Concrete Atlantic béton Atlantique

Concrete Tech-Tip #11

# Overdesign in Mixtures

## What is Overdesign?

Overdesign in concrete mixtures occurs when a mix contains more cementitious material, water, or other constituents than is actually necessary to meet the specified strength and performance requirements. While this might seem like a “safer” approach, overdesign can have negative impacts on both cost and durability.

## Why Overdesign?

Overdesign can result from conservative assumptions during mix design, variability in material properties, or pressure to meet early strength targets. In some cases, concrete suppliers may deliberately overdesign a mix if they suspect poor testing conditions on site, aiming to avoid potential failed strength results. Contractors may also increase cement content to compensate for anticipated field conditions, such as cold weather or uncertain curing.

## What are the Impacts?

The following are impacts on overdesign:

- Increased Cost: Using excess cement or supplementary cementitious materials raises material costs unnecessarily.
- Durability Concerns: High cement content can increase the risk of cracking, shrinkage, and thermal stresses, especially in mass concrete.
- Workability Issues: Overdesigned mixes may require more water or admixtures to maintain slump, which can negatively affect long-term strength and durability.
- Environmental Footprint: Excess cement increases greenhouse gas emissions, reducing the sustainability of the project.

## Steps to avoid Overdesign?

- Careful testing of aggregates, cement, and admixtures to reduce variability
- Using performance-based mix design rather than fixed cement content
- Monitoring field conditions, including temperature and moisture, to adjust curing rather than mix proportions
- Considering early-age strength requirements in combination with maturity methods or field cured cylinders instead of simply increasing cement

## Three Rules to Consider:

1. Conduct thorough testing of aggregates, cement, and admixtures to minimize variability in the mix
2. Base the mix design on performance requirements rather than simply increasing cement content
3. Monitor field conditions like temperature and moisture, and adjust curing instead of overdesigning the concrete

***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*