

**Report****DRAFT**

Date:	24 March 2017	Project:	Werkplaats Bilthoven (NL)
Our reference:	-	Locatie:	Bilthoven
Reference:	V037548aa.00001.jvu	Betreft:	Acoustic measurements
Version:	01_001		

## 1 Introduction

LBP|SIGHT performed acoustic measurements in the primary school of the 'Werkplaats Bilthoven, the Netherlands'.

The new part of the primary school building has a fully open plan layout in which pupils in the age of 4 till 12 years and teachers are working together. The existing part of the building has a layout with more traditional classrooms, but mostly the doors between those classrooms and the adjacent circulation area are open. So in practice, the existing part of the building can be regarded as a school with an semi-open plan lay-out.

Despite this (semi) open plan layout the users of the school are very satisfied with the acoustics. For this reason it's interesting to know more about the acoustics in the school in terms of sound attenuation between different spaces in the building. Therefore measurements of the sound decay between several source and receiver positions were done.

The results of these measurements and conclusions are given in this report.

## 2 Lay-out

The school has a (semi) open plan layout in which spaces for instruction/plenary sessions are set up around a large central space. This central space is the main circulation area, but is also used as break-out area for the pupils.

In figure 1 the lay-out of the school is given. In appendix I some pictures of the school are presented to get a better idea of the situation.



**Figure 1**  
Lay-out of the 'Werkplaats Bilthoven' (primary school)

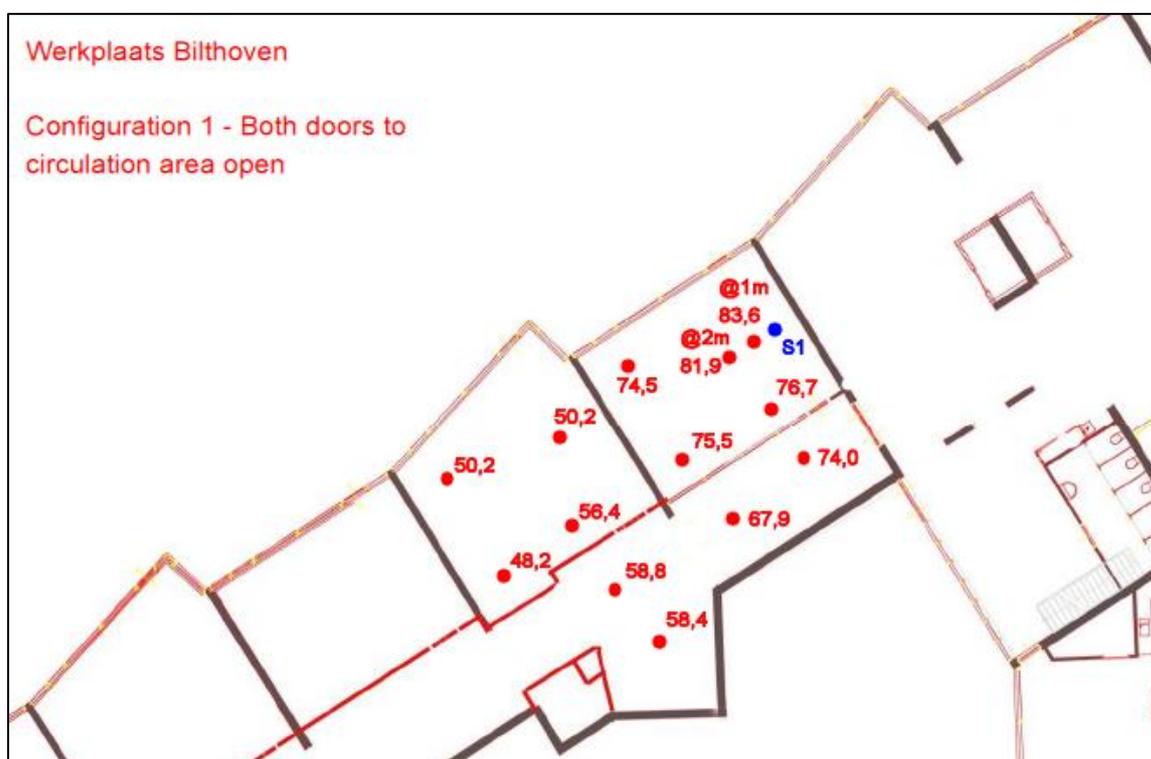
## 3 Acoustic measurements

The acoustic measurements were performed using a reference sound source (type Norsonic NO278). This source was placed in a classroom in the existing part of the building (S1). The resulting averaged sound pressure levels of the source in the adjacent classroom and circulation area were measured on several positions. These measurements also were carried out with and without sliding doors opened between classrooms and circulation area.

