Probably a great many water works managers or superintendents will say that they have tried to reduce waste by house-to-house inspections, but that either no reduction in the daily consumption has resulted, or what reduction has occurred has not been sufficient to be of any practical value. This was the situation in nearly all of the unmetered cities where the "Pitometer system" has been introduced in the past twenty years. It is a matter of interest to note that inspections had been carried on for a number of years previous to the installation of this system in Buffalo, but in spite of that fact, the consumption was gradually increasing each year. The same force which had been employed in carrying on this work was used in making the systematic inspections under the supervision of the "Pitometer," and the increase in the efficiency of the inspections is well demonstrated by the results obtained. The reason is easily explained:—

Efficiency of Work Increased

When the inspections are made under the supervision of the "Pitometer," the inspector knows the amount of waste in each block before he starts his inspections. He also knows that there will be a remeasurement after repairs have been made, and if the flow has not been reduced to a satisfactory amount, further inspections will have to be made. This arouses his personal interest and enthusiasm, and the efficiency and thoroughness of his work increases correspondingly.

All Must Curtail Waste

Every city of Canada and the United States where the consumption figures show the existence of water waste, must some day take steps to curtail this waste. The leaks will not stop of themselves, and it is not only uneconomical and impractical to continue to install new pumps, build new reservoirs and lay new mains, but in many cases it is impossible on account of insufficient supply.

The fact that a city or town has an inexhaustible water supply, as is the case of those situated on lakes or rivers, is no reason for allowing waste to exist. No matter what the conditions are, it can only be brought to the consumer at considerable expense, and it is inexcusable to permit the waste of water on this account when such waste can be eliminated and controlled at a nominal expense.

Hopeless if Too Late

The fact cannot be emphasized too strongly that when the city is actually facing a water shortage, it is usually too late to save the situation by reducing the waste. It is then almost invariably necessary to install the new pump, to build the new reservoir or to lay the new main, thereby burdening the city with a much greater expenditure. The far-seeing water works manager or superintendent will never allow conditions in his plant to reach this point, when they may be avoided by comparatively small expense and effort on his part.

A very curious situation was brought to light some years ago in a large office building, where an apparently excessive consumption caused the water officials to attach a meter to the service pipe for the purpose of arriving at a suitable charge. It was hardly to be believed, but the registration by the meter showed that more water was being consumed at night, when the building was empty save for the janitor and family, than during the day, with all the suites occupied and water being freely used by all. A careful investigation was made, and it was found that all the toilets were fitted with a very poorly-constructed ball-cock fixture, which became disarranged every night by the increased pressure in the mains. This allowed a steady flow from the tanks, down the waste pipes, that lasted throughout the entire night all over the building until the day usage again reduced the pressure. Naturally, the owners of the building had a heavy water bill, but, needless to say, the wasteful fixtures were speedily replaced by others of a better kind and this ususual and costly source of waste was closed.

PROPORTIONING OF PIT-RUN GRAVEL FOR CONCRETE*

By Prof. R. W. Crum
Iowa State College, Ames, Iowa

THE factors upon which the strength of concrete must depend are (1) the density of the concrete, and (2) the extent to which the particles are cemented together. The latter factor depends upon the amount of cement in a given volume, and upon the total surface area of the particles.

Table I.—Ratio of Cement to Aggregate Constant

Per cent of "Sand" in Aggregate, by Weight.	Proportions (1:5).	Density.	Water, per cent of dry materials.	Compressive Strength, lb. per sq. in.
42	1:2:3	0.789	9.33	1600
55	$1:2\frac{3}{4}:2\frac{1}{4}$	0.770	10.65	1200
75	$1:3\frac{3}{4}:1\frac{1}{4}$	0.737	12.65	920
95	$1:4\frac{3}{4}:\frac{1}{4}$	0.673	15.30	480

Inasmuch as numerous authorities are agreed that the density of the mixture is partly and the surface area wholly dependent upon the grading of the aggregate, and that the density also depends upon the consistency, or amount of water in the mixture, the writer has formulated for his own use the following rule for proportioning concrete mixtures:—

Use the best graded aggregate available, enough cement to make concrete of the class desired, and mix with the least

Table II.—Physical Characteristics of Aggregates Used

Sand No.	Pebbles No.	Percentage of Voids, Loose.	Loose Weight, lb. per cu. ft.	Percentage of Silt.	Specific Gravity.	Sieve Analysis: Per cent Passing Sieve No.								
						......	......	......	4	8	14	28	48	100
						Size of Opening, in.								
						1.5	0.75	0.371	0.185	0.093	0.046	0.023	0.0116	0.0058
1		39.8	99.9	4.0						100.0	67.5	25.5	6.5	1.5
2		39.3	100.7	2.0						100.0	83.5	57.0	18.5	4.5
3		42.2	95.9	9.0						100.0	72.5	37.0	12.0	7.0
4		37.9	103.0	2.0						100.0	82.0	49.5	10.0	3.8
5		40.5	98.4	4.0					100.0	82.0	58.0	23.6	5.8	1.5
6				1.3					100.0	87.0	69.5	45.2	16.0	2.0
7		45.0	91.3	7.5					100.0	79.8	55.3	28.2	10.0	3.8
8		39.7	99.8	0.8					100.0	85.2	66.5	39.4	6.2	0.3
11		41.2	98.8	2.0	2.68					100.0	87.6	43.2	11.1	1.3
12		41.3	101.1	1.8	2.75				100.0	96.4	60.1	32.9	18.2	3.8
13		42.0	99.1	1.8	2.73					100.0	76.6	39.3	9.7	1.8
15		41.2	98.7	2.0	2.69				100.0	85.2	59.7	31.6	8.6	1.2
16		39.3	104.4	1.6	2.75			100.0	92.8	61.5	35.2	17.9	9.7	2.1
17		42.3	98.5	1.5	2.72			100.0	98.0	83.9	61.3	30.6	7.4	1.6
20		40.0	100.0	2.0	2.68			100.0	99.1	87.7	63.7	33.7	9.1	2.1
21		37.7	103.6		2.66			100.0	99.4	87.3	59.8	31.5	10.2	2.1
	9	37.5	103.7	0.0		100.0	89.7	52.8	29.6	1.9				
	10	41.6	98.1	0.0		100.0	84.5	24.2	3.7	0.8				
	18	42.4	102.3	0.0	2.81	100.0	86.9	49.2	27.9	8.4				
	19	42.4	100.0	0.0	2.82	100.0	74.8	31.7	10.3					
	22	42.2	101.0	1.5	2.80		100.0	82.5	31.5	1.6				
	23	37.4	103.5	1.0	2.65	100.0	64.9	52.5	12.7	1.1				

amount of water which will yield a workable mixture for the conditions under which the concrete is to be placed.

The material to be considered in this paper is pit-run gravel, to be used without change as it comes from the pit. The problem is to establish some relation between grading and the amount of cement such that, for mixtures of the

*Paper read at the annual meeting of the American Society for Testing Materials, June 24th to 27th, 1919.