was substituted for a portion of the water and in the proportion of one to twenty.

TABLE 1.
RESULTS OF TESTS OF METHODS OF WATERPROOFING CONCRETE
(Pressure, 15 pounds per square inch.)

Specimen.	Seepage (Duration of test-7 hours.) Cu. Inches per Sq. Inch.	Cu. Centimtrs. per Sq. Centimtr.	Gals. per Sq. Ft.	T'l Seepage in Cu. Centimts.
Perfect Mixture	1.53	3.99	3.22	721
Concrete (1-2-4)	6.30	16.6	13.85	3,000
Concrete with				
Clay-5%	0.85	2.20	1.78	398
Clay-10%	0.12	0.31	0.25	56
Concrete with				
Fine Sand- 5%	4.86	12.65	10.21	2,290
Fine Sand-10%	1.20	3.12	2.51	565
Concrete with				
Hydrated Lime- 4% ..	0.71	1.83	1.48	332
Hydrated Lime- 6% ..	0.24	0.62	0.50	112
Hydrated Lime- 8% ..	0.10	0.27	0.22	49
Concrete with				
Medusa- 2%	0.92	2.49	2.01	450
Medusa- 4%	0.	0.	0.	0.
Concrete with				
Maumee- 4%	0.23	0.61	0.49	110
Concrete with				
McCormick	0.17	0.44	0.36	80
Concrete with				
Ceresit	1.98	5.03	4.22	928
Concrete with				
Toxement- 4%	0.	0.	0.	0.

The dry waterproofing compounds and the hydrated lime were added to and thoroughly mixed with the cement before wetting. The tests covered by table 1 were all carried out with a pressure of water of slightly over fifteen pounds per square inch and for a period of seven hours. Care was taken to avoid error due to evaporation.

Further tests showed that the quantity of seepage was approximately proportional to the pressure applied and that there was no material cessation after an application of pressure for eighteen hours.

TABLE 2.
Results of Tests to Determine Effect of Waterproofing Materials upon the Tensile Strength of Neat and Mortar (1:3) Briquettes.

Waterproofing materials added.	How added.	Per Cent. added.	Tensile Strength Neat 7 dys.	Neat 28 dys.	Mortar 1-3 7 dys.	Mortar 1-3 28 dys.
McCormick "A" from St. Louis.	Combined with cement at mill	...	797	740	205	307
McCormick "B" Local	Combined with cement at mill	...	513	577	199	220
Ceresit	In place of water	5	642	669	311	375
Moulding Sand...	In place of sand*	5	698	743	176	368
Moulding Sand...	In place of sand	10	636	642	177	510
Hydrated Lime...	Added directly ..	5	749	651	387	511
Hydrated Lime...	To dry cement...	10	608	635	371	505
Clay.............	In place of sand*	2.5	753	737	235	344
Clay.............	In place of sand	5.0	718	912	221	401
Clay.............	In place of sand	7.5	644	802	344	327

*In the case of the neat briquettes the amount of sand and clay added were percentages of the dry cement.

Tests were made to ascertain if the addition of the sevral waterproofing materials in varying amounts reduced the tensile strength of neat and 1:3 mortar briquettes. The results of this study are given in table 2.

As a result of these investigations, concrete to be used in wet localities has been made by the substitution of 10 per cent. of the regular (Ohio River) sand by a like amount of fine moulding sand containing some clay. The first test of this mixture was in the reconstruction of a fire cistern in private property. This cistern was filled with water soon after its completion and the leakage was so slight, if there was any at all, that after a period of forty-eight hours, there was no perceptible reduction in the height of the water in the neck of the cistern, twenty-one inches in diameter. The cistern was ten feet in diameter and contained a depth of thirteen feet of water. Since this test several sewers have been built of concrete made in this way with uniformly satisfactory results, so far as it has as yet been possible to test the structures.

ASPHALT PAVEMENT THICKNESS AND GUARANTY PERIOD*

By J. W. Howard, Consulting Engineer.

City officials, taxpayers and bonding companies are all directly and financially interested to see that pavements are laid of good quality and full thickness. The entire public, which uses streets in one way or another every day is directly and indirectly put to a loss and inconvenience, when an asphalt or other pavement is of poor quality or of less thickness than it should be.

Efforts have lately been made by either the open or secret agents of a few asphalt contractors to have the thickness of the asphalt pavement wearing surface and of the binder reduced. This effort has been made since the practically united action of the bonding companies to refuse to furnish guaranty bonds for the quality or maintenance of an asphalt pavement for longer than a period of five years. The reduction of the thickness of an asphalt pavement surface, when first constructed, to less than two inches and of the binder to less than one and one-half inches, to depart from that which is the best practice in regard to durability and subsequent economy.

Since the report on the "Use and Abuse of Pavement Guarantees," reprinted in pamphlet form, supplied on demand by the writer, there is every evidence that city engineers, taxpayers and bonding companies practically agree with the following statement made in that report: "A guaranty bond takes a pavement from the control of the engineering department and puts it for a long period as a burden on the legal department of a city which is an unsatisfactory, slow and uncertain way to convert a poor pavement into a good one, and it is not for the interests of cities to require guarantees beyond such a period as will bring out defects due to neglect or accident and that such defects appear within one or two years. Two years are sufficient to demonstrate the quality of a pavement laid under inspection of a competent man in any city. Taxpayers wish a good pavement on a street and not a bond in a city hall."

The quality and thickness of an asphalt or other pavement, from the standpoints of municipal engineers or others who design it and inspect its construction, and those who pay for the pavement, should not be influenced by a guaranty or absence of guaranty. Pavements must be laid of full

*From a paper read before the American Society for Municipal Improvements.