TABLE III.—EFFECT OF SIZE AND GRADING OF AGGREGATE AND CONSISTENCY OF CONCRETE

Compression tests
Age at test, 28 days
Sand and pebble aggregate

Six by 12-in. cylinders, hand-mixed concrete
Stored in damp sand; tested damp
Each value is the average of five tests made on various days

		Water		Aggregate				Surface Area		Concrete			
Ref. No. (1)	Mix by Volume (2)	Relative Consistency (3)	Ratio to Cement (4)	Size, Inches (5)	F.M.* (6)	Weight, Pounds per Cubic Foot (7)	Density (8)	Square Inches per Pound of Aggregate (9)	Square Inches per Pound of Cement (10)	Weight, Pounds per Cubic Foot (11)	Density (12)	Yield† (13)	Compressive Strength, Pounds per Square Inch (14)
				Nominal Mix for 0–1½-inch aggregate, 1:2½:5									
15	1:6.7	1.00	0.91	0–1½	5.67	125	0.755	923	8,280	152	0.846	0.978	1,640
16	1:5.4	1.05	0.91	0–¾	5.09	124	0.743	1,052	7,500	151	0.828	1.006	1,800
17	1:3.7	1.13	0.91	0–⅜	4.10	121	0.725	1,737	8,300	145	0.768	1.115	1,760
18	1:2.5	1.21	0.91	0–4	2.99	112	0.671	2,601	7,750	139	0.696	1.241	1,950
19	1:2.2	1.23	0.91	0–8	2.58	108	0.648	3,056	7,730	136	0.669	1.299	1,630
20	1:1.9	1.29	0.91	0–14	2.24	105	0.629	3,695	7,840	134	0.643	1.377	1,940
21	1:1.2	1.50	0.91	0–28	1.81	102	0.611	4,494	5,860	135	0.603	1.685	2,000
													Average 1,820
				Nominal Mix for 0–1½-inch aggregate, 1:2:4									
22	1:5.4	1.00	0.80	0–1½	5.67	126	0.755	923	6,680	152	0.842	1.003	2,230
23	1:4.3	1.05	0.80	0–¾	5.09	124	0.743	1,052	5,980	150	0.814	1.050	2,130
24	1:2.9	1.13	0.80	0–⅜	4.10	121	0.725	1,737	6,480	144	0.754	1.183	2,550
25	1:2.0	1.20	0.80	0–4	3.00	112	0.671	2,604	6,210	139	0.690	1.322	2,160
26	1:1.7	1.22	0.80	0–8	2.58	108	0.648	3,056	5,970	136	0.658	1.418	2,280
27	1:1.5	1.26	0.80	0–14	2.24	105	0.629	3,695	6,180	132	0.625	1.522	2,440
28	1:0.9	1.47	0.80	0–28	1.81	102	0.611	4,494	4,390	135	0.594	1.937	2,400
													Average 2,310
				Nominal Mix for 0–1½-inch aggregate, 1:1½:3									
29	1:4.0	1.00	0.69	0–1½	5.67	126	0.755	923	4,950	152	0.832	1.054	3,100
30	1:3.2	1.04	0.69	0–¾	5.09	124	0.743	1,052	4,450	149	0.799	1.120	2,970
31	1:2.2	1.11	0.69	0–⅜	4.10	121	0.725	1,737	4,930	144	0.743	1.273	3,390
32	1:1.5	1.16	0.69	0–4	3.00	112	0.671	2,601	4,650	139	0.679	1.463	3,270
33	1:1.3	1.20	0.69	0–8	2.58	108	0.648	3,056	4,570	136	0.651	1.570	3,220
34	1:1.1	1.22	0.69	1–14	2.24	105	0.629	3,695	4,540	132	0.615	1.740	3,200
35	1:0.7	1.37	0.69	0–28	1.81	102	0.611	4,494	3,410	129	0.565	2.308	2,930
36	1:0	1.92	0.69	....	Neat	...	.....	.....	.....	132	0.467	.....	3,230
													Average 3,160

*Fineness modulus of aggregate.
†Yield was calculated on the basis of the original volume of dry aggregate.

the coarser sizes. Our experience indicates that the quantity of water required for these fine sands is not in proportion to the amount that would be suggested by the surface areas.

The area of a tetrahedron is 25 to 30% greater than that of a sphere of the same volume, or one having a diameter equal to the height of the tetrahedron. Our experience in testing concrete made of crushed aggregates as compared with rounded pebbles does not indicate that there is any discrepancy in the quantity of water required, as would be suggested by the surface-area method.

The computation of surface-areas begins at practically the same point where the determination of the fineness modulus ends. There appears to be little room for question as to which of the proposed methods is the more simple in application.

No doubt, the surface-area method could be worked out so that it would apply over a limited range. In fact, almost any function of the size of particle could be used in this way. This would be equivalent to representing a portion of the curve by a line or by an arc of different curvature.

(NOTE.—The foregoing article by Prof. Abrams is abstracted from a letter to the editor of "Engineering News-Record," of New York, and was written in reply to a letter by Capt. Edwards defending the surface-area method of proportioning mortars and concretes. It is of special and timely interest owing to the announcement by Mr. Young of his tests supporting Capt. Edwards' method. It is to be hoped that we will be able to publish in early issues further discussion by Capt. Edwards and Mr. Young of the points raised by Prof. Abrams.—EDITOR).

ASPHALT ASSOCIATION ENGAGES ENGINEERS

PROMINENT federal, state and municipal engineers are included in the newly-formed staff of the Asphalt Association, whose headquarters have been established at 15 Maiden Lane, New York City, under the direction of J. E. Pennybacker, secretary.

There will be a Research and Technical Department managed by Prevost Hubbard, Chief of the Research and Testing Division of the United States Bureau of Public Roads prior to his affiliation with the association. Mr. Hubbard is one of the foremost authorities in the United States on research work in all classes of bituminous materials and is the author of standard text books on the subbect.

Field engineers who will devote their attention to aiding state, county, and municipal authorities in the working out of their highway problems, include Fred W. Sarr, who was Deputy State Highway Commissioner of New York in charge of the maintenance, repair and reconstruction of all state and county highways comprised in New York's system.

A. T. Rhodes, for years street commissioner of Worcester, Mass., and later secretary of the Granite Paving Block Manufacturers' Association, and who is vice-president of Massachusetts Highway Association, will look after the New England territory and other eastern points. Mr. Rhodes' practical experiences included the design and installation of the city asphalt plant at Worcester and the construction of the asphalt pavements of that city.

At the Chicago office of the association, J. B. Hittell, formerly city engineer of Chicago, and president of the Illinois Society of Engineers, will be in charge of the work of the association in the middle western states.

A branch office will soon be established in Atlanta, in Canada and elsewhere, and announcements will be made of the engineers selected for the various posts.

The Supreme Court of Canada has dismissed the appeal of the city of Toronto from the decision of the Board of Railway Commissioners for Canada, concerning the application of the Toronto Terminals Railways Co., for authority to lay and maintain steam lines across various city streets. The new Union Station will now be heated by the exhaust steam from the Toronto Electric Light Co.'s plant.

A. S. Clarson, general secretary of the Association of Canadian Building and Construction Industries, is soliciting subscriptions of $100 and upwards from prospective direct members of the association. These contributions are being solicited to meet the expenses of the association until formal adoption of constitution and by-laws, after which the officers of the association hope to be able to meet expenses out of the regular fees to be collected from a definite list of members.