Introduction

Normally the sound absorbing properties of a (ceiling) product are expressed in a graph with corresponding table as shown here:

volume reverberation room: 214 m^3

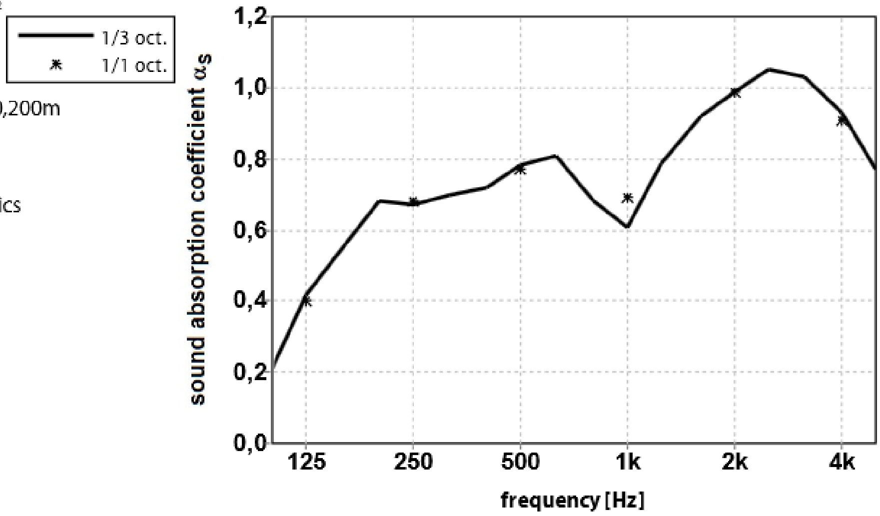
surface area sample: 10,8 m^2

heigth of the construction: 0,200m

measured at:
Peutz Laboratory for Acoustics

signal: broad-band noise

bandwidth: 1/3 octave



α_w (ISO 11654) = 0,75(H)

NRC (ASTM) = 0,75

SAA (ASTM) = 0,78

	125	250	500	1k	2k	4k
	0,21	0,68	0,72	0,68	0,92	1,03
1/3 oct.	0,42	0,67	0,78	0,61	0,99	0,93
	0,56	0,70	0,81	0,79	1,05	0,77
1/1 oct.	**0,40**	**0,68**	**0,77**	**0,69**	**0,99**	**0,91**

The level of sound absorption is expressed in a value α_s (absorption coefficient). To be able to have a proper representation of the sound absorbing performance of a product, the α_s values are determined over a frequency range running from 125 Hz up to 4000 Hz. As you can see in the graph, this value varies over the range of the frequencies (sound wave spectrum). To make it easier to compare materials with each other the sound absorbing properties are also declared as a single value α_w (European way) or NRC/ SAA value (American way).

Reverberation time

For a comfortable acoustic ambiance in a room, the proper reverberation time is one of the most determining factors. In a standard office environment the reverberation time should be around 0.4-0.8 seconds. This reverberation time can be measured in situ but when the project is still in a design phase that is impossible. The reverberation time can then be calculated but this exercise requires a detailed insight in the different surfaces in a room and from which materials these surfaces are made.

The formula to be used is called Sabine's Equation and is expressed as follows:

