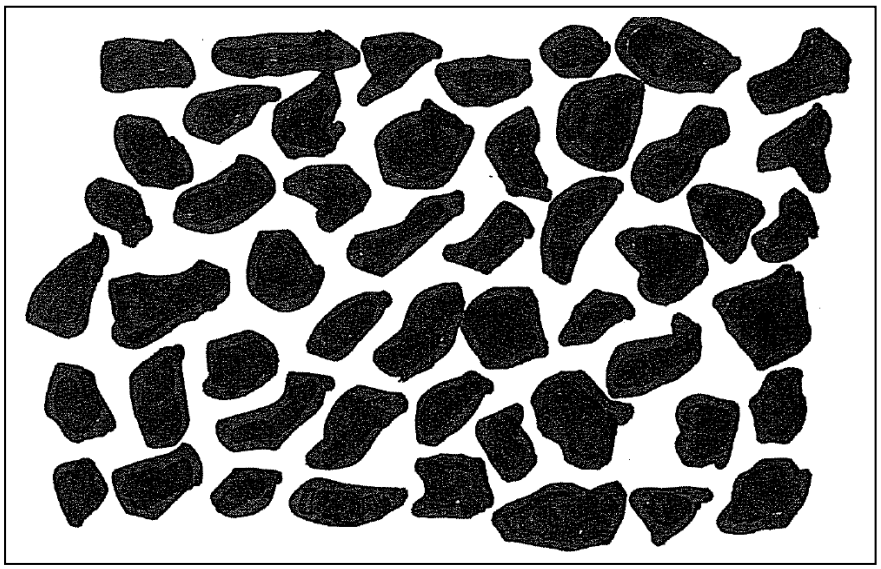
# LOOKING FOR WHAT IS THE IDEAL BLEND 1



Material Retained  Plus Cement

- 100% coarse particles passing 3/8 and retained on # 4.
- Illustration of cut away section of concrete
- Poor gradation since too many voids between particles and cement
- Weak structure not usable in manufacture of concrete masonry units (CMUs)
- Gradation improvement necessary

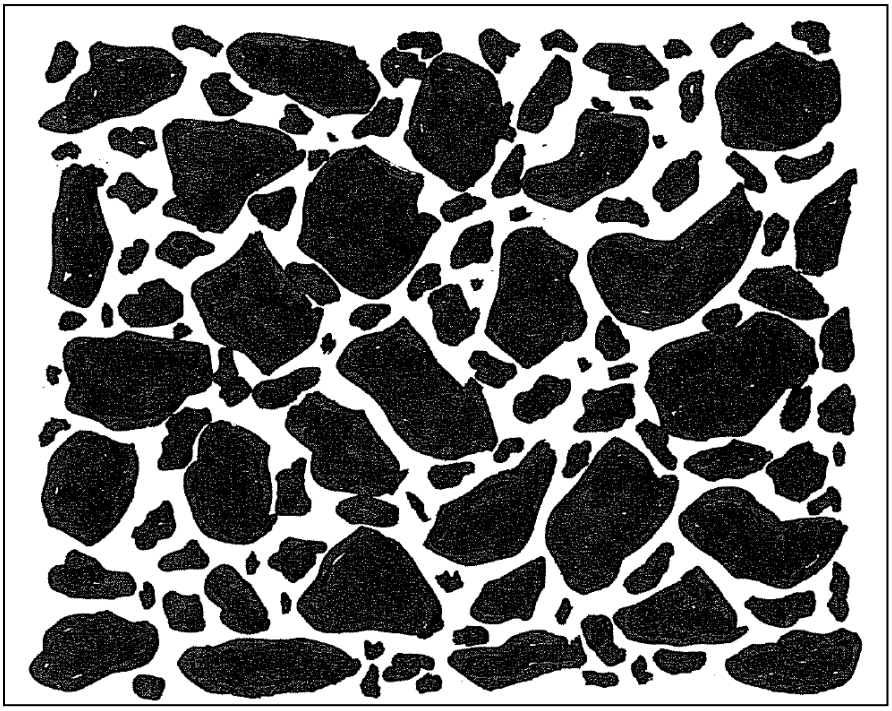
## INFLUENCE OF GRADTION ON DENSITY

The number 1 illustration above gives you a cut away section of the worst possible gradation of materials that might be used in a concrete product. It is intended that the graphic view shown will demonstrate what occurs if 100% of the aggregate passed a 3/8" (9.5mm) sieve and was retained on the # 4 (4.76mm) sieve. This coupled with the normal amount of cement water paste would produce a form of concrete that would have

many large interconnecting voids. As we increase voids in concrete we decrease impermeability with the result being a very porous concrete. We liken this example to a cubic foot of ping - pong balls and the normal amount of cement mortar paste. In such a hypothetical case, it can be seen that each ball would make only a very slight contact with the rest of the mass which would furnish and extremely weak structure and one of the very poorest nature.

On the following three graphs it can be seen that as the gradation of material improves the density becomes greater thus reducing the voids.