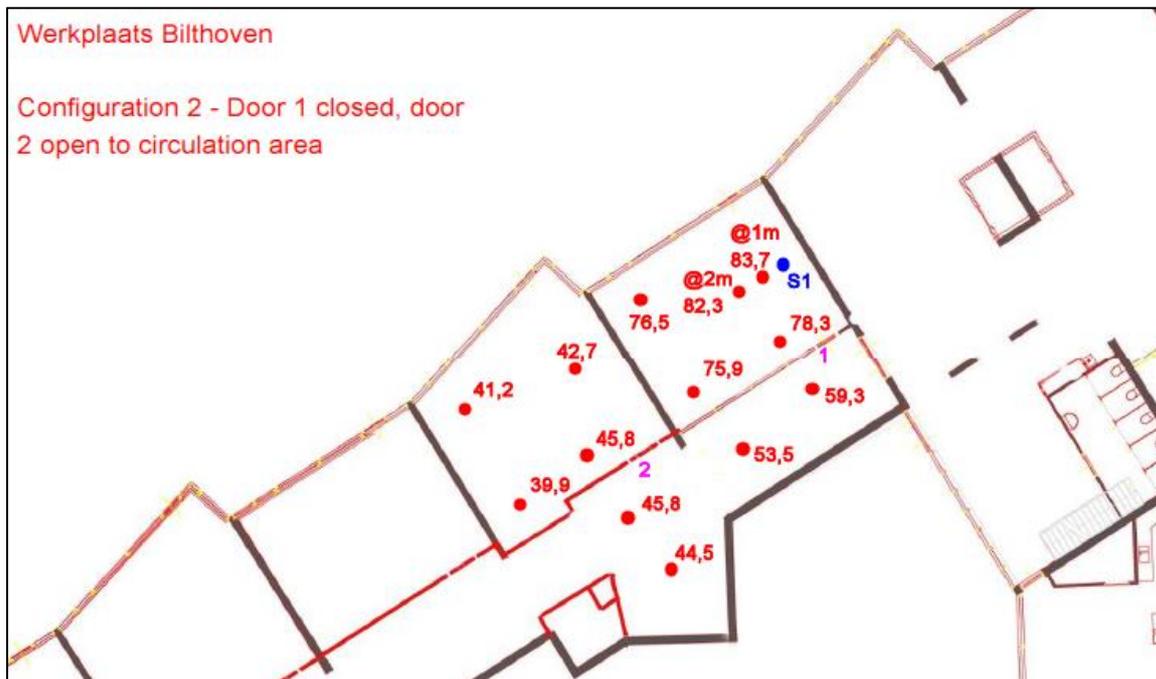
The same measurements were done in the new part of the building with the open plan layout, with the sound source on position S2.

