MIXER EFFECTIVENESS MEASUREMENT - TIME OR INTENSITY

The index of mixing difficulty for different materials and other confirmed testing/research establishments is at its most difficult for paving concrete.

Rapid mixers have been developed using large blades in a specially phased relationship which has been established by testing to give the most thorough mixing possible with a wide range of products. They use gears to keep the shafts in the correct phasing relationship. The relationship between each mixing blade interaction must be constant for repeatable and continuous quality.

"Retention Time" is not a meaningful measure of mixing intensity for a continuous twin shaft mixer. What matters is the number of blade interactions with the material and the intensity of those interactions. Consider the following cases:

MIXER COMPARISON:	OTHER RETENTION MIXER	RAPID HIGH INTENSITY MIXER
Blades	10	72
Blade Size	0.1 m2	0.3 m2
Speed RPM	10	110
Retention Time in seconds	60	15

It is not difficult to grasp this concept by recognizing that the larger number of bigger blades of the Rapid High Intensity Mixer, running at a much greater speed will provide much more intense and therefore, thorough mixing.

Many specifications refer to "retention time" and call for reversible blades to increase the mixing thoroughness. From extensive tests, Rapid has found that the reversal of blades and restriction of the throughput by installation of wires intended to increase the retention time, have no measurable effect on the performance of a properly designed mixer other than to slow it down. (For poorly designed mixers, those measures may have some effect.) Application of such a specification approach is like substituting myth for scientific method.

Because HIGH Intensity mixers, as developed by Rapid, mix in a collision mode rather than by slowly turning and folding the material, evaluation approaches arising out of the "drum" mixer experience, or from rotating blade batch mixers such as "pan" mixers, are not relevant. The Rapid mixing index has been formulated to better define the performance expectations of a twin shaft mixer.

THE RAPID **MIXING INTENSITY** INDEX (**MI**)

*Number of of mixing faces **X** speed (r.p.m.) **X** shaft centers (m.) **X** blade size (m2) **X** phasing factor **X** pre-mix factor.*

For a high intensity Rapid mixer, the phasing factor is taken as 1.00. For most other types of mixers, the factor is between 0.7 and 0.9.

If the fine binder components, such as cement, are all pre-divided to each side of the mixer before entering the mixer, the disbursement of the binder is more rapid and thorough. In the Rapid layout, where this is practiced, the pre-mix factor is taken as 1.0. However, if the cement is loaded onto the aggregate belt or dropped into the mixer all in one place, a factor of 0.7 or less is applicable. Greater factors of up to 1.2 can be applied for pre-slurred binder mixes.

For thorough mixing, mixer intensities of more than 55 for Roller-Compacted Concrete (RCC) have been established as being necessary to match field results with laboratory results. For treatment of toxic wastes, a minimum index of 80 is also recommended.

The power consumption of a continuous mixer varies for low strength cement treated base with fine cohesive sandy materials, which are suitable for road base, or in the sealing of waste contaminate areas. To ensure thorough mixing of all kinds of materials, power available to the mixer should be at least 0.75 Kw per compacted cubic meter per hour of throughput. Less powerful mixers cannot properly mix the more difficult materials.

Mixers with the following features may not produce satisfactory results in all cases:

- Mixers which run at relatively low speed (less than 110 r.p.m.)
  - They will have a low mixing intensity
- Mixers which have a small number of mixing faces of small size
  - Calculate the mixing intensity (MI) and be careful about applying such mixers to critical mixing tasks.
- Mixers of low specific power availability
  - Less than 0.5 Kw per m3 can only be safely used for clean washed and graded aggregates. The mixing thoroughness of mixers with less than that would require test investigation and verification.

Continuous mixing technology, if correctly applied, can produce results of amazing consistency and productivity. If all factors are not correct, the results can be very poor. This technology is intolerant of compromise upon correct practice. Poor results are usually the accumulation of a number of seemingly small compromises. The best way to be sure is to use a Rapid system which has been designed from the start for efficient and thorough mixing on a continuous basis.