

# **ACOUSTICS**

## **LECTURE 4**

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## Reverberation time :

Because of the importance of the proper control of reverberation in rooms, a standard of measure called reverberation time (abbreviated Tr) has been established. This is the time required for a specified sound to die away to one thousandth of its initial pressure, which corresponds to a drop in a sound pressure level of 60 dB, Fig. 3.2.

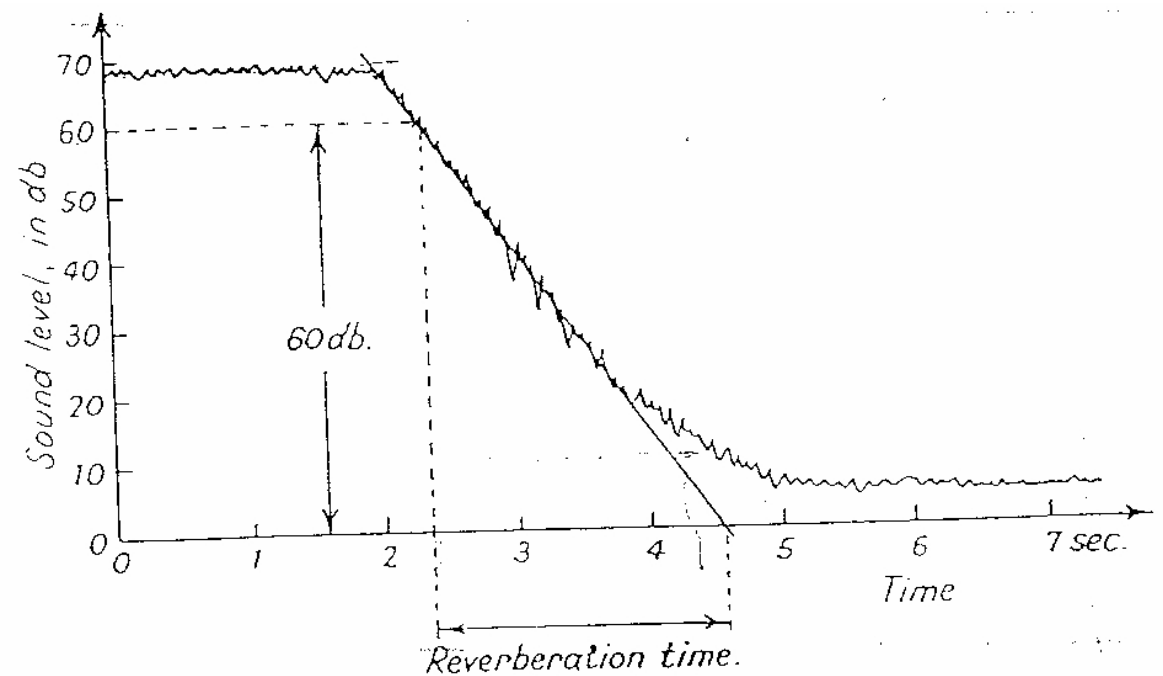


Fig. 3.2. Reverberation time

From the expression of the average decay curve it follows that the time for a decay of 60 dB is :

$$T_r = \frac{0.161V}{s \left[ -2.3 \log_{10} (1 - \bar{\alpha}) \right]}$$

( v and s are expressed in terms of meters )

$$T_r = \frac{0.049v}{s \left[ -2.3 \log_{10} (1 - \bar{\alpha}) \right]}$$

( ft units )

when  $\bar{\alpha}$  is small compared to unity,

$$T_r = \frac{0.161V}{S\alpha} \text{ sec}$$

(mt units )

$$T_r = \frac{0.049V}{s\alpha} \text{ sec}$$

( ft units )

## Measurement of reverberation time :

To measure the reverberation decay curve, an arrangement consisting of a sound source, a microphone with associated microphone amplifier, and a level recorder are necessary. As it is important to determine the dependency of the reverberation time upon frequency, either the sound transmitting or the sound receiving part of the equipment must be frequency selective.

In its simplest form such an arrangement may thus consist of a microphone, a frequency analyzer and a level recorder as shown in Fig. 4.2.

