

## ENVIRONMENTAL BENEFITS OF METAMAX®

### STRENGTH AND DURABILITY PASS LIFE CYCLE ASSESSMENT

Engelhard's MetaMax® high reactivity metakaolin enhances the strength and durability of concrete to make concrete even more suitable for sustainable construction. Extra strength translates into more efficient structural designs that use less material to carry a given load. And greater durability means that concrete can continue to perform for generations to come with only minimal maintenance.

### REDUCED GREENHOUSE GAS EMISSIONS

MetaMax has approximately 90 percent less carbon dioxide emissions compared to the manufacture of portland cement. Carbon dioxide is a "greenhouse" gas and has been associated with increasing global temperatures. According to the US Environmental Protection Agency, **portland cement production releases 1.1 to 0.9 tons of carbon dioxide** per ton of cement. This compares with an average of **just 160 pounds of CO2 emissions from the manufacturing of a ton of MetaMax** high reactivity metakaolin.

During the manufacturing of MetaMax, kaolinite clays are heated in a process known as calcining. Calcining requires just enough fuel to heat kaolinite until it fuses into an amorphous state. On the other hand, production of portland cement requires enough fuel to stimulate an endothermic chemical reaction. Furthermore, calcium carbonate (limestone), the principle raw material of portland cement, releases additional CO2 when it decomposes under high heat.



### LEED CREDITS

The use of MetaMax can contribute towards the following credits under the [LEED Green Building Rating System for New Construction and Major Renovation, Version 2.1](#) published by the United States Green Building Council.

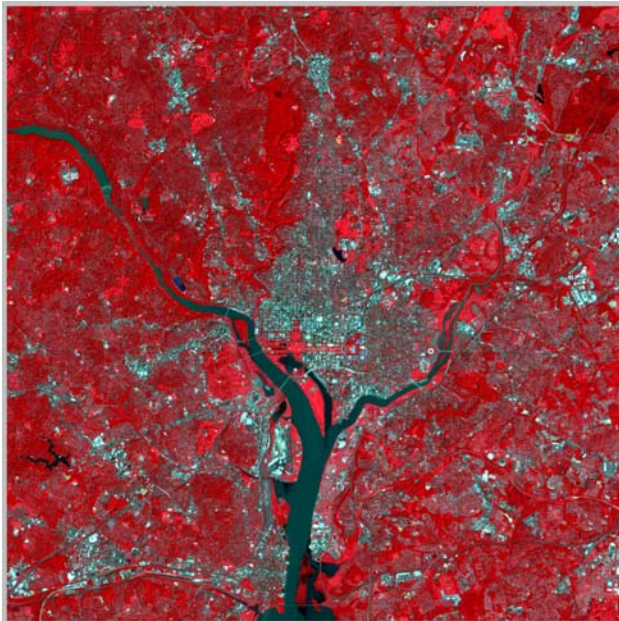


### **Site Selection Credit 7.1 - Heat Island Effect: Non-Roof:**

The goal of this credit is to reduce the heat build-up that results when dark colored paving materials absorb the sun's energy and re-radiate it as thermal energy. LEED recommends using light light-colored/high-albedo materials with reflectance of at least 0.3. This can generally be achieved by using light-colored paving materials such as portland cement concrete.

Depending upon the mixture and concrete texture, however, some sources of ordinary portland cement can be too dark to meet the LEED albedo requirement. Furthermore, the addition of fly ash or other dark mineral additives can darken concrete. In these instances, the addition of light colored MetaMax other mineral additives may brighten the concrete enough to meet LEED requirements.

White portland cement can provide even a higher albedo; and since the white color of MetaMax does not darken concrete, it is especially suitable for use with white cement.



**Energy and Atmosphere Prerequisite 2 – Minimum Energy Performance**  
**Energy and Atmosphere Credit 2 – Optimize Energy Performance**

The energy efficiency of lighting can be improved by using light colored floor, wall, and ceiling materials. This suggests that, whenever concrete is used as an interior finish, MetaMax, with or without white cement, should be considered to brighten the concrete and improve the reflectivity of exposed surfaces.



