Analysis of data

A review of the b data for simple trapezoidal and rectangular channels is given by Knight, Yuen & Alhamid (1994), and an equation proposed for determining the percentage of the total boundary shear force that acts on the wall (or bed) of the channel, for any aspect ratio (b/h), side slope, relative roughness distribution, and flow state (sub & super-critical). Ancillary equations are also presented for determining the mean and maximum boundary shear stresses. It should be noted that no generalised equations have been presented for the distribution of b around the wetted perimeter of particular channels shapes, due to the difficulty of generalising the influence of the secondary flow cells.

The number and position of these cells creates perturbations around a mean curve, and the distribution of b can change markedly for small changes in aspect ratio, as shown in Fig. 2 where the aspect ratio changes from 2 to 10. See also Knight & Patel (1985a&b). These data have been used by many authors (e.g. Khodashenas & Paquier, 1999; Thorne et al., 1998; Yang & Lim, 1997; Zheng & Jin, 1998), to illustrate the complexity of predicting the boundary shear stress distribution.

Much work has also been undertaken on compound trapezoidal channels (Figs 3 & 4), on pipes running part full (Figs 5-6) and other shapes such as V-shaped channels (Fig. 7), compound ducts (Fig. 8) and lenticular ducts. See Knight & Sterling (2000), Lai & Knight (1988), Sterling & Knight (2000) and Rhodes & Knight (1994) for further details. A review of some of the compound open channel flow data is given by Abril & Knight (2004), Atabay & Knight (2005) and Atabay et al. (2005). The FCF data (Knight, 1992, 1999) form one of the more complete sets of data on overbank flow. All such data are important, as open channel flow forms the basis of analysis for many practical problems related to rivers, flood defence, pollution, eco-hydraulics, drainage, sewers or hydro tunnels running part full, and sediment transport.