

## 0 Introduction

The guideline ISA-US-BF1 as stated by NOC \* NSF requires that a sports hall at post completion test may have a maximum reverberation time. Measuring positions and measuring the reverberation time thereby are prescribed. It is assumed that, prior to the building process, a calculation of the reverberation time is made. However, in practice, the measured reverberation time is often longer than the calculation. The purpose of this questionnaire is to identify the causes of this discrepancy.

This questionnaire is split up in two parts:

1. The guideline is the basic assumption a sports hall must meet
2. The guideline will be discussed to see if any improvements can be done, related to the guideline or the method.

## 1 The review of guideline NOC\*NSF ISA-US-BF1

### 1.1 The design proces

We assume that a database of materials and geometric data is used for the design proces.	<input type="checkbox"/> Yes I do use such a method <input type="checkbox"/> No, this can be done smarter, that is: .....
Does such a database really contain such materials or are only the absorption coefficients mentioned?	<input type="checkbox"/> Absorption coefficients <input type="checkbox"/> Materials <input type="checkbox"/> .....
From the database a calculation of the reverberation time is made. Which one do you use? Off course there are several possible answers.	<input type="checkbox"/> Reverberation formula according Eyring <input type="checkbox"/> Reverberation formula according Sabine <input type="checkbox"/> Reverberation formula according Fitzroy e.a. <input type="checkbox"/> Calculation according NEN 12354-6 <input type="checkbox"/> Calculation according a Ray-tracing model <input type="checkbox"/> Another method .....
Which one you "trust" the most to check the RT in relation to the standard.	<input type="checkbox"/> Reverberation formula according Eyring <input type="checkbox"/> Reverberation formula according Sabine <input type="checkbox"/> Reverberation formula according Fitzroy e.a. <input type="checkbox"/> Calculation according NEN 12354-6 <input type="checkbox"/> Calculation according a Ray-tracing model <input type="checkbox"/> Another method .....

And what is this “trust” based on??	<ul style="list-style-type: none"><li><input type="checkbox"/> Measurements in previously realized sports halls</li><li><input type="checkbox"/> Intuition</li><li><input type="checkbox"/> .....</li></ul>
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Do you select the absorbing materials yourself?	<ul style="list-style-type: none"><li><input type="checkbox"/> No</li><li><input type="checkbox"/> No, it is the architect who does that; he is very capable doing it</li><li><input type="checkbox"/> We do that in cooperation with the architect</li><li><input type="checkbox"/> A supplier gives advice</li><li><input type="checkbox"/> .....</li></ul>
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And how do you choose the materials	<ul style="list-style-type: none"><li><input type="checkbox"/> Experience from previous projects</li><li><input type="checkbox"/> Dutch building documentation</li><li><input type="checkbox"/> I google the web</li><li><input type="checkbox"/> I google the web, but only if the architect comes up with something special</li><li><input type="checkbox"/> The material is being measured first if the architect brings up something unknown</li><li><input type="checkbox"/> .....</li></ul>
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Do you deliberately apply scattering objects on the wall	<ul style="list-style-type: none"><li><input type="checkbox"/> Yes</li><li><input type="checkbox"/> No</li><li><input type="checkbox"/> .....</li></ul>
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How do you do this?	<ul style="list-style-type: none"><li><input type="checkbox"/> By using crooked walls</li><li><input type="checkbox"/> I use scattering objects</li><li><input type="checkbox"/> .....</li></ul>
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If you apply scattering objects, where do you apply these?

- On the entire long sides
- On the long sides, on approximately the bottom two meters
- On the entire short sides
- On the entire short sides, on approximately the bottom two meters
- On the entire short and the entire long sides
- On both the short and the long sides, on approximately the bottom two meters
- .....

Where do you find diffusion coefficients of existing materials??

- From the supplier
- I google the data
- I have the materials measured
- .....

