



LIMITS ON THE PROPORTIONS OF FLY ASH IN CONCRETE

Introduction

This TechNote discusses the implications of limits on the proportions of fly ash in project specifications. This TechNote addresses only fly ash that meets current, applicable specifications such as [ASTM C618](#). Prescriptive specifications for concrete construction projects often include a clause that limits the proportion of supplementary cementitious materials (SCMs) ([Obla and Lobo 2015](#)). For example, the clause incorporated in Section 033000 pertaining to cast-in-place concrete from the [MasterSpec \(2014\)](#) states:

Cementitious Materials: [Limit percentage, by mass, of cementitious materials other than portland cement in concrete as follows:]

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.
4. Silica Fume: 10 percent.

[MasterSpec \(2014\)](#) notes inform the designer that this clause is used for concrete exposed to freezing-and-thawing cycles and the application of deicing salts. This advice, however, seems to be ignored by specification writers. In an NRMCA review of more than 100 specifications ([Obla and Lobo 2015](#)) for projects funded by private agencies, these limits were noted in 85 percent of the specifications, without consideration of the anticipated exposure condition for concrete members. Some specifications specifically prohibited the use of SCMs.

Question

Should limits on the proportion of fly ash meeting ASTM C618 in concrete be specified?

Answer

Limits on the percentage of fly ash that meet ASTM C618 are generally unnecessary if relevant fresh and hardened concrete performance requirements are specified. An exception is the case where the concrete will be exposed to deicer chemicals in a freezing-and-thawing environment when building code limits apply.

Industry standards—Provided as one example, Table 1 replicates Table 26.4.2.2(b) in [ACI 318-14](#), which establishes limits on the proportion of SCMs for concrete members in Exposure Class F3, defined as “concrete exposed to freezing-and-thawing cycles with frequent exposure to water and exposure to deicing chemicals.” Additionally, ACI 318 requires air entrainment, a maximum water-cementitious materials ratio (w/cm) of 0.40, and a minimum specified strength of 5000 psi (35 MPa) for structural concrete. Plain concrete requires air entrainment, but the limits on w/cm and specified strength are 0.45 and 4500 psi (31 MPa), respectively.