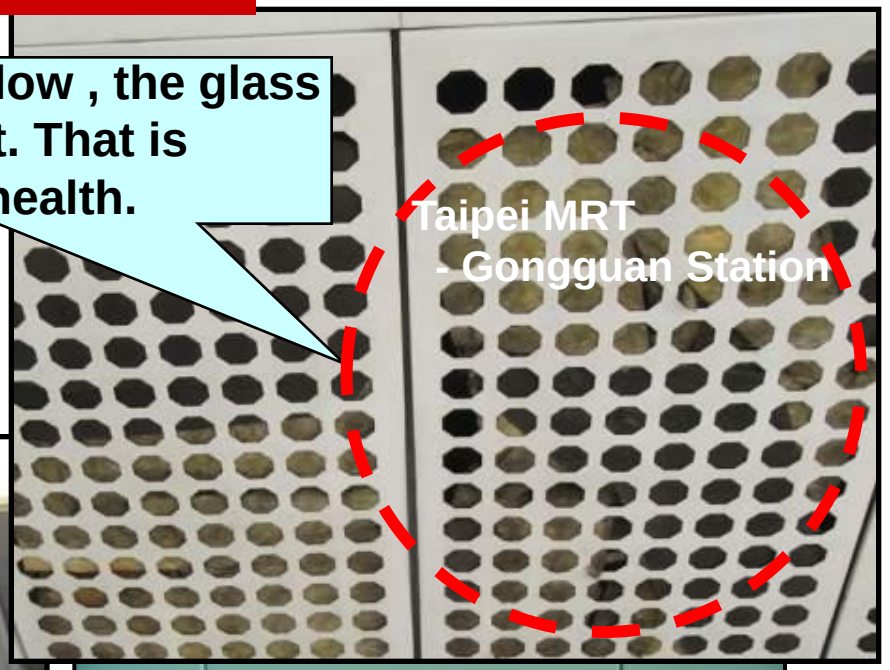
Because of the airflow , the glass fiber is falling apart. That is harmful to human health.




Because the backside material is not attached well, the airflow easily passes through the ceiling causing the panel to be dirty.



Installed with SoundMicro after two years.

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## 7.2 SoundMicro VS. Conventional in Durability

Some plants grow up from the backside material (rockwool) through the holes.

**SoundMicro**

# 8. Reverberation Time

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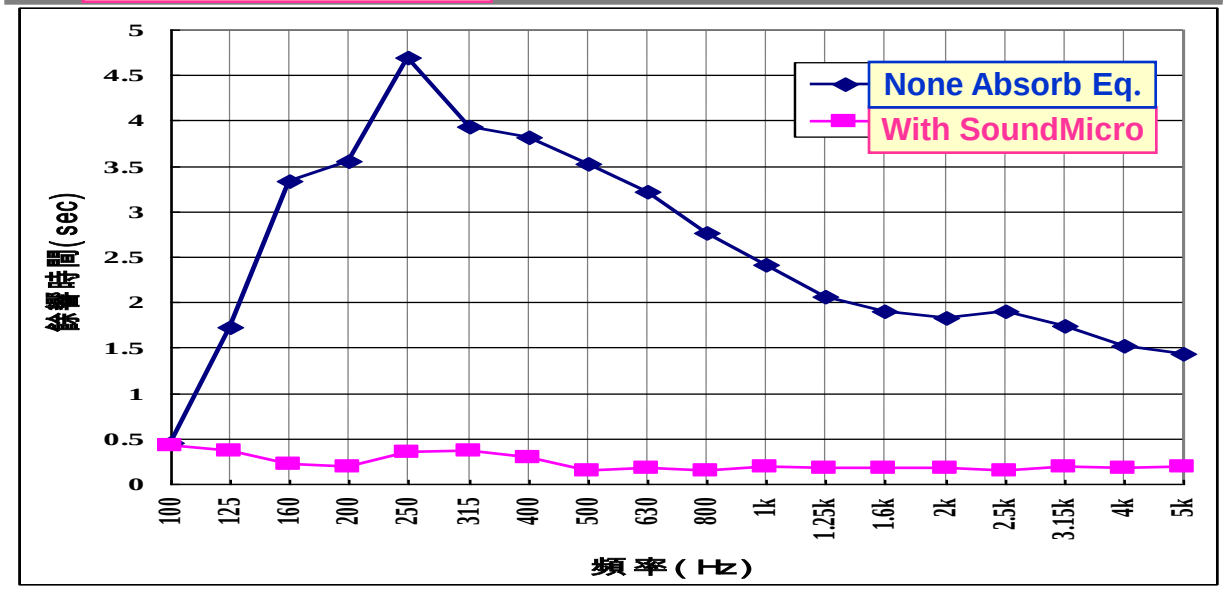
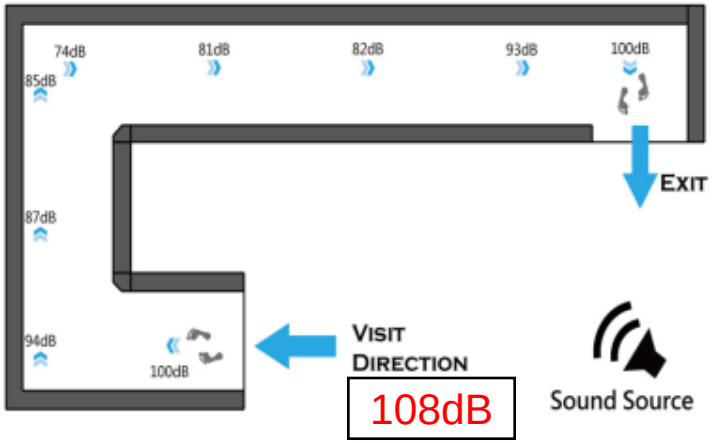



