

# Specification and Mix Design Guidelines for MetaMax HRM

## STANDARDS

MetaMax high reactivity metakaolin (HRM) is classified as a natural pozzolan and complies with ASTM C 618-03 – *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete*, Class N. While it is not produced in accordance with ASTM C1240-04 – *Standard Specification for Silica Fume Used in Cementitious Mixtures*, it does meet the chemical and physical requirement for silica fume and is generally acceptable as an alternative for silica fume. HRM is accepted under ACI 318 – *Building Code Requirements for Structural Concrete and Commentary*.

## MIXTURE DESIGN

Pozzolans such as HRM are typically added as a partial replacement for portland cement, and the pozzolanic content is referred to as the percent (by weight) of cement replaced.

In typical concrete mixture designs, the optimum benefit of HRM can be obtained by replacing 10% to 20% of the portland cement in the mixture with HRM.

At an HRM replacement level of 5 to 10% concrete is generally more cohesive and less likely to bleed. As a result, the effort required for pumping and finishing processes is reduced. Compressive strength and density of hardened concrete are also increased.

Higher replacement levels (up to 20%) produce a concrete with lower porosity and improved resistance to attack by sulfates, chloride ions, and other aggressive substances. Freeze/thaw resistance is improved and the risk of damage resulting from impact and abrasion is reduced for properly finished and cured concrete.

The addition of HRM reduces concrete slump and generally requires the addition of a high range water reducer (HRWR). HRM requires a lower dosage of HRWR than would silica fume.

Test data on a wide range of concrete mixture designs can be found in the technical reports included at the MetaMax website. Due to the wide variation in ingredients and techniques used to produce, place, finish and cure concrete, Engelhard recommends that trial batches be produced using proposed materials and techniques prior to start of construction. Comply with requirements of applicable codes and industry practices when designing or using any concrete mixture. Consult a reputable concrete professional to assist in optimizing mixture designs for project conditions.

## COMPATIBILITY

HRM is compatible with all commercially available concrete admixtures with which it has been tested. When using with an unfamiliar product, however, it is prudent to consult

the admixture manufacturer or to conduct trials before use. Do not mix metakaolin directly with styrene monomer.

Air entraining admixtures may require somewhat increased dosage when used with HRM.

MetaMax has white color that is over 90 on the Hunter L scale and can be used in white portland cement without darkening a mixture, and will tend to lighten mixtures made with ordinary gray portland cement. MetaMax will also brighten integrally colored concrete. Testing is required prior to use with colored concrete stains. For additional information, *click here...*

HRM can be combined with fly ash or other pozzolanic materials for ternary mixtures with synergistic effects, such as higher early strength development in fly ash concrete.

#### HANDLING

HRM should generally be added to a concrete batch after portland cement and before any high-range water reducer (superplasticizer) is added.

Avoid excessive inhalation, ingestion, and skin and eye contact. Observe safety precautions appropriate for type of work being performed. See manufacturer's Material Safety Data Sheet (MSDS). Keep dry before use.

#### PLACEMENT AND FINISHING

Concrete with metakaolin can be placed, finished and cured in pretty much the same manner as concrete without HRM. MetaMax tends to improved troweled finishes by giving concrete a "creamy" or "buttery" texture that makes it easy to spread and finish.

#### FOR ADDITIONAL INFORMATION

- Technical Data Sheet
- Guide Specification