$$T_{60} = \frac{0.161V}{A} = \frac{0.161V}{\sum S_i \, \alpha_i}$$

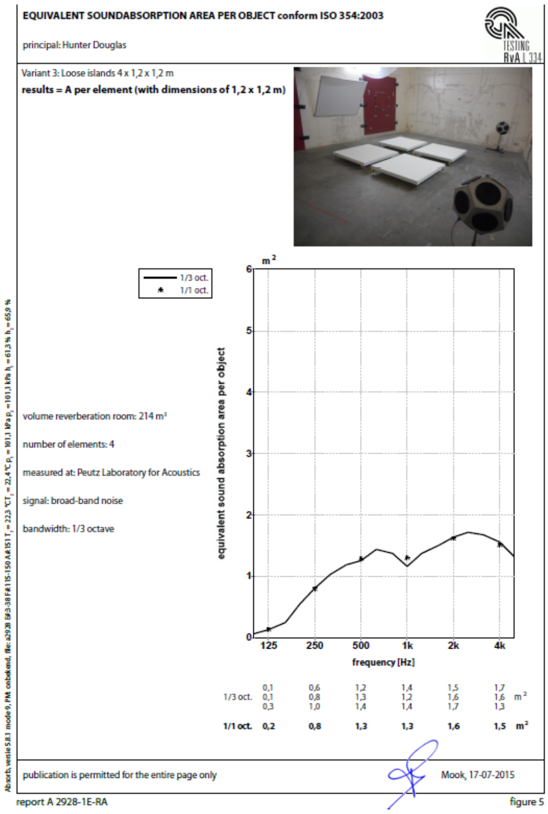
Where: V= volume of the room (m^3)
A= total absorbing area in m^2 Sabine
S_i = area in m^2 of the individual surfaces/ materials
α_i = absorption coefficients of those surfaces/ materials (varies with the frequency)

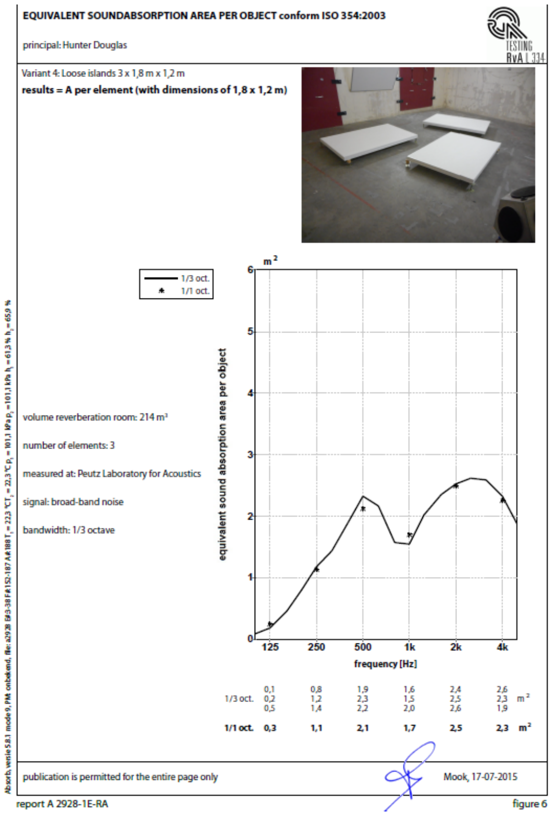
To calculate the total absorbing area, one measures all the different surfaces, multiplies them with the α_s values (either from reference tables or results from sound absorption tests) for the range of frequencies. The reverberation time is then calculated by dividing the volume of the room with the total absorbing area and multiplying the result with the factor 0.161.