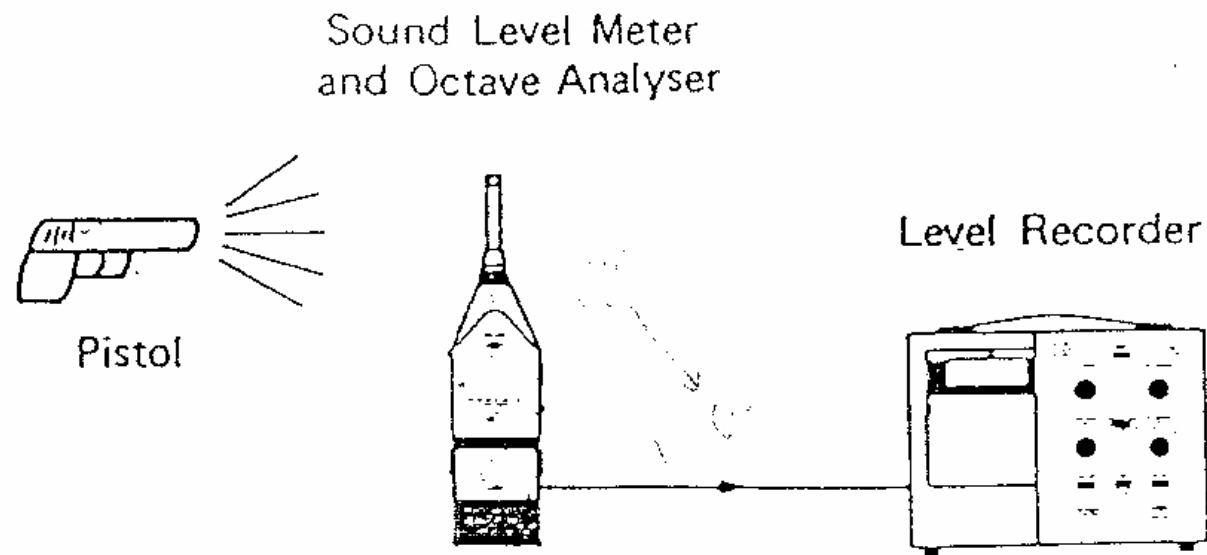


Fig. 4.2 Simple arrangement for measuring reverberation Time.

The sound is in this case produced by a shot from a gun, and it is necessary to make as many shots as the number of decay curves desired. Fig. 5.2 shows also a decay curve recorded by means of the arrangement shown in Fig. 6.2. The curve shown can be seen to be straight-lines. This is due to the level recorder's logarithmic characteristic, which of course will transform exponential function into straight lines.

