You will find an article in the Paving Journal of April, 1896, with reference to these proportions, and his investigations.

In Toronto, excellent concrete for roadway foundations is made by using the proportions of one, three and seven, but in Vancouver, I am using one, two and one-half and six, as I have found it advisable to reduce the quantity of sand as much as possible, owing to its being of inferior quality.

Yours truly,

W. A. Clement,
City Engineer.

Vancouver, January 24, 1908.

CONCRETE SPECIFICATION.

Sir,—"Associate" is under the impression that the wording of his specification is loose. And it would appear in the same light to many others. It is clear and precise. There is no ambiguity about it. The term "1:3:5" is only used in journalism or letter writing, and the "initiated" only understand its true meaning. The specification reads in this manner: "One measure of Portland cement, three measures of sand and five measures of broken stone." Then they go on to define the above ingredient in this way: "The cement shall be of such a brand as to stand a tensile strain of so many pounds per square inch after so many days of immersion in water, so many hours to dry before being broken. The sand shall be clean, sharp sand. It may be bank, pit, river, or sea-shore sand. The stone shall be of sound, hard, durable rock, broken to pass through a 2 or 2½-in. ring." Then it specified how to assemble all this material on a strong platform of such a length and breadth and thoroughly water-tight; that the sand be spread evenly on the platform, then the mixture turned so many times when dry and so many times when wet; that this mortar be spread out evenly, the crushed stone sprinkled with water, then thrown on the mortar and turned so many times before being deposited—that is the first way. Another way is that the sand, cement and broken stone be all assembled together on a platform, and turned so many times dry and so many times wet—that is the second way.

If mixed by mechanical contrivance, it may state that a very small quantity of water be put in first. This is to act as an oil to keep the blades and drums clean, then the sand, cement and broken stone are all put in together. So many revolutions dry, then, on the addition of water, so many revolutions. It is then ready to be built. Suppose that it is gravel. It has first to be ascertained how much sand it contains. This generally turns out to be from 3 to 3½ cubic feet of sand in every 8 cubic feet of concrete. Those eight cubic feet just suit the bags for all practical and general purposes.

Now that the specification is defined the next process is to work by measure. All cements are parcelled in cotton bags, which contain almost a cubic foot, that being so if it is gravel cement. Then the measure for one bag will be 4 feet by 4 feet by 6 inches. If sand and broken stone, and the true measure is required, it will be sand 3 cubic feet; broken stone 5 cubic feet. That is your specification, and that is how the engineer speaks in his specification. The engineer never made this one. He had nothing at all to do with it. His specification is this: "For Portland cement concrete, one measure of cement, two measures of sand and three measures of broken stone, as already defined." When he does alter this it is always to enrich it by taking one part of the broken stone off, which would be 1:2:2. The enquirer takes no chances—leaves nothing to Bumbleton to lay his claims or clutches upon. It took a cleverer character than Bumbleton to scheme and devise that 1:3:5 affair. Personally, I do not know the copyist nor his ways. I have met this tribe. They are numerous in all nations.

The engineers are using this specification without question. Why do they use it? That reason is not far to seek. This is a comparatively new building agent that has crept into the building world. Engineering is a very conservative profession, and rightly so. There were only a few in the earlier days that had courage to venture upon the unknown substance. The majority held back and conducted this work with the older and tried methods. Then another tribe stepped in, got hold of the original specification, and to make it appear as their discovery they clapped on two to the broken stone and two to the sand, which made it appear thus: 1:3:5. They then sounded their horn that this was the cheaper and best, and got many companies and corporations to swallow this dose. That they got in is certain, or there would be no occasion to write this letter. Whenever this specification has been carried out to the letter, it has proved disastrous to the undertaking and to the reputation of good men. Engineers did their very best to carry out the 1:3:5, and said that it was only a pure mass of stones, but porous for certain mentioned works, and to obviate this a three-inch facing of the three parts sand and one part cement made into mortar, this mortar facing was built simultaneously with the 1:3:5 concrete. To make the concrete water-tight was the honourable object the engineers had in view. The object of this three-inch mortar facing was not to make walls water-tight. The object was to have a smooth face and not rob any mortar from 1:2:3, and not to disturb the form or destroy the polish by facing up with a trowel and sometimes a shovel. That was the threefold object of this mortar facing. The engineer's water-tight facing is as follows: "One measure of cement, two measures of sand, and two measures of broken stone to pass through an one-inch ring. When this 1:2:2 was made into concrete, it was built as a six-inch face lining and built simultaneously with the 1:2:3 by using dividing boards, the mortar of the 1:2:2 and the 1:2:3 was the same so that they comingled and cohered together. That engineers now recognize that cement concrete is to be greatly used is indicated by the fact that they give it what they did not give it in the early days—a more hearty recognition. And I am in the hopes that I may live to see this 1:3:5 rejected as unfit for any work but street bottoming, and not too good for that either. Engineers or the Government will yet by a Royal Commission look into this, and when they do so, it will be found that three cubic feet of mortar will not envelope five cubic feet of angular cubes. Showing that if it cannot envelope every cube, then it cannot be solid, and, if not solid, then it can be neither wind nor water-tight. And thus this original 1:2:3 will become the standard specification by statute. It would require to be so for public safety. 1:3:5 is much more costly, as there is two cubic feet always to be broken and paid for when there is no necessity. The 1:2:3 was ordained to carry a far greater burden than the "2." Some say 35 per cent, some say 40 per cent. I had to burden it to 60 per cent., and made splendid, sound and solid work by rubble displacers on an extension sea wall. Not one discovery that can be mentioned, but had its origin, lowly and simply be it, in any of the sciences. But the sharks are on the prowl. They scourge mankind with their ferocity and voraciousness. They must have their snouts plunged in, and as they cannot do it by honourable means, then by any means—by robbing other men of their labourers.

Let "Associate" stick to his specification, carry it out to the best of his ability. He is just on the same road as a great many others, but if he does his best that is all the best can do.

So long as the 1:3:5 specification is maintained, so long will there be eternal warfare between those who are in charge of works and the execution. Were I writing for the remaining days of my existence, this 1:3:5 would keep me going to explain and expose the low, mean products that I have witnessed.

O. Fraser.

Port Colborne, Ont.

VERTICAL CURVES.

Sir,—I would be pleased if some of your readers would tell of their experience with vertical curves. I have not as yet been able to secure a suitable method of running in vertical curves. A method both accurate in mathematics and yet simple enough to be used in the field. Yours,

Niagara, February 1908.