Equivalent absorbing area

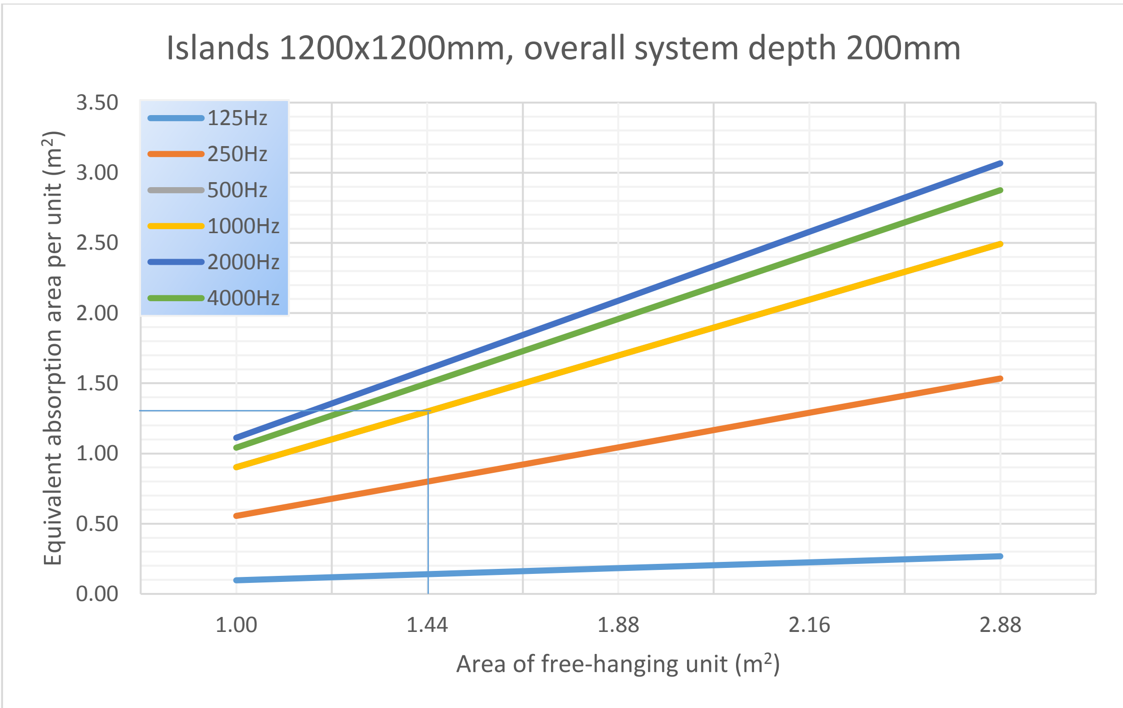
Turning the above calculation around, with a given reverberation time and volume one can calculate how many m^2's of sound absorbing area are required to achieve the desired result. Again by multiplying the m^2's of surfaces with the α_s values one determines how much absorbing area is present ("A" in above equation). When this is not sufficient, the remainder can then be supplied by the Techstyle® Islands.

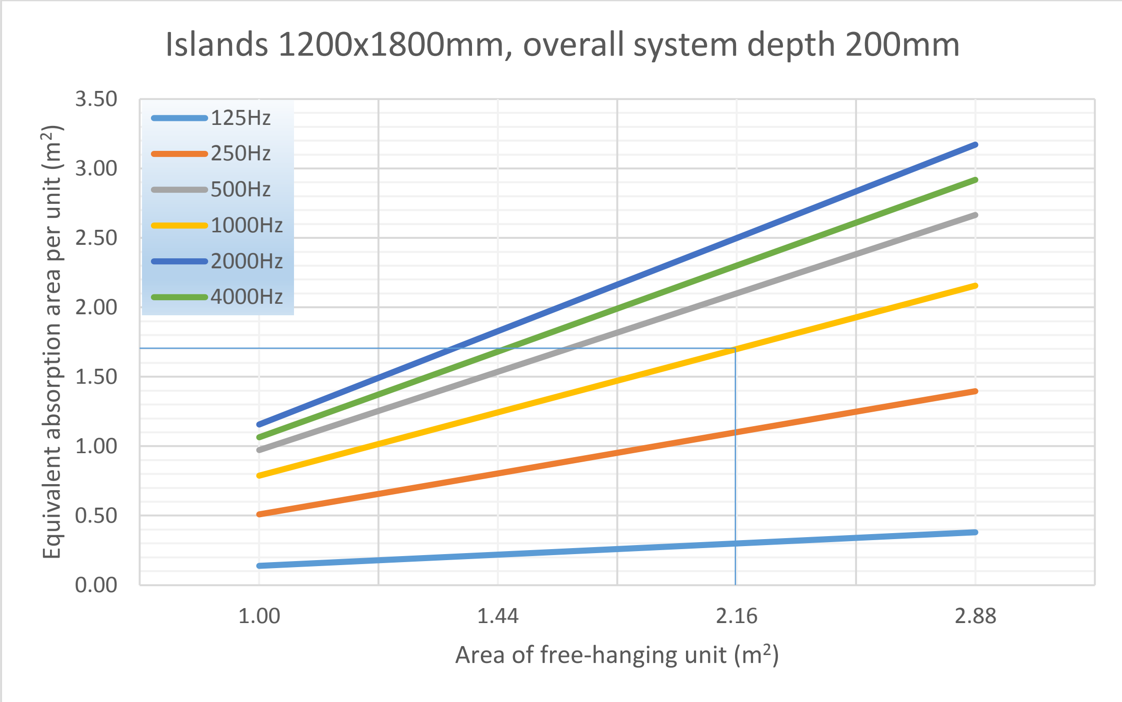
This is where the so-called equivalent absorbing area comes into play. Again, this is a value that varies with the frequency. We have tested 2 different Island configurations to determine the equivalent sound absorbing area per element: 4 pcs. 1200x1200mm and 3 pcs. 1200x1800mm in random orientation.





