## CODE

(c) Equipment used to convey concrete from the mixer to the location of final placement shall have capabilities to achieve the placement requirements.

(d) Concrete shall not be pumped through pipe made of aluminum or aluminum alloys.

(e) Concrete shall be placed in accordance with (1) through (5):

(1) At a rate to provide an adequate supply of concrete at the location of placement.

(2) At a rate so concrete at all times has sufficient workability such that it can be consolidated by the intended methods.

(3) Without segregation or loss of materials.

(4) Without interruptions sufficient to permit loss of workability between successive placements that would result in cold joints.

(5) Deposited as near to its final location as practicable to avoid segregation due to rehandling or flowing.

(f) Concrete that has been contaminated or has lost its initial workability to the extent that it can no longer be consolidated by the intended methods shall not be used.

(g) Retempering concrete in accordance with the limits of ASTM C94 shall be permitted unless otherwise restricted by the licensed design professional.

(h) After starting, concreting shall be carried on as a continuous operation until the completion of a panel or section, as defined by its boundaries or predetermined joints.

(i) Concrete shall be consolidated by suitable means during placement and shall be worked around reinforcement and embedments and into corners of forms.

## COMMENTARY

**R26.5.2.1(c)** The Code requires the equipment for handling and transporting concrete to be capable of supplying concrete to the place of deposit continuously and reliably under all conditions and for all methods of placement. This applies to all placement methods, including pumps, belt conveyors, pneumatic systems, wheelbarrows, buggies, crane buckets, and tremies.

**R26.5.2.1(d)** Loss of strength can result if concrete is pumped through pipe made of aluminum or aluminum alloy. This loss is caused by the formation of hydrogen gas generated by the reaction between the cement alkalies and the aluminum eroded from the interior of the pipe surface. The strength reduction has been shown to be as much as 50 percent (Newlon and Ozol 1969). Hence, equipment made of aluminum or aluminum alloys should not be used for pump lines, tremies, or chutes other than short chutes such as those used to convey concrete from a truck mixer.

**R26.5.2.1(e)** Concrete should be available at a supply rate consistent with the capacity of the placement equipment and the placement crew. Concrete supplied at a faster rate than can be accommodated by placement equipment or crew can result in loss of workability of concrete in equipment waiting to discharge. Excessive delays in the supply of concrete can cause previous placements to stiffen and result in the formation of cold joints.

Each step in the handling and transporting of concrete needs to be controlled to maintain uniformity within a batch and from batch to batch. It is important to minimize segregation of the coarse aggregate from the mortar or of water from the other ingredients.

Rehandling and transferring concrete over large distances from delivery vehicles to the point of placement in the structure can cause segregation of materials. The Code therefore requires that concrete be deposited as close to its final location as possible. However, self-consolidating concrete mixtures can be developed to flow longer distances and maintain their stability with minimal segregation. Guidance on self-consolidating concrete is provided in ACI 237R.

**R26.5.2.1(g)** ASTM C94 permits water addition to mixed concrete before concrete is discharged to bring it up to the specified slump range as long as prescribed limits on the maximum mixing time and ***w/cm*** are not violated.

**R26.5.2.1(i)** Detailed recommendations for consolidation of concrete are given in ACI 309R. This guide presents information on the mechanism of consolidation and provides recommendations on equipment characteristics and procedures for various types of concrete mixtures.