



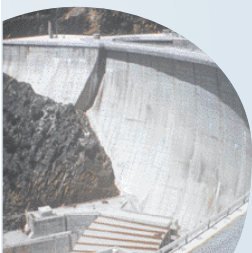
Mass *Concrete*

Mass concrete: Concrete cast in massive sections requires special consideration be given to handling the heat of hydration and the temperature rise after casting. Uncontrolled temperature rise can result in unacceptable surface cracks or internal damage to the concrete. For lack of a standard definition, CTLGroup considers mass concrete to be any element with a minimum dimension equal to or greater than 3 ft. Similar considerations should be given to other concrete elements that do not meet this definition but contain Type III cement or cementitious materials in excess of 564 lb/yd³ of concrete. In many cases, these non-mass elements will also generate significant amounts of heat.

Can thermal cracking be avoided? Limited cracking may be acceptable under certain circumstances. However, thermal cracking can be avoided by using several methods, including:

- Changing concrete mix 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

The job specifications were not clear when we bid on the project and I may already have a problem. What now? CTLGroup's experts can help you to assess your situation and recom-



mend remedial actions. We are available 24 hours a day.

My specification says I need type IV cement, but I can't find it. What can I do? Type IV cement can be special-ordered for large projects but is not commonly available, although it is often cited in contracts and specifications. Type II and Type V cements can be viable alternatives. CTLGroup can help you select suitable additives and alternative mixes. We can also verify the solutions by testing the mixtures for you.

Will adding slag or fly ash to my mix solve my thermal problems? Slag and fly ash might help, but require precautions to be taken. The reactivity of slag is highly temperature-dependent. For small mass concrete pours with limited temperature rise, slag can be useful. However, for large concrete pours, slag can generate more heat than the cement it replaces. Fly ash can be highly reactive and, in some cases, can generate as much heat as cement.

Should the maximum concrete temperature be limited to 125°F? That depends on your specifications, the size of the concrete element, and the cement content of the mix design. If the initial concrete temperature is high, then the maximum temperature also may be increased. For specific mixes, the temperature can be allowed to reach 175°F.

Should the maximum allowable temperature difference be limited to 35°F? While this is the industry rule-of-thumb intended to prevent thermal cracking, it can be overly restrictive or too conservative. The reinforcing steel, the geometry of the concrete element, and the concrete's mechanical properties all play a role in determining the safe allowable differences in temperature, which may be more than 35°F. CTLGroup's experts can develop allowable temperature differentials for your project, based on analytical modeling. We can also support your project with laboratory testing.

It's just a large volume of concrete, right? What's the big deal? The making of concrete is both a physical mix and a heat generating reaction. The larger the pour, the slower the dissipation of reaction heat. Heat generation and dissipation in mass concrete pours require special consideration. Temperatures can quickly rise well above acceptable and safe limits. Heat dissipation can continue over extended periods. Large amounts of thermal cracking may occur if precautions are not followed.

CTLGroup is a world leader in consulting services related to mass concrete technology. We have helped countless contractors, engineering/ design firms, and owners to write, adapt, understand and work within specifications for mass concrete elements and structures. CTLGroup can work with owners, engineers, architects, material suppliers, and contractors to develop project-specific thermal control plans based on thermal modeling. If necessary, these requirements can be supplemented and verified using laboratory tests.

Let CTLGroup's experts help you to design a plan that fits your needs, specifications and timetable. For help with mass concrete problems please contact: John Gajda at JGajda@CTLGroup.com



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