

Mixing Time and Uniformity

What is Concrete Mixing Time?

Concrete mixing time is the period during which concrete ingredients are actively mixed to produce a homogeneous and uniform mixture. It begins once all materials are in the mixer and continues until the concrete achieves consistent appearance, workability, and distribution of constituents. Mixing time requirements vary depending on mixer type, batch size, material characteristics, and mixture proportions.



Example of On-Site Concrete Field Testing

Why Mixing Time and Uniformity Matter?

Adequate mixing is essential to ensure uniform distribution of cementitious materials, aggregates, water, and admixtures throughout the batch. Insufficient mixing can lead to non uniform concrete with localized variations in strength, air content, slump, and durability. Over mixing can also be detrimental, potentially causing excessive air loss, segregation, temperature rise, or premature slump loss. Proper mixing time supports consistent performance, predictable quality, and compliance with specifications.

Factors Affecting Mixing Time?

Several factors influence the required mixing time. These include mixer type and condition, batch volume relative to mixer capacity, aggregate gradation and moisture condition, cementitious materials, and the use of chemical admixtures. High performance mixtures, low water to cementitious materials ratios, and mixes containing supplementary cementing materials or fibers often require longer or more controlled mixing to achieve uniformity.

Mixer Types and Considerations

Different mixers have different mixing efficiencies. For example, truck mixers rely on drum revolutions at mixing speed, and minimum revolution requirements are often specified in standards and project documents. Worn blades, build up inside the drum, or operating outside recommended capacities can significantly reduce mixing effectiveness.

Assessing Concrete Uniformity

Testing for uniformity of mixed concrete can be evaluated in accordance with CSA A23.1:24 Clause 5.2.4.5 and CSA A23.1 Table 13. Within batch uniformity shall be based on concrete using normal density aggregate with a nominal size or not more than 40mm.

Indicators of good uniformity include consistent density, air content and slump/slump flow. CSA A23.1:24 Table 13 provides a range between highest and lowest values of three test samples.

Significant variation in test results or appearance may indicate inadequate mixing or segregation. Periodic uniformity testing is useful for verifying mixer performance and identifying operational issues.



Three Rules to Consider:

1. Mix long enough at proper mixing speed to achieve a uniform appearance and consistent fresh properties
2. Adjust mixing time based on mixer type, batch size, materials and admixtures
3. Verify uniformity using density, air content, and slump limits in CSA A23.1 Table 13

References

1. CSA A23.1 A23.2 2024. *Concrete materials and methods of concrete construction Test methods and standard practices for concrete.* CSA Group
2. *Design and Control of Concrete Mixtures. 9th Edition.* Cement Association of Canada

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