Working with the graphs from the test report is a bit confusing. Presenting the results in a different way makes it easier to work with the data.



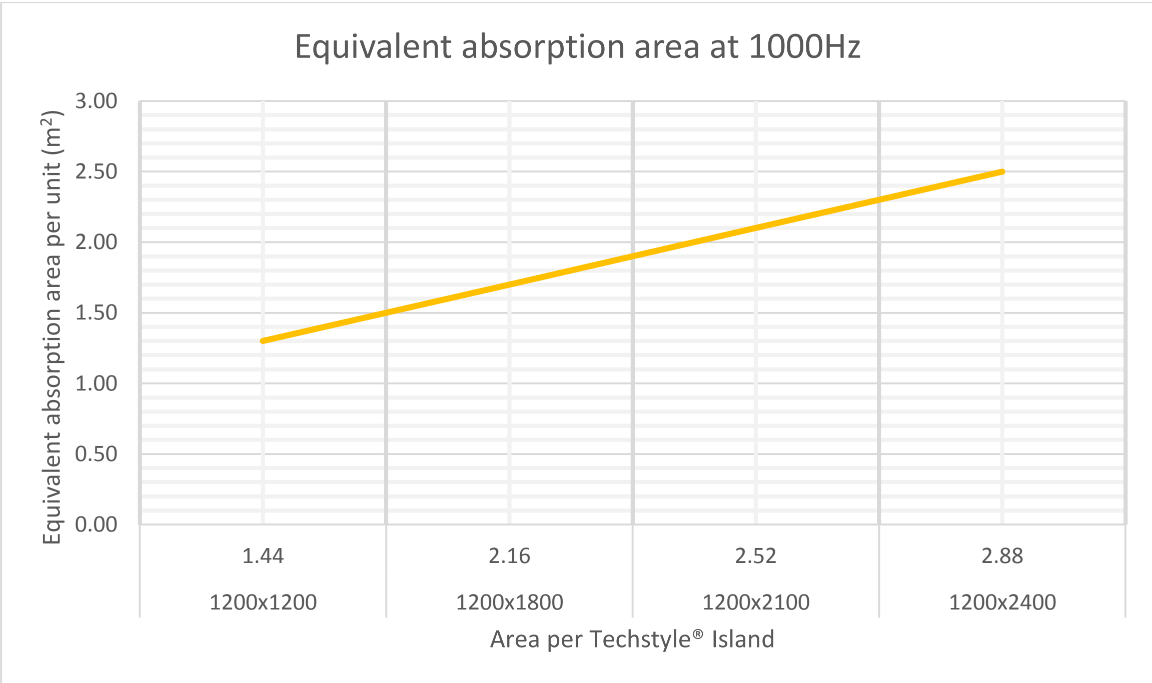


To make life less dificult we do the calculation for a frequency of 1000 Hz which is more or less in the midst of the range of vocal frequencies.

How to read the graphs:

- Each Techstyle® Island 1200x1200mm is 1.44 m^2 and at 1000 Hz the equivalent absorbing area is 1.3 m^2 Sabine.
- Each Techstyle® Island 1200x1800mm is 2.16 m^2 and at 1000 Hz the equivalent absorbing area is 1.7 m^2 Sabine.

Since we only tested 2 dimensions we have extrapolated the results also for Techstyle® Islands 1200x2100mm and 1200x2400mm (for the frequency of 1000Hz only).



To summarise: at 1000Hz

- Techstyle® Islands 1200x1200mm, equivalent absorbing area= 1.3 m^2 Sabine
- Techstyle® Islands 1200x1800mm, equivalent absorbing area= 1.7 m^2 Sabine
- Techstyle® Islands 1200x2100mm, equivalent absorbing area= 2.1 m^2 Sabine
- Techstyle® Islands 1200x2400mm, equivalent absorbing area= 2.5 m^2 Sabine