



OHIO READY MIXED CONCRETE ASSOCIATION

P.O. Box 29190, Columbus, OH 43229-0190 ~ (614) 891-0210 ~ FAX (614) 891-2675

E-mail: ormca@ohioconcrete.org ~ Website: www.ohioconcrete.org

July 2006

To: ORMCA Producers, Admixture Associates and Testing Laboratories

From: Ken Cauble, President

Re: Updated Guidelines for Batching Microsilica Concrete

Attached are updated guidelines that may assist you when batching microsilica concrete. These guidelines were developed in cooperation with Elkem Materials, the Silica Fume Association and the Ohio Department of Transportation.

There have been changes made to the bags that contain the bagged densified silica fume. These modifications include reducing the number of layers of paper and modifying the design of the corners and filling spouts to reduce the thickness of those areas. This results in a more user friendly bag that is designed to disintegrate more easily. As can be expected there is a trade-off between making the bags easier to disintegrate and strong enough to protect the silica fume during shipment and handling. Also, without the proper combination of wetting and grinding the paper bags during concrete mixing, it may be necessary to open the bags and empty the silica fume directly into the mixer. The low water to cement ratio of high performance concretes can contribute to the lack of wetting; and use of small coarse aggregates, rounded gravel, and small concrete loads can each contribute to a lack of grinding. If there are doubts that the bags will not disintegrate, conduct testing under specific project conditions with materials and equipment that will be used for that mix. Emptying the microsilica from the bags may be required if the bags do not disintegrate.

It is important to remember that these are only guidelines, and if you are experiencing no problems with current procedures, there is no reason to change anything.

If you have any questions, feel free to call ORMCA at 614-891-0210.

BATCHING MICROSILICA CONCRETE

- I. There are three fundamental items that must be addressed to prevent balling in low water/cement ratio (w/c) microsilica concretes. When batching microsilica concrete, it is important to remember to treat the microsilica like any other cementitious material and batch accordingly.
 - A. Never place microsilica in any form into an empty mixer without first adding the coarse and fine aggregates and 75-90% of the batch water.
 - ◆ Microsilica will immediately gel and subsequently “ball” if the silica fume is placed into the high pH (cement coated) mixer. Leftover wash water will trigger this effect. Always reverse all wash water out of the mixer prior to batching; and introduce batch water, coarse aggregate and fine aggregate before, or at the same time, as the microsilica.
 - B. In low w/c ratio mixes it is important to have the mix as wet as possible, given the low water design, before slowly ribbon feeding the cement into the mix.
 - ◆ This is particularly true for high strength, low w/c ratio mixes, whether containing microsilica or not. The slow feed of cement is critical especially when bulk microsilica is weighed and batched with the cement. Ready Mix Companies (RMC’s) may have to slow their normal cement feed time to accomplish the above.
 - C. The number of mixing revolutions required for truck mixed concrete is increased from the minimum of 70 revolutions as required by ASTM C94 to 100 or more revolutions at mixing speed.
 - ◆ The mixing time for concrete mixed in a central mix drum may also have to be increased to fully disperse and adequately mix all components, which decreases the potential for balling.
 - ◆ Microsilica concrete cannot be “overmixed”; longer mixing times ensure a more uniform concrete.
- II. The Ohio Ready Mixed Concrete Association (ORMCA) continually professes that any “short-cuts” to good concrete practices, as outlined in ASTM and ACI documents, will result in a magnification of normal concrete problems. This includes batching, mixing, placing, finishing and curing practices.

Procedures To Batch Microsilica Concrete *(rev July 2006)*

DRY BATCH or CENTRAL MIX PLANTS – Densified Microsilica Bags (front-loaded)

- A. Bagged microsilica shall be kept dry. No bag or microsilica material containing moisture shall be introduced into the concrete mixer. Select the number of bags for the volume of concrete being produced.
- B. Reverse truck mixer or central mixer to remove remaining wash water.
- C. Place the entire amount of microsilica bags into the truck drum mixer with the coarse aggregate, fine aggregate, and 75-90% of the batch. Do not add bags or attempt to premix microsilica alone in mixer as the likelihood of balling is increased.
- D. Batch remaining ingredients as normal, slowly ribbon feeding the cement in being careful to avoid surges when adding cement.
- E. When producing low w/c ratio concretes a sufficient quantity of High Range Water Reducer (HRWR) should be added with the initial batch water to obtain a target slump of 2-4 inches. Sufficient mixing of the concrete, normally 100 revolutions or more, must occur to ensure a uniform slump throughout the entire load.
- F. Add the remaining batch water and HRWR required to produce the desired slump and mix (a minimum of 30 revolutions at mixing speed).

Notes:

- 1. It may be necessary to limit the load of the drum capacity to achieve better dispersion of the microsilica (optimum considered at 63% capacity per ASTM C94). However, a 6 cubic yard load size should also be maintained at a minimum for optimal bag disintegration.
- 2. If there are doubts that the bags will not disintegrate, conduct testing under specific project conditions with materials and equipment that will be used for that mix. Emptying the microsilica from the bags may be required if the bags do not disintegrate.

DRY BATCH or CENTRAL MIX PLANT - Bulk Densified Microsilica

- A. Bulk microsilica shall be kept dry. No microsilica material containing moisture shall be used.
- B. Reverse truck mixer or central mixer to remove remaining wash water.
- C. Batch coarse aggregate, fine aggregate, and 75-90% of mix water into the mixer. This includes the microsilica and cement, which is slowly ribbon fed into the load. Avoid surges when adding the microsilica and cement.
- D. When producing low w/c ratio concretes a sufficient quantity of water reducer or HRWR should be added to the initial batch water to obtain a target slump of 2-4 inches. If mixed in a truck-mixer, sufficient mixing should occur so as to ensure a uniform slump throughout the load. Microsilica concrete will require a longer mixing time.
- E. Add the remaining batch water and HRWR required to produce the desired slump and mix for truck-mixed concrete a minimum of 30 revolutions.