## 1.2 The measurements after realization of the product

Do you measure the sports hall yourself first?	<ul style="list-style-type: none"><li><input type="checkbox"/> Yes</li><li><input type="checkbox"/> No, the owner of the sports hall does that or has it done by a third party</li><li><input type="checkbox"/> I measure it myself first, but the owner decides what to do in the end</li><li><input type="checkbox"/> Another method .....</li></ul>
The guideline prescribes measurement of the RT. Do you measure other acoustic variables?	<ul style="list-style-type: none"><li><input type="checkbox"/> No</li><li><input type="checkbox"/> SPL, the sound pressure level</li><li><input type="checkbox"/> G, strength</li><li><input type="checkbox"/> <math>DL_2</math>, the decrease of SPL/G by doubling the distance</li><li><input type="checkbox"/> STI, the speech transmission index</li><li><input type="checkbox"/> Other variables.....</li></ul>
In what areas/places in the hall do you measure the acoustic variables?	<ul style="list-style-type: none"><li><input type="checkbox"/> .....</li></ul>
Do you do "echo-hunting" to detect echoes or flutter-echoes? If so, what is the criterion to whether or not you call something an echo or a flutter?	<ul style="list-style-type: none"><li><input type="checkbox"/> No, I don't do echo-hunting, the reverberation time is hard enough</li><li><input type="checkbox"/> I shoot with an alarm pistol and use my ears</li><li><input type="checkbox"/> The pulse response appears on the computer screen and I use my eyes</li><li><input type="checkbox"/> I use a programme that indicates the harmfulness of echoes</li><li><input type="checkbox"/> Andere methode.....</li></ul>

### 1.3 Review of the guideline

<p>The guideline IS met. That is the measured RT is below the value as stated in the guideline.</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> The hall sounds fine and the acoustic quality is being appreciated</li><li><input type="checkbox"/> The guideline is met but "one" is not satisfied with the acoustics</li></ul>
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<p>If the guideline IS met but one is not satisfied with the acoustics, what are the complaints about?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> Still too noisy</li><li><input type="checkbox"/> The speech intelligibility is insufficient</li><li><input type="checkbox"/> One thinks the reverberance doesn't sound very good</li><li><input type="checkbox"/> There are still complaints about (flutter-) echoes</li><li><input type="checkbox"/> .....</li></ul>
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<p>The guideline is NOT met. That is the measured RT is above the value as stated in the guideline. So the measurement differs from your original calculation.</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> The end-users asses the acoustic quality as negative</li><li><input type="checkbox"/> That is strange because there are no complaints</li></ul>
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<p>How do you detect what exactly causes the complaints about the acoustics in the sports hall?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> .....</li></ul>
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<p>What causes did you encounter?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> Flutters lengthen the RT</li><li><input type="checkbox"/> The absorption is not equally spread</li><li><input type="checkbox"/> The curved roof causes strong focusing</li><li><input type="checkbox"/> All absorption is in the ceiling; not enough absorption on the walls</li><li><input type="checkbox"/> Not enough absorption in the bottom parts of the walls</li><li><input type="checkbox"/> .....</li><li><input type="checkbox"/> .....</li><li><input type="checkbox"/> .....</li><li><input type="checkbox"/> .....</li></ul>
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## 2. The guideline discussed

In spite of the NOC\*NSF guideline it frequently goes wrong. What can be the cause of this?

<p>Which acoustic characteristics determine the audible “quality” of a sports hall according to you?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> Little reverberance</li><li><input type="checkbox"/> Reverberance with a “nice, linear” curve</li><li><input type="checkbox"/> Low sound levels caused by other sources in the hall</li><li><input type="checkbox"/> A good speech intelligibility on a few meters distance</li><li><input type="checkbox"/> A good speech intelligibility throughout the hall</li><li><input type="checkbox"/> The absence of (flutter) echoes</li><li><input type="checkbox"/> The presence of (flutter) echoes</li><li><input type="checkbox"/> .....</li><li><input type="checkbox"/> .....</li></ul>
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<p>How can your favourite properties be made measurable with existing or new techniques?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> .....</li><li><input type="checkbox"/> .....</li></ul>
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<p>If the quality can only be partly measured is an additional assessment by the human ear imaginable?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> Yes, a statement by an arbitration commission should be possible</li><li><input type="checkbox"/> No, rather not. The description "avoid audible flutter-echo's" will only lead to even more discussion</li><li><input type="checkbox"/> .....</li></ul>
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<p>What is the ideal RT for the experience of the user in a sports hall?</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> .....</li></ul>
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What would you like to change or add regarding the guideline?

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