### 3.1 Source position S1 – Classroom existing part

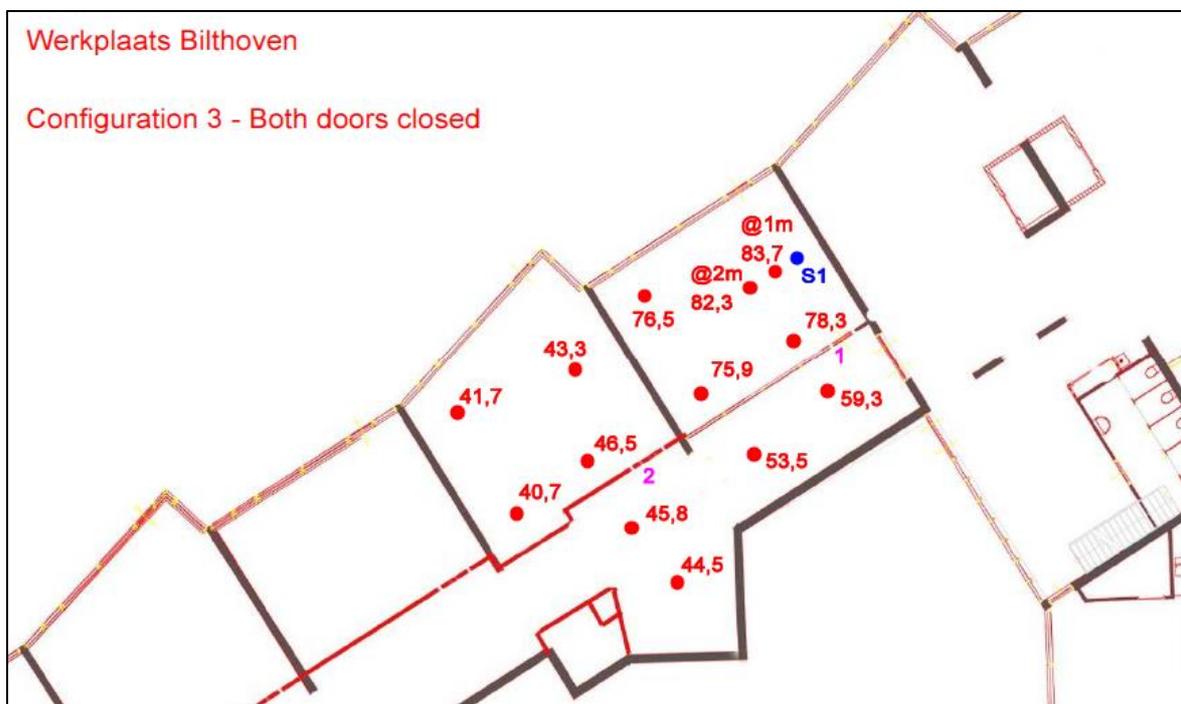
The results of the measurements with the source in position S1 are shown in figures 2-4.



**Figure 2**  
Measured sound pressure levels ( $L_{Aeq}$ ) as a result of the reference sound source in position S1, both sliding doors open.



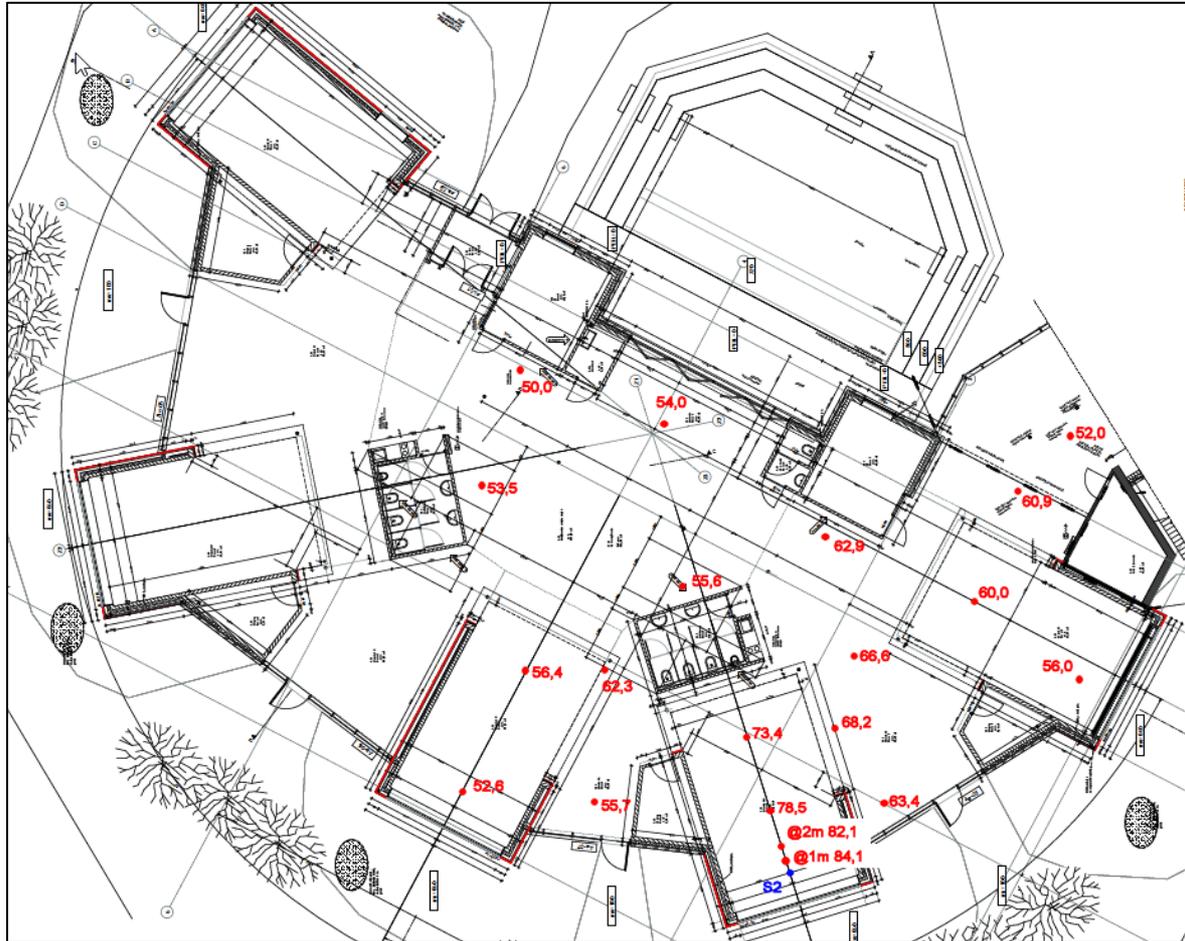
**Figure 3**  
Measured sound pressure levels ( $L_{Aeq}$ ) as a result of the reference sound source in position S1. Sliding door 1 is closed, sliding door 2 is open.



