SE INSIGHTS
FOR MASONRY DESIGN

Early Strength Development in Masonry: Implications for Construction Practices

A great question that comes up relatively often for shoring, and wall bracing, and other masonry construction inquiries is how quickly masonry gains strength. The common strength requirement for concrete masonry, and similarly for plain concrete, is to require full strength at 28-days.

A simple answer from NCMA is that "masonry gains strength pretty rapidly.".

Research from NCMA in the early 2000's, which is not part of the TMS code, states that masonry has more than 50% of its strength at 24 hours after construction completion. That is also the value used in wall bracing guides from NCMA and IMI.

First, concrete masonry units comprise of a large percentage of the overall masonry wall assembly. These units arrive to the job site and are relatively far along the curing process.

Second, when comparing masonry strength to concrete strength, masonry should be ahead of the curve for strength gain in the early stages of construction. A comparison of the two materials is shown in Figure 1 below:

According to research by the National Concrete Masonry Association (NCMA), masonry exhibits rapid strength development soon after construction.

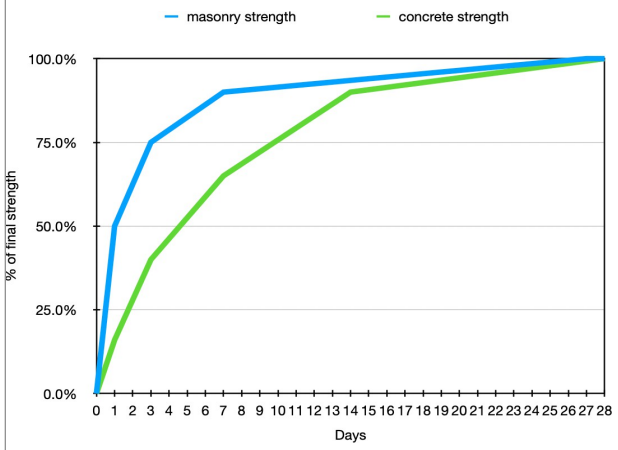

Figure 1: Age vs Strength

Although these findings are not explicitly included in the TMS code, they are recognized in wall bracing guidelines from NCMA and the International Masonry Institute (IMI). The research indicates the following general strength development timeline for masonry:

1 Day: Approximately 50% of final strength is achieved.

3 Days: Around 75% of final strength is reached.

7 Days: The masonry gains up to 90% of its final strength.

28 Days: Full design strength (F'm) is realized.

These values suggest that masonry can be used to support light loads relatively soon after construction, depending on the design requirements and safety factors.

Understanding the early strength profile is crucial for construction decisions, such as the removal of shoring or formwork and the scheduling of subsequent construction activities. When comparing masonry strength gain to that of conventional concrete, masonry typically exhibits a more rapid early strength gain. This can be attributed to the fact that the majority of the masonry's compressive strength comes from the pre-cured CMUs, rather than from the in-situ curing of fresh concrete. As a result, masonry walls can often achieve sufficient strength to support loads and resist lateral forces more quickly than cast-in-place concrete elements of similar design strength.

Factors Influencing Early Strength

Several factors contribute to the early strength of masonry, including the properties of the masonry units, mortar, and environmental conditions:

Masonry Unit Properties: Concrete masonry units (CMUs) used in construction have often undergone significant curing before arriving on site, contributing to the overall strength of the masonry wall. The proportion of CMUs in the wall assembly means that their early strength significantly influences the initial strength of the entire structure.

Mortar Characteristics: The type of mortar used, and its curing process play a role in the strength gain of the masonry assembly. While mortar may exhibit lower compressive strength in early stages compared to fully cured concrete, the bond strength between the mortar and masonry units is sufficient to contribute to rapid strength development.

Environmental Conditions: Temperature, humidity, and exposure to moisture affect the curing rate of masonry. Higher temperatures and adequate moisture availability can accelerate curing, while cold or excessively dry conditions may slow the process.