#### **Materials and Resources Credit 4 – Recycled Content**

There are two ways in which MetaMax contributes towards the LEED goal of encouraging the use of recycled content in building materials:

A. **Fly Ash:** Fly ash, a byproduct of coal-fired electric power generation, is increasingly used as a recycled ingredient in concrete. While fly ash is a pozzolanic material, it is less reactive than MetaMax high reactivity metakaolin. MetaMax can be used in combination with fly ash to produce concrete with higher strength and lower porosity than can be achieved with fly ash alone. Combinations of portland cement with two supplementary cementitious materials (such as metakaolin and fly ash) are called ternary mixtures. For additional information on mixtures with fly-ash and MetaMax, see the research report “High Reactivity Metakaolin – A Mineral Admixture for High Performance Concrete”.

B. **Recycled Glass Aggregate:** MetaMax makes it possible to recycle crushed glass as concrete aggregate. Ordinarily, most types of glass cannot be added to concrete because it triggers an alkali-silica reaction (ASR) that can cause concrete to crack. But MetaMax mitigates ASR, making it practical to use post-consumer glass in concrete. Not only is this an environmental benefit, it can also produce beautiful finishes, with the color and sparkle of the glass adding luster to the concrete.



Photo courtesy of [Wausau Tile](http://www.wausau.com).

### **Materials and Resources Credit 5 – Local/Regional Materials:**

- A. In North America, MetaMax is produced in Gordon, GA (near Macon, GA). Building sites within 500 miles can of the plant may be able to earn additional credits for the use of locally extracted raw materials.
- B. Because MetaMax mitigates alkali-silica reaction (ASR), it can allow the use of locally extracted aggregate that might otherwise be too reactive for use in concrete. In many locations, the quarries producing non-reactive aggregates have been or are being depleted and non-reactive aggregates have to be hauled in from outside of the building locality. By adding MetaMax to a concrete mixture, it may be possible to use locally extracted aggregates even if they are somewhat reactive.

### **Innovation And Process Credits**

While LEED is a ground-breaking method for improving the sustainability of buildings, it is still evolving. For example, LEED currently awards credit for the use of certain types of carpets and paints. Common sense suggests that omitting carpet and paint and leaving underlying surfaces exposed could be an even more sustainable solution in many buildings. Since MetaMax can improve the beauty of concrete floors and plastered walls, it may be possible to omit applied finishes from building surfaces. This 1) reduces the environmental costs associated with manufacturing the applied finishes. 2) eliminates the



adhesives or solvents that are typically required to install applied finishes, and 3) reduces the life-cycle environmental costs associated with maintaining and replacing less durable finishing materials.

### **ENGELHARD WINS TWO ENVIRONMENTAL AWARDS**

**Presidential Green Chemistry Challenge Award:** Engelhard Corporation has been honored Monday with a Presidential Green Chemistry Challenge Award from the U.S. Environmental Protection Agency (EPA) at a ceremony held at the National Academy of Sciences in Washington, D.C. [More...](#)

**Reclamationist of the Year:** Engelhard Corporation carefully reclaims the land where it mines the minerals used to produce MetaMax. In fact, Engelhard was named the "Reclamationist of the Year" by the [National Association of State Land Reclamationists](#). "Quality land restoration is an expensive and time-consuming task that calls for patience and commitment," says Jim Raymond, a geologist with the Georgia Department of Natural Resources who nominated Engelhard for the award. "Engelhard has been on top of this for many years. This is a shining example of what is possible." [More...](#)

### **FOR ADDITIONAL INFORMATION**

EcoSmart Concrete: [www.ecosmart.ca](http://www.ecosmart.ca)

Environmental Council of Concrete Organizations: [www.ecco.org](http://www.ecco.org)

United States Green Building Council: [www.usgbc.org](http://www.usgbc.org).

NOTE: While Engelhard believes these suggestions comply with LEED guidelines, each building project requires its own assessment. Engelhard recommends that you consult with a LEED Accredited Professional regarding material selections for your project.