# Mass Concrete

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The American Association of State Highway and Transportation Officials' *AASHTO LRFD Bridge Design Specifications*[1] defines "structural mass concrete" in Article 5.2 as "any large volume of concrete where special materials or procedures are required to cope with the generation of heat of hydration and attendant volume change to minimize cracking."

Though the AASHTO LRFD specifications provide a definition, they do not include guidance on addressing issues related to mass concrete. The references and additional resources at the end of this article provide further information on this topic.

It is generally accepted that concrete is considered to be mass concrete when the maximum temperature in the placement exceeds the typical industry standard limit of 160°F or when the temperature difference between the interior of the placement and a point that is 2 to 3 in. below or inside the center of a nearby surface exceeds the typical industry standard limit of 35°F .[2]

The definition in the AASHTO LRFD specifications is often interpreted to apply when the least dimension of a member is greater than 3 or 4 ft or 1 meter. However, this assumption can be misleading because the heat of hydration is affected by many factors other than the size of the member. Members with a thickness of 1 ft or more and a high cementitious materials content can achieve temperatures in excess of 160°F.

High concrete temperatures and high temperature differences between the interior and surface of a mass concrete member can be controlled by a variety of techniques. These include lowering the heat of hydration using supplemental cementitious materials, lowering the initial temperature of the fresh concrete with the use of ice or liquid nitrogen, insulating the forms, and internal cooling of the concrete through the use cooling pipes.

Failure to control the temperature in concrete can result in cracking and undesirable chemical reactions. Project specifications should require that the contractor develop a thermal control plan showing how temperature rise and thermal cracking will be controlled in applicable elements. Internal concrete temperatures can then be monitored to ensure adherence to the plan.

## References

1. American Association of State Highway and Transportation Officials (AASHTO). 2017. *AASHTO LRFD Bridge Design Specifications,* 8th ed. Washington, DC: AASHTO.
2. Gajda, J., and J. Feld. 2015. "When Should Mass Concrete Requirements Apply?" *ASPIRE* 9 (3): 44-45.

## Additional Resources

- American Concrete Institute (ACI) Committee 207. 2007. *Report on Thermal and Volume Change Effects on Cracking of Mass Concrete* (ACI 207.2R-07). Farmington Hills, MI: ACI.
- ACI Committee 207. 2005. *Cooling and Insulating Systems for Mass Concrete* (ACI 207.4R-05). Farmington Hills, MI: ACI.
- ACI Committee 207. 2006. *Guide to Mass Concrete* (ACI 207.1R-05). Farmington Hills, MI: ACI.
- *Concrete Bridge Views*, Issue 47, January/February 2008. Federal Highway Administration and the National Concrete Bridge Council. http://www.concretebridgeviews.com.
- *Concrete Bridge Views*, Issue 80, March/April 2016. Federal Highway Administration and the National Concrete Bridge Council. http://www.concretebridgeviews.com.
- Gajda, J. 2007. *Mass Concrete for Buildings and Bridges* (EB547). Skokie, IL: Portland Cement Association.

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**EDITOR'S NOTE**

*The Texas Department of Transportation (TxDOT) offers free ConcreteWorks software to aid in the design and construction of mass concrete on its engineering software page: https://www.txdot.gov/business/resources/engineering-software.html.*