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SEWER DESIGN OPTIONS

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ABSTRACT

A list of available codes of practice for self-cleansing sewers is presented and a review of appraisals of minimum velocity criterion is summarised. Comparisons of newly developed "minimum velocity" criteria and "minimum shear stress" criterion are presented. Some design charts are also given.

KEY WORDS

Sewer design; limit deposition; sediment transport; self cleansing.

INTRODUCTION

Old sewerage systems were designed based on empirical rules to minimise sediment problems and these design rules are still in practice. Either minimum velocity or minimum shear which may not allow any deposition at any time or at least over a long period of time no deposits would build-up (i.e. high flows flush the deposits) govern these design procedures. In the present trend, "no deposit condition" (clean pipe) in each individual pipe is maintained by allowing flushing to take place fairly frequently and minimum velocity to be achieved under full or half-full conditions. Table 1 reproduces some of the available design criteria given in CIRIA (1987).

Ab. Ghani (1993) presented a new design criterion for clean pipe (no deposition) and another one for a pipe having loose deposited sediment bed. A summary of the development of the criteria and ranges of data used is given elsewhere (see Nalluri and Ab. Ghani 1994 a & b). Table 2 gives the newly derived criteria; equations 1 and 2 are applicable for storm sewers only (i.e. with non-cohesive sediments).

APPRAISALS OF "MINIMUM VELOCITY" CRITERION

Ab. Ghani (1993) appraised the "minimum velocity" criterion (half-full flow, clean pipe and $V = 0.75$ m/s) used by Ackers (1984) and Nalluri (1986) and in general concluded and confirmed that the velocity criterion overdesigns the slope for small pipe diameters ($D < 500$ mm) and underdesigns the slope for larger pipe diameters.

Comparisons of Ab. Ghani (1993) equations (eqns 1a and 1b) and "minimum velocity" criterion of 0.75 m/s for half-full flow in a clean pipe (Nalluri and Ab. Ghani 1994a) confirm the inadequacy of the present practice to minimise sediment deposition in pipe sewers. The results also show that the presence of a limited depth of sediment deposit reduces the slope requirement over the entire range of pipe diameters.