| | Wall | Ceiling |
|---|---|---|
| Air space | 100mm | 200mm |
| Center Hz | absorption | |
| (Hz) | (1/3)Octave | |
| 100 | 0.20 | 0.41 |
| 125 | 0.34 | 0.60 |
| 160 | 0.63 | 0.63 |
| 200 | 0.89 | 0.88 |
| 250 | 0.83 | 1.11 |
| 315 | 0.82 | 0.99 |
| 400 | 0.99 | 1.05 |
| 500 | 1.07 | 1.02 |
| 630 | 0.89 | 0.89 |
| 800 | 0.93 | 0.67 |
| 1k | 0.86 | 0.65 |
| 1.25k | 0.79 | 0.73 |
| 1.6k | 0.73 | 0.71 |
| 2k | 0.64 | 0.69 |
| 2.5k | 0.68 | 0.65 |
| 3.15k | 0.65 | 0.67 |
| 4k | 0.61 | 0.64 |
| 5K | 0.62 | 0.62 |
| NRC | 0.85 | 0.85 |
| SAA | 0.84 | 0.84 |

# 9. Noise Reduction


74dB




**Noise reduction channel**

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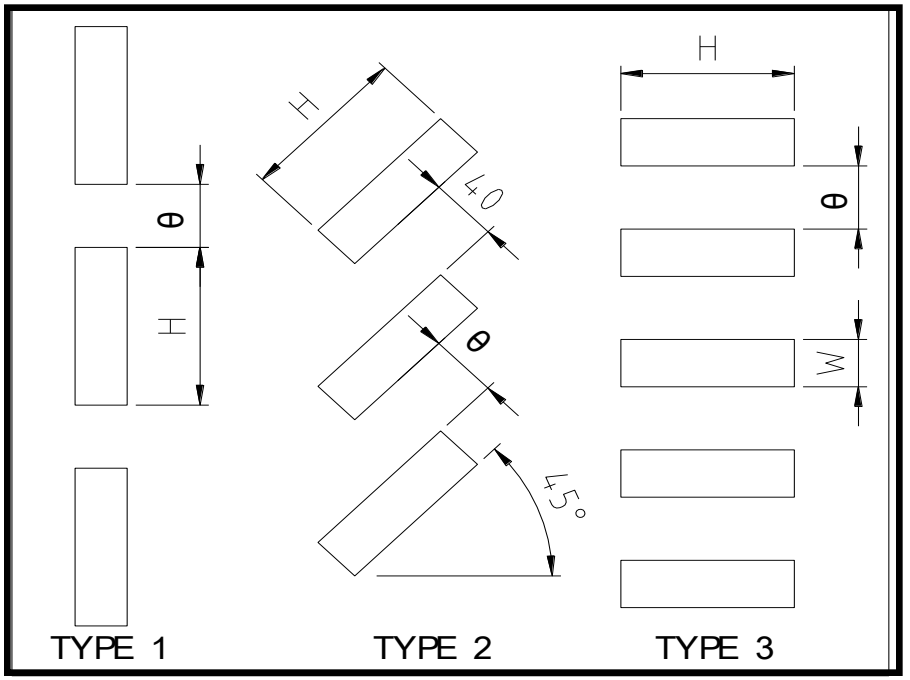
# 10. SoundMicro Apply to Noise Reduction Louver Research.

| HZ | NR Angle 0 degree | NR Angle 45 degree | NR Angle 90 degree |
|---|---|---|---|
| 100 | 8.73 | 6.47 | 7.03 |
| 125 | 9.73 | 7.03 | 7.07 |
| 160 | 9 | 6.1 | 6.4 |
| 200 | 12.97 | 9.5 | 9.33 |
| 250 | 12.53 | 10.17 | 9.9 |
| 315 | 12.53 | 10.3 | 10.87 |
| 400 | 12 | 9.5 | 8.73 |
| 500 | 11.5 | 8.47 | 8.47 |
| 630 | 12.93 | 9.47 | 9.13 |
| 800 | 13.9 | 9.9 | 9.83 |
| 1000 | 15.2 | 10.37 | 9.53 |
| 1250 | 14.93 | 10.27 | 9.5 |
| 1600 | 14.97 | 10.6 | 9.87 |
| 2000 | 15.7 | 11.33 | 10.3 |
| 2500 | 16.4 | 13.27 | 11.03 |
| 3150 | 20.23 | 14.63 | 11.73 |
| 4000 | 18.4 | 12.9 | 11.33 |
| 5000 | 19.6 | 12.73 | 11.3 |
| LP | 15.2 | 10.7 | 9.8 |

| item | Louver Length ( H ) | Width ( W ) | Seam ( Θ ) | Angle |
|---|---|---|---|---|
| 1 | 100 | 30 | 40 | 0 |
| 2 | 100 | 30 | 40 | 45 |
| 3 | 100 | 30 | 40 | 90 |




※SoundMicro noise reduction louver research is under proceeding now, please wait.

# 11. Taipei Palace Museum RT Improvement Project

Lobby（RT：Before 3.1 Sec.，Target 1.6 Sec.）

# 12. Taiwan High Speed Rail Acoustical Panel


- After installation, lower the LEG to be 7.2 dB(A)~14.8 dB(A) with different speed.
- Train Lmax, also lower down between 8.1 dB(A)~14.6 dB(A).

# *Thank you~*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