## SLIGHTLY IMPROVED BLEND 2



Material retained  Plus cement

- 70% coarse passing 3/8 and retained on #4.
- 30% No. 8 – 16 added
- Add No. 8 – 16 to produce more dense concrete by reducing voids and increasing contact between particles and cement
- Not usable since numerous interconnecting voids produce permeable concrete

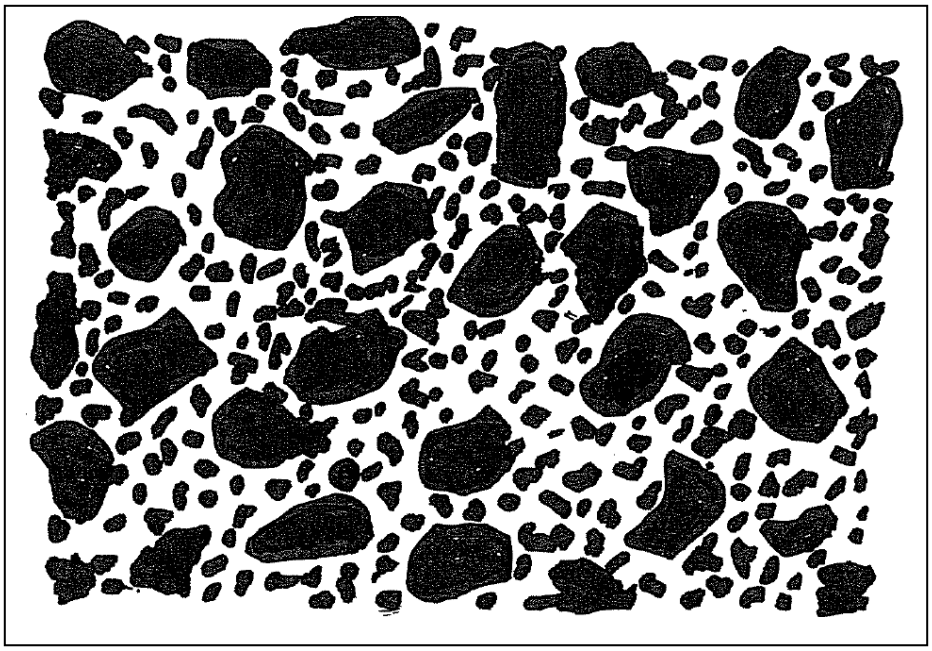
## SLIGHTLY IMPROVED BLEND CONTINUED
## 2

Number 2 Illustration shows that we have taken a step toward improving the blend by adding material of the No. 8 (2.38mm) and No. 16 (1.19mm) sieve size which in turn reduces the percentage of coarse material as shown on the preceding page. Using the same amount of cement water paste, this presentation show that we are reaching for more dense concrete thus reducing the voids and making more contact between the cement coated particles.

There can be no more questions that this first step with proper mixing and block machining would densify the concrete produce greater strength.

We still have a good portion of interconnecting voids and mix that has by no means reached a point where this could be considered tight impermeable concrete. As we proceed with this graphic presentation, we hope to show that proper gradation plays an important part in the making of quality concrete and also has a great bearing on the amount of cement to be used.

## MORE BALANCED BLEND
## 3



Material retained  Plus cement

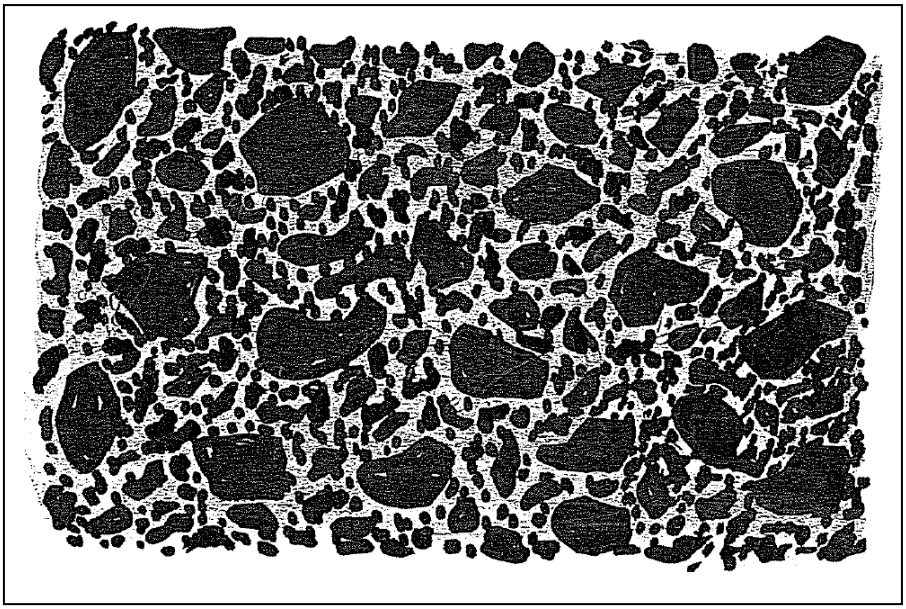
## MORE BALANCED BLEND CONTINUED
## 3

Step 3 shows that we are improving the blend by a better gradation of material. Here we have added material from the No. 30 (.594mm) and 50 (.284) sieve size which again reduces the amount of larger pieces and starts to bring the mass into a more balanced blend. While there are still interconnecting voids, we are reducing these voids which affords a decided improvement in the impermeability of the concrete.

For all practical purposes, this would still be considered a poor concrete because of a lack of important mortar making sizes of aggregate, namely those sizes from the No. 100 (.149mm).

The whole story in these four graphs shows the importance of a proper material gradation and the part it plays in producing quality concrete.

## OPTIMUM BLEND
## 4



Material retained  Plus cement

## OPTIMUM BLEND CONTINUED 4

Finally, as you can see from the illustration on step 4 from the illustration on previous page, material of all the sieve sizes has been included to produce concrete of maximum density.

The addition of 15% of No. 100 (.149mm) sieve and pan size material pass the No. 100 (.149mm) sieve now makes concrete of a more plastic nature. The larger No. 4 (4.76mm) size material has again been reduced and the mortar making materials or last two sizes have taken its place.

Many experts in the field of the concrete industry have proven that gradations of material close to his blend will produce quality units, when core mixing and curing application are employed.

The illustration shows that the larger all one size particles have now been reduced to a point where each one is surrounded by smaller particles, which in turn are surrounded by still smaller particles and so on until the most dense possible mass is the end result.