# SOUND INSULATION

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### 1.2.6.3.3 *Non-diffuse field: non-uniform distribution of absorption*

Non-diffuse fields also occur due to non-uniform distribution of absorption over the room surfaces; one common example occurs when there is a highly absorptive ceiling but the walls and the floor have relatively low absorption. In these situations the decay curve can also show curvature or a distinct double slope as illustrated in Fig. 1.22. Considering the different modes, it is possible to make a basic qualitative assessment of the reasons for this double slope. When the early part of the decay is predominantly determined by the oblique modes (as in the previous example for the 5000 Hz band) we can expect large numbers of these modes to be rapidly attenuated as they impinge upon the highly absorbent ceiling. This gives rise to the fast decay rate in the early part of the decay curve. However, some of the axial and tangential modes will only be reflected from the side walls which have low absorption. Hence we can expect these modes to have relatively long reverberation times and contribute to the late part of the decay, which compared to the early part, will have a much slower rate of decay. The main features of the decay curve can be predicted by dividing the modes into two groups (Nilsson, 2004). The first group contains modes where the waves propagate almost parallel to the ceiling (grazing waves). In the second group the modes propagate at angles that are oblique to the ceiling (non-grazing waves). Using this grouping, the non-grazing waves determine the early part of the decay curve and the grazing waves determine the late part of the curve. Other prediction





formulae for rooms with non-uniform distribution of absorption can be found in work by Fitzroy (1959), Arau-Puchades (1988), and Neubauer (2001).