**Figure 4**  
Measured sound pressure levels ( $L_{Aeq}$ ) as a result of the reference sound source in position S1. Sliding door 1 is closed, sliding door 2 is open.

### 3.2 Source position S2 – New part of the school

The results of the measurements with the source in position S2 are shown in figure 5.



**Figure 5**  
Measured sound pressure levels ( $L_{Aeq}$ ) as a result of the reference sound source in position S2.

## 4 Conclusions

Based on the measurements the following is concluded:

- The sound attenuation in the existing part of the school is about 25-30 dB between both classrooms with the sliding doors open. This is lower than recommended standards for sound insulation between classrooms, but higher than the recommended sound attenuation between spaces in schools with an open plan layout.
- With closed sliding doors a decay of circa 20 dB was measured towards the circulation area behind the sliding doors and at least 25 dB on greater distances. This is lower than recommended standards for sound insulation between classrooms and circulation areas.
- In the open plan lay out in the new part of the school a sound attenuation on short distance (in the space for instructions/plenary sessions of circa 10 dB was measured.
- Between adjacent spaces there are great differences in measured values due to the present screens between those spaces. A drop of 15 dB was measured in the adjacent space closest to the source and 20-25 dB towards other adjacent spaces. If compared with the guidelines a partitions between adjacent activity areas the sound attenuation should achieve at least 20 dB.
- Towards the central circulation are the sound attenuation is about 30 dB.

If compared with guidelines for acoustic design of schools<sup>1,2</sup>, partitions between adjacent activity areas in open plan bases schools should achieve at least 20 dB sound attenuation. Furthermore the recommended sound insulation  $D_{nT;w}$  between classrooms should be 45-50 dB or  $D_{nT;A} = 43$  dB. Between rooms and circulation areas the sound insulation  $R_w$  of the doorset should be 30 – 35 dB or  $D_{nT;A} \geq 31$  dB.

LBP|SIGHT BV

ir. J. (Jeroen) Vugts

Appendix: 1

1 Acoustics of Schools: a design guide' by IOA/ANC dated November 2015.  
2 'Programma van eisen frisse scholen 2015' van de Rijksdienst voor Ondernemend Nederland.  
3

## Bijlage I Pictures



**Figure I.1**  
Classroom in existing part of the school



**Figure I.2**  
Classroom in existing part of the school



**Figure I.3**  
Overview of the circulation area in the existing part of the school



**Figure I.4**  
Sliding doors between classroom and circulation area



**Figure I.5**  
Open plan lay-out in the new part of the school



**Figure I.6**  
Open plan lay-out in the new part of the school



**Figure I.7**  
Open plan lay-out in the new part of the school



**Figure I.8**  
Open plan lay-out in the new part of the school



**Figure I.9**  
Open plan lay-out in the new part of the school



**Figure I.10**  
Open plan lay-out in the new part of the school