

*Concrete sets and hardens as a result of a chemical reaction called hydration.*

*Set characteristics of concrete are influenced by a wide variety of factors.*

## WHAT IS TIME OF SET?

**Time of set** is defined as the point in time at which penetration resistance reaches specified values. ASTM C 403 identifies initial and final time of set as:

Penetration resistance	
Initial Time of Set	500 psi
Final Time of Set	4000 psi

Typically to a concrete contractor, initial time of set refers to the time at which a concrete surface can bear the weight of an individual with minimal indentation.

When water comes into contact with hydraulic cement, a chemical reaction called hydration occurs. This reaction



combines water with cement forming chemical compounds, increasing the strength of the material and changing it from a plastic, moldable material to a solid capable of withstanding substantial loads.

## WHY IS TIME OF SET SIGNIFICANT?

Initial and final set times are important because they give an indication of when the concrete can be properly placed, consolidated and finished.

## WHAT INFLUENCES TIME OF SET?

Among other things, the initial and final time of set are influenced by:

- Cementitious material chemistry
- Cementitious material fineness
- Cementitious material content
- Water to cementitious materials ratio
- Concrete and ambient temperatures
- Admixture types
- Fly ash and pozzolan properties



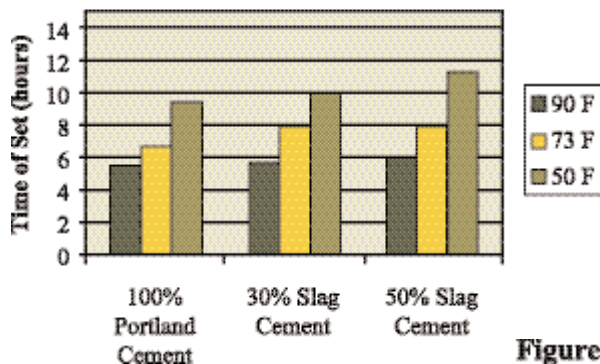
*As with all concrete mixtures, trial batches should be performed to verify concrete properties. Results may vary due to a variety of circumstances, including temperature and mixture components, among other things. You should consult your slag cement professional for assistance. Nothing contained herein shall be considered or construed as a warranty or guarantee, either expressed or implied, including any warranty of fitness for a particular purpose.*

# CONCRETE TIME OF SET

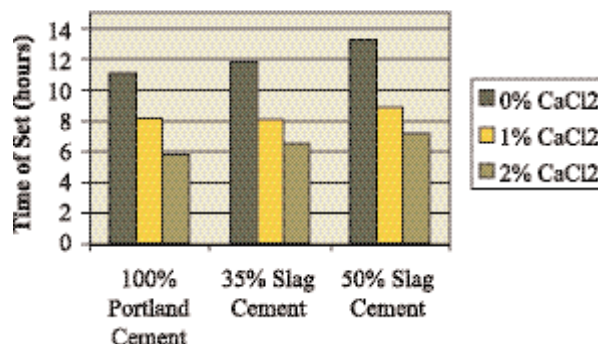
## HOW DOES SLAG CEMENT AFFECT TIME OF SET?

At temperatures less than 85 degrees Fahrenheit, concrete containing slag cement can have longer times of set, when compared with 100 percent portland cement concrete. The lower the ambient and/or concrete temperatures, the slower the set times will be (Figure 1). The percentage of slag cement used can also affect times of set. However, replacement rates of less than 30 percent generally will not affect times of set significantly. Slower times of set are beneficial in hot weather because the contractor has a longer time to deliver, place, and finish the concrete. If times of set need to be reduced, accelerators, heated materials or reduced slag cement content may be used (Figure 2).

**Figure 1: Effect of Temperature on Initial Time of Set**



**Figure 2: Effect of Accelerators on Initial Time of Set**



**Reference**

1. C403/C403M-99, *Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance*, American Society for Testing and Materials, West Conshohocken, PA, 2001.

### About the Slag Cement Association...

The Slag Cement Association is the leading source of knowledge on blast-furnace slag-based cementitious products. We promote the increased use and acceptance of these products by coordinating the resources of member companies. We educate customers, specifiers and other end-users on the varied attributes, benefits and uses of these products.

*Slower times of set are often beneficial because the contractor has a longer time to deliver, place and finish the concrete.*



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