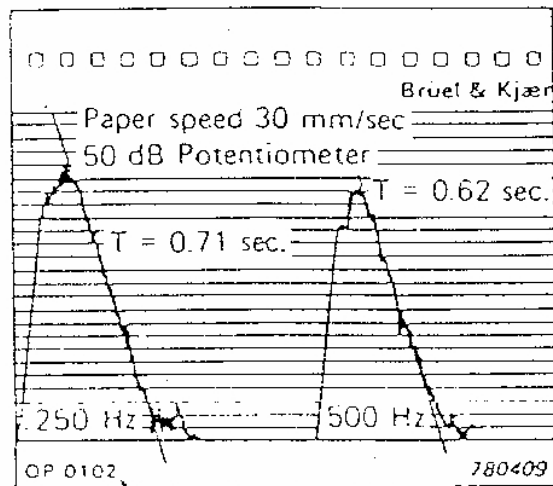


Fig. 5.2 Decay curve of reverberation time

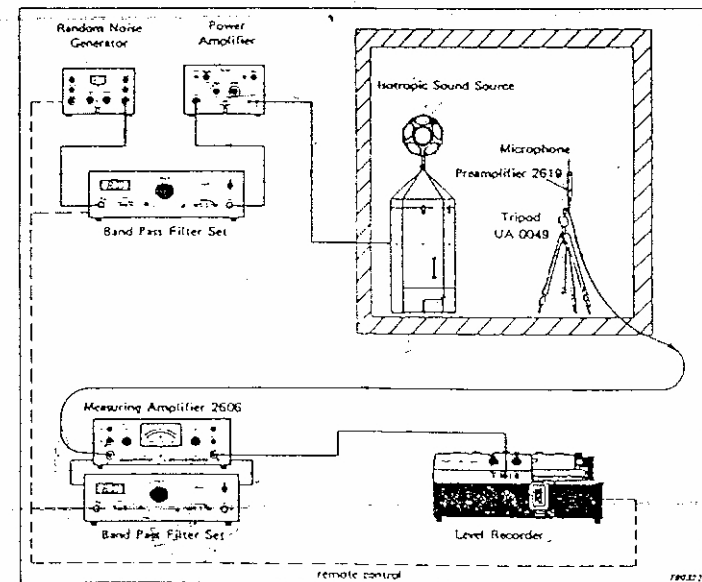


Fig. 6.2 Arrangement for measuring reverberation time

## Sound field of a sound source :

The nature of the sound field around a sound source in a room consists of two components i.e. the direct field and the reverberation field, see Fig. 8.2. fig. 9.2.

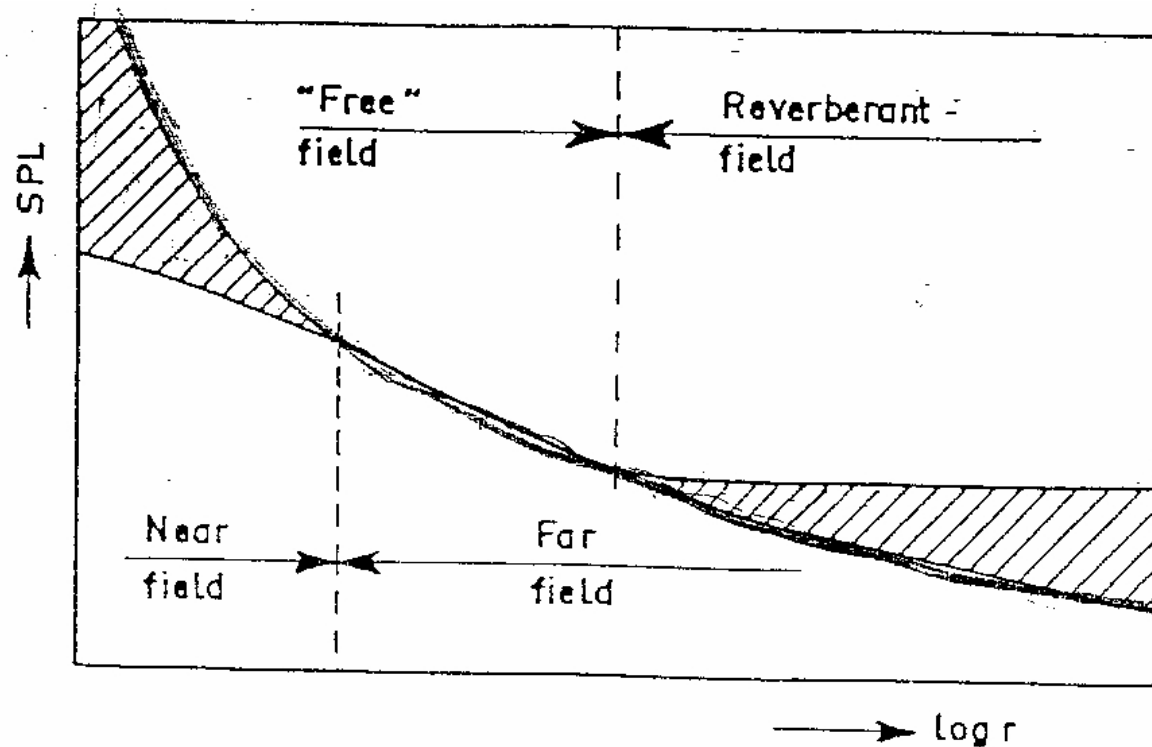


Fig. 8.2. Variation of sound pressure level as a function of distance.

