

Mass Concrete Consulting

Concrete cast in massive sections requires that special consideration be given to handling the heat of hydration and the temperature rise after casting. Uncontrolled temperature rise and temperature differences within the placement can result in internal damage and surface cracks to the concrete. There is not a consensus in the industry regarding a minimum dimension or minimum cementitious content which can result in behavior of a concrete placement as mass concrete. Oftentimes a concrete placement having a minimum dimension of 4 ft or even 3 ft is specified to be treated as mass concrete. However, depending on the cementitious content of the concrete mixture, these dimensions could be too small or even too large.

Concrete consists of physical materials, but the cementitious materials create a heat-generating chemical reaction. The larger the minimum dimension of the placement, the slower the dissipation of the generated heat. Heat generation and dissipation in mass concrete pours require special consideration, especially considering that the heat dissipation can continue over very prolonged periods – sometimes 1 to 2 months or more. Temperatures can quickly rise well above acceptable and safe limits, which can lead to damaged concrete. Large amounts of thermal cracking or delayed ettringite formation (DEF, which is an irreversible internal expansion and deterioration of concrete) may occur if precautions are not followed.

For some projects, limited cracking may be acceptable under certain circumstances. However, thermal cracking can be minimized or avoided by:

- Changing concrete mixture proportions
- Protecting the exposed surfaces and formwork from environmental extremes
- Using aggregate with more desirable thermal properties
- Precooling the concrete constituent materials
- Cooling the concrete itself via internal cooling pipes
- Placing concrete in several lifts or pours

CTLGroup has helped contractors, engineering/design firms, and owners on over 800 hundred projects encompassing thousands of mass concrete placements to write, adapt, understand, and work within specifications for mass concrete elements and structures. Our team can assist in developing project-specific thermal control plans based on thermal modeling, as well as developing low heat concrete mixtures using the materials that are locally available to the project site. If necessary, these requirements can be supplemented and verified using laboratory tests.

