

Naturally, precasters spend a large amount of their time working to understand the chosen materials that go into their concrete mix designs. But how important is the order to which they choose to introduce these various components into the mix? Also known as sequencing, the order that they choose is critical. When sequencing is done properly, it can ensure that the admixtures are working as needed, can save wear and tear on the mixtures, help to avoid issues such as inhomogeneous mixing or balling and finally ensure the desired final properties for their products are attained. Below is a brief summary of NCPA's [Sequencing in Mix Design](#) article.

The first and foremost factor that affects sequencing is the type of mixer that is being used. If using an old or well-used mixer, it is important to analyze it to determine its capabilities and that it can do the job to meet the goals. It is important to note that mixing time varies depending on the mixer, batch size, admixture recommendations, as well as the plant's philosophy about wet and dry cycles.

Batching is the term given to measuring raw ingredients before mixing by weight, volume or both. It is another very important factor that affects sequence.

"Sometimes, weight and proportions change based on sequencing choice made during batching," Paul Ramsburg, technical sales specialist at Sika Corp., states. "Since sequencing affects optimizing the mix design, they should go hand in hand".

Batch size also makes a difference. For instance, as noted by Frank Bowen, director of quality assurance at Piedmont Precast in Atlanta, for large batches in their pan mixtures, a dry mix is first created and water elements are added afterwards. For smaller batches, on the other hand, the mixing order changes - starting with 80 percent of the wet ingredients and then adding the dry ingredients.

Starting with a dry mix cycle followed by a final wet cycle is the most common sequence that we find across precast plants. That is, coarse and fine aggregates are weighed, checked for moisture and added to the mixer. Then, if air-entraining is not necessary, cementitious ingredients are added. The wet cycle's final mix time is dependent on the efficiency of the mixer as well as what the precaster wants to achieve.

Changing climates have numerous effects on concrete. They can affect the amount of air that is trapped in the concrete, and so air-entraining agents may be required. By sequencing air-entraining agents differently, Ramsburg states that this can help to move the air around as a means of achieving more consistent concrete.

There is likely an issue with your sequencing when problems such as clumping or balling

develop in the mix. Balling refers to when cement and water clump together, forming solid balls that then float to the surface. They prevent the cement from interacting with the rest of the mix. Inconsistent mixing can then lead to lower strength and aesthetic issues. Clumps can form when cement is added too early, or if moisture in the air is exposed to any of the aggregates on rainy days. If compensating for this extra moisture isn't working, then a sequence change may.

Ramsburg stresses that precasters should always consider sequencing as part of the mix design processes. He further states that companies should allocate resources to understanding sequencing as much as is done with understanding various admixture components themselves.

Source: [Sequencing in Mix Design](#), [W&J Chambers Ltd](#)