CONCRETE SASK

**TECH TIP #8**

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# CONCRETE YIELD

## WHAT is concrete yield?

Concrete yield is defined as the volume of freshly mixed concrete made from a known quantity of ingredients. Ready mix concrete is sold on the bassis of volume of fresh, unhardened concrete in cubic meters ($m^3$) as discharged from a truck mixer. Most concrete is batched by weight so it is important to determine the volume of concrete produced from the actual batched quantities produced. The density of the fresh concrete is used to produce this relationship.

The volume of concrete in each batch shall be determined from the total mass of the batch divided by the density (unit weight) of the concrete. The total mass of the batch shall be calculated either as the sum of the masses of all materials entering the batch, including all water added, or as the net mass of the concrete in the batch as delivered. The density shall be determined in accordance with CSA A23.2-6C.

It should be noted that the volume of concrete supplied is not determined from the calculated dimensions of the constructed member.

## WHY do yield problems occur?

Yield discrepancies can be real or perceived. Real discrepancies occur when quantity of materials batched do not produce the intended yield. This can be evaluated by density measurements. If yield determined from density measurement indicates a discrepancy, it should be corrected by the concrete producer. Perceived discrepancies, typically under-yield, is when the concrete ordered does not fill the forms due to:

- Miscalculation of form volumes or slab thicknesses when the actual dimensions exceed the assumed dimensions used in estimates.
- Deflection or distortion of the forms resulting from pressure exerted by the fresh concrete.
- Placing concrete on irregular subgrades or granular fills and settlement under pressure prior and during placement of the fresh concrete.
- Waste, spillage, loss of some entrained air, settlement of wet mixes and use of excess concrete in incidental mud sills or footings throughout the course of a job can be perceived as a deficiency in yield.

An over-yield can be an indication of a problem if the excess concrete is caused by too much air, water or aggregate or if the forms have not been properly filled.

Differences between actual and target weights and air content in concrete, within the permitted tolerances, will result in yield discrepancies.

## HOW to prevent yield discrepancies?

To prevent or minimize concrete yield problems:

- Check concrete yields by measuring concrete density in accordance with test method CSA A23.2-6C early in the job. Repeat periodically and especially if problems arise. Ensure that the scale is accurate and placed on a level surface, that the volume density measure is accurately determined, that a flat plate is used for final strike off, and that the outside of the measure is cleaned prior to weighing. Concrete yield in m3 is total batch weight in kilograms (kg) divided by density in kg/m3. The total batch weight is the sum of the weights

of all materials from the batch ticket, including any added water.

- The mixer truck can be weighed empty and full as a rough check. Care should be taken to ensure that such things as fuel, water and mud do not adversely affect the two weightings.
- Order sufficient quantity of concrete to complete the job and reevaluate the amount required towards the end of the placement. Provide this estimate to the concrete producer so that the order for the last 2 or 3 loads can be adjusted to provide the required quantity of concrete. This can prevent waiting for a short load after the plant has closed or the concrete trucks have been scheduled for other jobs. Disposal of returned concrete has environmental and economic consequences to the concrete producer and the purchaser.
- Estimate extra concrete needed for waste and increased placement dimensions over nominal dimensions. Include an allowance of 4 to 10 percent over plan dimensions for waste, over excavation and other contingencies. Repetitive operations and slip form placement permit more accurate estimates of the amount of concrete that will be needed. Sporadic operations involving alternating placement in slabs, footings, walls, and as incidental fill around pipes will require a bigger allowance for contingencies.
- Construct forms with adequate bracing and shoring to minimize deflection and bulging when concrete is placed. This is important for elevated slabs.
- Accurately finish and compact the subgrade and granular fills to the proper elevation for slabs-on-grade.

References:

1. *Ready Mixed Concrete, Gaynor, R.D. & Lobo, C.L., NRMCA Publication 186, NRMCA, Alexandria, VA, www.nrmca.org.*
2. *Improving Concrete Quality, Obla, K.H., CRC Press, available from NRMCA, Alexandria, VA.*
3. *No Minus Tolerance on Yield, Malisch, W. R. and Suprenant, B. A., Concrete Producer, May 1998.*
4. *Causes for Variation in Concrete Yield, Suprenant, B. A., The Concrete Journal, March 1994*
5. *CIP 8 – Discrepancies in Yield, National Ready Mix Concrete Association*
6. *CAN CSA A23.1-24/A23.2-24*