
MIXING WATER USED IN CONCRETE

References:

- California Code of Regulations, Title 24
Part 2: 2013 California Building Code (CBC), Sections 1603A2, 1613A, 1616A, 1613*, 1616*, and 1803A
- American Concrete Institute (ACI) 318-11 Section 3.4
- American Society of Testing and Materials (ASTM)
 - C94-07, Specification for Ready-mixed Concrete
 - C476-10, *Standard Specification for Grout for Masonry*
 - C1602-12, *Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete*

Disciplines: Structural

History: Issued 04-16-14

Purpose: This Interpretation of Regulations (IR) provides general requirements for the acceptance and use of mixing water from various sources of water used in concrete mixes for projects under the jurisdiction of the Division of the State Architect (DSA). Water sources may include:

- Potable water
- Non-potable water
- Water from concrete production operations
- A combination of potable water, non-potable water and/or water from concrete production operations.

Scope: This IR applies to all projects using water other than potable water in concrete mixes submitted to DSA for review under the 2013 edition of the CBC. It may also be used for projects submitted for review under prior editions of the CBC. This IR is *not* applicable to masonry grout mixing water as ASTM C476 requires the mixing water to be clean and potable.

Background: The ready mix concrete industry in California uses millions of gallons of water each year. Some of this water is used to batch the concrete and is necessary for the concrete to properly mix, hydrate, and gain strength. The balance of this water is used for the concrete plant production operations, which could be recycled and used as mixing water. Water sources collected at ready-mix concrete plants generally include storm water runoff, wash water, and other water that contains residual concrete ingredients.

Non-potable water sources, such as water from wells, streams, lakes, or other recycled sources, may also be used as mixing water.

Use of non-potable water for mix water benefits the environment by reducing waste water, lessening the need to draw from fresh drinking water sources. Generally, all of these water sources could be used as mixing water without detrimental effects to the plastic and hardened concrete provided adherence with all of the following requirements.

1. CONDITIONS OF USE:

1.1 Potable water is permitted as mixing water in structural and non-structural concrete without testing or qualification in accordance with ASTM C1602.

1.2 Other water sources are permitted as mixing water in structural and non-structural concrete provided all the following requirements are met for the combined mixing water:

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- The combined mixing water complies with ASTM C1602.
- The combined mixing water shall not exceed the limits for chloride, sulfate, alkalis, and total solids per ASTM C1602 Table 2, unless more stringent limits are specified by the design professional in responsible charge. These limits are not optional as noted in ASTM C1602. These limits need not apply to nonstructural concrete unless otherwise specified by the design professional in responsible charge.
- Any further restrictions or limitation imposed by the design professional in responsible charge.
- Records shall be maintained by the manufacturer to comply with the testing requirements and frequency of testing in ASTM C1602.

1.3 Submittal to DSA: When DSA-approved construction documents permit the use of other water sources for concrete mixing water either by direct reference to ASTM C1602 or by general reference to ACI 318 or ASTM C94, no submittal is required to DSA to request its use provided the mix design requirements in Section 2 of this IR are followed.

When DSA-approved construction documents do not permit water sources for concrete mixing other than potable water, and the school district and the design professional in responsible charge desire to permit its use, then a Construction Change Document (CCD) per DSA IR A-6 shall be submitted to DSA for approval. The CCD scope need only address permitting the use of other water sources for concrete mixing water per ASTM C1602 and any further limitations by the design professional in responsible charge. The mix design requirements shall comply with Section 2 of this IR.

2. MIX DESIGN: Concrete mix designs shall comply with the provisions of ACI 318 Chapter 5 and DSA IR 19-3, Section 2. Concrete proportions shall be selected by a registered civil engineer with experience in concrete mix designs and shall prepare and submit a mix design report and associated ASTM C1602 tests to the DSA approved testing laboratory for review.

2.1 Special Considerations: Concrete mix designs shall account for the physical and chemical properties of the mix water when the water source is not potable, such as:

- Mix water demand
- Chloride content of mix water
- Temperature of the mix water
- Concrete setting characteristics
- Concrete slump loss
- Concrete rate of compressive strength gain
- Concrete drying shrinkage
- Concrete permeability
- Admixture compatibility

3. RESOURCES: For additional information, see the following resources:

- Colin Lobo & Gary Mullings, *Recycled Water in Ready Mixed Concrete Operations*, Concrete InFocus, Spring 2003
- National Ready Mixed Concrete Association, *TIP 10 - Mixing Water Quality for Concrete*, October 2013.

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This Interpretation of Regulations (IR) is intended for use by the Division of the State Architect (DSA) staff, and as a resource for design professionals, to promote more uniform statewide criteria for plan review and construction inspection of projects within the jurisdiction of DSA which includes State of California public elementary and secondary schools (grades K-12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is reviewed on a regular basis and is subject to revision at any time. Please check the DSA web site for currently effective IRs. Only IRs listed on the Web page at www.dgs.ca.gov/dsa/publications at the time of plan submittal to DSA are considered applicable.
