FLOW OF WATER IN OPEN CHANNELS, PIPES, SEWERS, CONDUITS, ETC., WITH TABLES, BASED ON THE FORMULAE OF D'ARCY, KUTTER AND BAZIN

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PREFACE.

The formulæ of D'Arcy, Kutter and Bazin are gradually, but surely, being adopted instead of the old formulæ of D'Aubisson, De Prony, Downing, &c.

The former formulæ, however, though admitted to be more accurate, are also, as a rule, more complicated in form, and more troublesome and tedious in their application, than most of the old formulæ in use. In these days, when numerous works on Sewerage, Water Supply, Irrigation, &c., are being constructed in this country, and in fact all over the civilized world, hydraulic formulæ are, perhaps, in more general use by Engineers than at any former time, and therefore, any ready method which combines rapidity with accuracy in the application of the new formulæ will, very likely, tend to their more general use than at present.

It is believed that this combination of rapidity with accuracy can be gained by the proper use of the tables in this book; and Hydraulic Engineers, who make it a practice to use the formulæ of D'Arcy, Kutter and Bazin, and to whom a saving of time and tedious computation is an object, will find the tables of material help in the solution of problems relating to the flow of water in open and closed channels.

CONTENTS.

FLOW OF WATER IN OPEN CHANNELS,

PIPES, SEWERS, CONDUITS, &c.

In the following formulæ let—

V = velocity in feet per second.

Q = discharge in cubic feet per second.

C = coefficient of mean velocity.

S = fall of water surface (h), in any distance (l), divided by that distance $= \frac{h}{l} =$ sine of slope.

a = area of cross section of pipe, conduit or open channel in square feet.

p = wetted perimeter of pipe, conduit or open channel in lineal feet.

r = hydraulic mean depth in feet = area of cross-section of pipe, conduit or open channel in square feet (a) divided by its wetted perimeter in lineal ft. $r = \frac{a}{p}$

d = diameter of pipe or conduit.

n = the natural coefficient, the value of which depends on the nature and condition of the bed of the channel through which the water flows, or in other words, its degree of roughness.

The plan on which the tables are constructed will be briefly stated here and their use will be more fully explained further on.

Chezy's general form of formula for velocity is—

$$V = c\sqrt{rs} = c\sqrt{r} \times \sqrt{s}$$

therefore

$$Q = ac\sqrt{rs} = ac\sqrt{r} \times \sqrt{s}$$

The factors on the right hand side of the equations are tabulated, $c\sqrt{r}$ and $ac\sqrt{r}$ for diameters usually adopted in practice, and $\sqrt{s}$ for 986 slopes.

Now to find the velocity, the diameter and slope being given. Look out and note down the number representing $c\sqrt{r}$ in its column and opposite the given diameter; also look out and note down the number respresenting $\sqrt{s}$ opposite the given slope. The product of these two numbers will give the required velocity. Again, given the slope and velocity in feet per second to find the diameter. From the equation

$$V = c\sqrt{r} \times \sqrt{s}$$

we have

$$c\sqrt{r} = \frac{V}{\sqrt{s}}$$

Look out the value of $\sqrt{s}$ corresponding to the given slope and divide the velocity by it. The quotient will be the value of $c\sqrt{r}$. In the column of $c\sqrt{r}$ look out the nearest number to the value of $c\sqrt{r}$ so found, and opposite to it in the same line will be the diameter required. At the same time the area and hydraulic mean depth can be found on the same line and the discharge can be found by looking out the value of $ac\sqrt{r}$ and dividing it by $\sqrt{s}$. In fact by inspection of the tables and the multiplication or division of two numbers, problems can be rapidly and accurately solved, which, by the use