

## ***ACI Cold Weather Provisions for Massive Metallic Embedments***

ACI 306R-88 indicates that “The placement of concrete around massive metallic embedments that are at temperatures below the freezing point of the water in concrete may result in local freezing of the concrete at the interface.” ACI 306 presented recommendations by Suprenant and Basham (1985) who stated “steel embedments having a cross-sectional area greater than 1 in<sup>2</sup> should have a temperature of at least 10F immediately before being surrounded by fresh concrete at a temperature of at least 55F”. The Committee concluded that “Additional study is required before definitive recommendations can be formulated.” The document recommended that the engineer/architect should determine whether the structure contains large embedments that pose potential problems.

The Mandatory Requirement Checklist in ACI 306.1-90 “Standard Specifications for Cold Weather Concreting” required the Specifier to identify massive metallic embedments. This Checklist also stated that the massive embedments “must be at a temperature above freezing prior to placement of concrete.”

ACI 306R-10 also addressed this issue by stating the architect/engineer should identify those portions of embedment that pose potential problems. This document recommended that “ideally, the embedment should be heated to the temperature of the concrete immediately before concrete placement.”

The massive metallic embedment issue has a curious history; from ACI 306R-88 that states “additional study is required before definitive recommendations can be formulated” to ACI 306.1-90 requiring massive embedments “to be at a temperature above freezing” to ACI 306R-10 which recommends that the massive embedment “should be heated to the temperature of the concrete.” During cold weather, the temperature of the fresh concrete could be as high as 60 to 65F.

While ACI 306R-88 indicated more study was required, it is not clear that any study was the basis for recommending massive metallic embedment temperatures of 32F and as high as 65F (concrete temperature) in ACI 306.1-90 and ACI 306R-10 respectively.

Fortunately, new experimental test results indicate that heating of embedments prior to concreting is not necessary. Not surprisingly, the experiential results show that the 50F concrete warms the cold massive embedment! The results have been measured for reinforcing steel as large as a No. 18 bar. This information is scheduled for publication in ACI’s *Concrete International* in March 2014. It will also be presented by Ron Kozikowski, PE of North Starr Concrete Consulting, at a session titled “Monitoring Cold Weather Concreting” at the ACI Reno convention on Monday, March 24 from 11:00 am to 1:00 pm. It is hoped that ACI Committee 306 will revise both of their documents based on Kozikowski’s experimental results.

Other speakers and topics at this session include: “Use and Misuse of Non-Contact Infrared Temperature Sensors for Concrete Construction” by Ken Hover, “Cold Weather Research Findings for Residential Concrete Foundation Walls” by James Baty, and “Insulation for Protection of New Concrete In Winter” by Kevin MacDonald.



Bruce Suprenant at the ASCC booth answering technical questions for members and visitors.