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Discussion: A note on uniform open channel flow in circular pipes

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I was interested to read this paper, which contains a novel version of proportional depth charts in terms of parameters Q_* and n_*. I agree that the inclusion of S_0 as proposed into the denominator of the dimensionless discharge Q_* is a definite improvement, particularly for results in the rough turbulent region that would, in practice, apply to culverts. It should be noted that this would not be precisely appropriate in the transitional turbulent region which usually applies in smaller-scale laboratory work.

I am also grateful to the authors for providing a welcome idea for a student laboratory project to investigate the results experimentally using a similar culvert to that described for the authors' experiment.

This ongoing project work, using a 50 mm internal diameter culvert, shows that all pairs of n_* and Q_{*f} values must lie exactly on the Fig. 1(b) curve, as might be anticipated from the definition of these terms. However, for flows in the transitional turbulent region, if results are gathered at various slopes, there is not one unique point on that curve for a given pipe or culvert.

In this work at the University of East London, the same data measured for Q_f and S_0 were used to calculate n and hence n_*, as well as Q_{*f}. This leads me to ask for clarification as to whether this was the procedure used by the authors, or whether independent evaluation of n was used. If the former applies, points should lie exactly on the line, and the slight differences apparent in the printed version are presumably due to rounding errors in calculations.

Concerning the authors' data, I deduce from Fig. 1(b) that the 44 mm internal diameter smooth glass pipe has a surface roughness height greater than 1 mm, which seems high. I wonder if the authors have any comment on this, and also whether they agree that if lower slopes had been taken, the resulting points on Fig 1(b) would be expected to move along the $Q_{*f} = 0{\cdot}312/n_*$ curve, simply illustrating that Q does not vary exactly with S_0 in the transitional turbulent region in which those results would lie.

P.S. I also note a typographical error and that the right-hand line on Fig. 1(a) should be $n_* = 0{\cdot}03$.

Authors' reply

The authors are grateful to Dr Marriott for his discussion and for pointing out that the parameter for the outermost curve in Fig. 1(a) should be 0·03 instead of 0·04. Since Manning's equation is used in equations (4) to (7), they are limited by the limitations of the Manning equation. As pointed out, for example by Jeppson,[6] for a pipe of given diameter, the Darcy–Weisbach friction factor f is proportional to n^2. Yet the procedure suggested in this paper, would provide a satisfactory estimate of Q_{*f} for practical purposes. Further, in the experiment with the small glass tube, a value of 0·011 was assumed for the value of Manning's n.

REFERENCES

6. Jeppson R. W. *Analysis of Flow in Pipe Networks*. Ann Arbor Science, Ann Arbor, MI, 1979, p. 42.