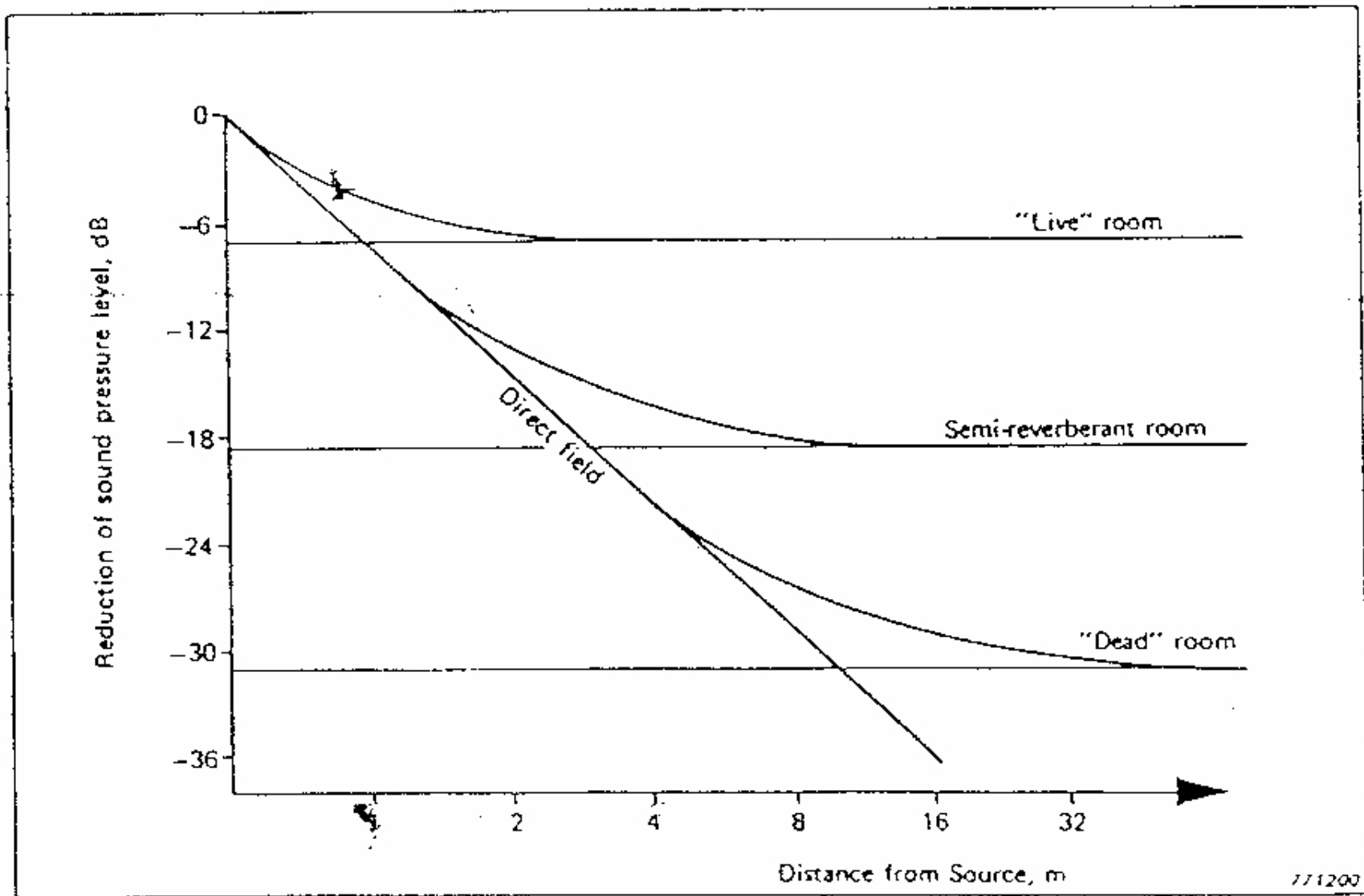


Fig. 9.2. Combination of direct and reverberation field.



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