1 2 3 4 5 6 7 8 9 10

$3n_{RRM}$. This relationship between uniformity indices of mass and size is valid for nominal diameter, equivalent sphere diameter and can also be considered valid for sieve sizes. If a graded material is represented by Equation 3.12 using masses, it may also be represented by its equivalent Ros-Ram equation using nominal sizes. Masses may be converted into sizes in term of nominal diameter D_n or sieve diameter D, which should not be confused. Conversion of masses to sizes is achieved by dividing by density to give volume, the cube root of which gives the nominal diameter D_n. To plot particle size obtained as D_n in terms of sieve diameter D, divide by 0.84.

Relating theory to NUL/NLL

Given any two fixed points on the Rosin-Rammler curve, M_{50} and n_{RRM} can be determined. For example, if the nominal lower limit mass of a grading is NLL and the fraction passing at that value is y_{NLL}, and similarly the nominal upper limit mass is NUL and the fraction passing at that value is y_{NUL}, then by solving the following two equations:

$$M_{50} = NLL\left(\frac{\ln(1-y_{NLL})}{-0.693}\right)^{-1/n_{RRM}} \qquad M_{50} = NUL\left(\frac{\ln(1-y_{NUL})}{-0.693}\right)^{-1/n_{RRM}} \tag{3.14}$$

to give

$$n_{RRM} = \log\left(\frac{\ln(1-y_{NUL})}{\ln(1-y_{NLL})}\right)\Big/\log(NUL/NLL) \tag{3.15}$$

the full curve described by Equation 3.12 is given.

How the idealised standard grading curves are obtained

The position and steepness of each idealised standard grading curve is set up not only to comply with the limit requirements, but also to lie in the middle of the range of compliant specifications for that grading. Standard EN gradings (eg 1000–3000 kg) impose requirements such that y lies between 0 and 10 per cent passing at NLL (1000 kg) and between 70 and 100 per cent at NUL (3000 kg). To define each idealised grading curve uniquely and keep the system simple, each standard heavy and light grading has been constrained using Equation 3.15 at the same two percentage passing points on the curve for each pair of NLL and NUL values designated in the EN 13383 standards. The values chosen are y_{NLL} = 6 per cent and y_{NUL} = 90 per cent respectively. Theoretically, these values give designers maximum reassurance that the M_{50} plotted lies near 0.5 (NLL+NUL). The more obvious first choice of 5 per cent and 85 per cent would lead the wider idealised standard grading curves to miss 0.5 (NLL+NUL) by an unacceptable degree. The values chosen minimise these differences to within 10 per cent of the target for the full suite of standard heavy and light gradings. The only exception is the special wide grading of 15–300 kg, where M_{50} is 26 per cent lower than the average of the nominal limits. For a more typical example such as the 1000–3000 kg grading, the idealised curve gives M_{50} = 2.08 t, ie within 4 per cent of 0.5(NLL+NUL). For further details see Latham *et al* (2006).

Plotting grading curves using Rosin-Rammler

Substitute a series of mass values M_y into Equation 3.12. This will return the series of fraction passing y values needed to complete the plot. Before doing so, first set the n_{RRM} and M_{50} values needed in Equation 3.12. To plot any heavy or light standard grading designated with NUL and NLL, calculate the uniformity index n_{RRM} using Equation 3.15 with y_{NLL} = 0.06, y_{NUL} = 0.90. To obtain M_{50}, substitute n_{RRM} using either the NLL or NUL form of Equation 3.14. The resulting idealised grading curves are presented in Figure 3.20. These summarise the expectations of a purchaser of standard gradings.