

High Quality Concrete without Using Any Special Materials!

SEC[®] concrete method improves quality of concrete by changing mixing procedure

Water is charged in two steps to stabilize and raise the quality of concrete. The quality of concrete is significantly affected by timing and sequence of charging materials as well as mixing duration.



SEC concrete

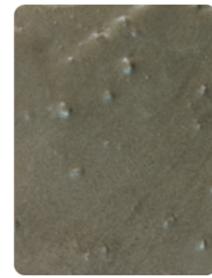


Conventional concrete
(same proportion as SEC concrete)

Simulating the state of the cavity under a steel reinforcing / steel frame



Separate mixing



Non-Separate mixing
(flocks are seen)

Cement dispersion effect in cement paste

SEC concrete method

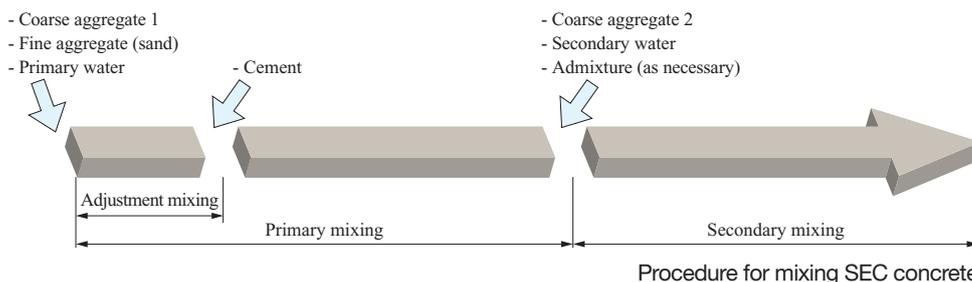
The SEC (Sand Enveloped with Cement) concrete method, distinguished by its mixing technique, is used with shotcrete for mountain tunnels and placed concrete for bridges, etc.

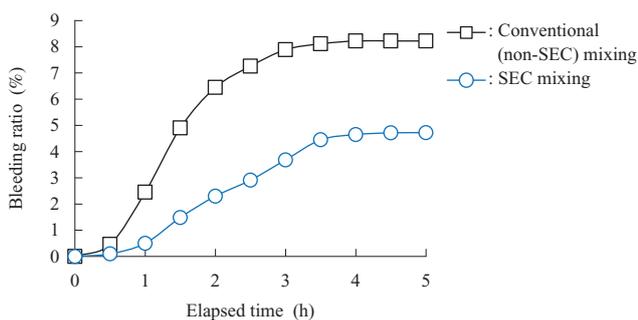
The quality of concrete varies depending on various factors, including timing of charging of water and other materials and mixing duration. Livecon Engineering Co., Ltd. has developed various mixing techniques to improve the quality of concrete and holds many patents on the SEC concrete method. SEC mixing techniques, not the concrete itself, are available to our customers on a per-construction-site basis in exchange for patent royalties.

SEC concrete method is a technique to raise the quality

of concrete by changing mixing procedure, without using any special materials. Ordinary concrete is a mixture of sand, coarse aggregate, cement, and water (plus an admixture), and all these materials are mixed at one time in a large mixer (conventional (non-SEC) mixing). In contrast, SEC concrete is mixed after multiple steps of preprocessing: ① measuring material characteristic values, including the bind water ratio of cement (ratio of water bound around cement particles) and the bind water ratio of sand (fine aggregate) (ratio of water adsorbed on the surface of sand), ② determining the division ratio of mixing water, and ③ determining the sequence of the charging materials into the mixer, the mixing duration, and so forth.

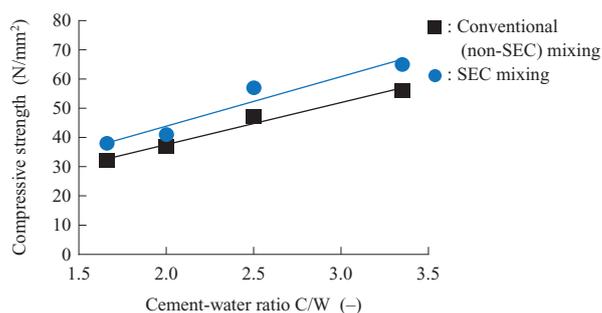
When SEC concrete is used at a customer's construction





(Note) Water-cement ratio = 55%

Results of bleeding test of concrete



Results of compressive strength test of concrete

site, the actual concrete materials to be used at the site is first tested at our company, under a patent license agreement with the customer, and then determined the characteristic values. The mix proportion of SEC concrete is determined in considering the characteristic values of the materials on site, and then the mixed concrete is delivered to the customer.

SEC concrete method is registered in NETIS (the New Technology Information System) as well, which is operated by the Ministry of Land, Infrastructure, Transport and Tourism.

Motives for the invention of SEC mixing techniques

During the development of the reduced-pressure mortar injection method, the properties of fresh mortar varied every time. As the result of investigations, it was found that the properties were affected by the amount of water on the sand surface.

In order to stabilize the amount of water on the sand surface, the primary water was added to the sand at first to evenly wet the sand surface, then the cement was added to mix the materials, and finally the remaining water (the amount of water minus the amount of primary water) was added and the materials were further mixed. As a result of implementing this method, the properties of the mortar were stabilized.

It was found that the properties of fresh mortar vary depending on the amount of primary water and that there was an optimum amount of primary water.

Conventional concrete vs. SEC concrete

In the case of conventional concrete, the water contained in concrete rises to the surface after placement. This water, called bleeding water, forms channels in the concrete and builds up not only on the concrete surface but also on the bottom surfaces of the aggregate (sand and coarse aggregate) and reinforcing bars.

A water cavity in concrete dries over time and then becomes a void. This is an internal defect of concrete that renders concrete inhomogeneous, leading to deteriorated strength and durability.

SEC concrete techniques are intended for all construction

sites where concrete is used and all ready mixed concrete manufacturers that deliver concrete to construction sites. SEC concrete, used in shotcreting, has the effect of reducing rebound from aggregate (sand and coarse aggregate), thus reducing material loss and then enabling material cost reductions. Furthermore, reduction of dust arisen from shotcreting is achieved.

When SEC concrete is placed, voids that form on the bottom surfaces of the aggregate and reinforcing bars due to bleeding water are reduced, which also increases the quality and compression strength of the concrete. Moreover, bidders for public works can expect the additional points when proposing the use of SEC concrete method, which are registered with NETIS, in technical proposals.

Future endeavors

The most important thing for SEC concrete method is to ascertain the characteristic values of each material, which determine the best amount of water, and the testing method of such characteristic values have been established. In addition, we have defined the sequence of the charging materials into a mixer and the mixing duration in order to stabilize the properties of concrete more effectively.

Although it is known that various qualities can be improved by applying the SEC concrete method, detail mechanism of these improvements is not clear at present.

In order to clarify this mechanism, we are currently conducting an experiment for visualizing the dispersion mechanism of cement particles of fresh cement paste, for example.

We will develop and disseminate more effective techniques of quality improvement by clarifying this mechanism.

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