CONCRETE SASK

TECH TIP #23

www.concretesask.org

DISCOLOURATION

WHAT is discolouration?

Discolouration on concrete surfaces is the non-uniformity of colour or hue on the surface of a single concrete placement. It may take the form of dark blotches or mottled discolouration on flatwork surface, gross colour changes in large areas of concrete caused by a change in the concrete mixture, or light patches of discolouration caused by efflorescence.
In this context, it is not intended to include stains caused by foreign material that comes in contact with the concrete surface after placement and curing, such as storm water runoff, vegetation, irrigation, corrosion products, and oil from automobiles.

WHY does discoloration occur?

Variation in colour due to changes in cementitious materials or fine aggregate in subsequent batches in a placement could occur but is generally rare and insignificant. Concrete with a higher water-cementitious ratio (w/cm) will generally be lighter in colour. Different types of flyash can result in darker concrete due to higher carbon content. Concrete containing slag cement generally has a lighter colour.

In newly placed concrete containing slag cement, a yellowish to greenish colouration may be evident. This is typically seen on vertical surfaces after formwork is removed. This discolouration disappears with time on exposure to air and sunlight. It has no impact to the quality of concrete. Silica fume concrete is typically darker in color. Inconsistent use of admixtures, insufficient mixing time, and improper timing of finishing operations can cause discolouration on slab surfaces. The discolouration of concrete cast in forms or in slabs on ground is usually the result of a change in either the concrete composition or concrete construction practice.

No single factor is identified as a primary cause for discolouration. Factors found to cause discolouration include: the use of flake form of calcium chloride that may not completely dissolve, variation in cement alkali content, delayed hydration of cement, some types of admixtures, hard-troweled surfaces, inadequate or inappropriate curing, concreting practices and finishing procedures that cause surface variation of the water-cementitious materials ratio, and changes in the concrete mixture proportions or constituents.

HOW to test grout?

The consistency of grout affects its strength and other properties. It is critical that grout consistency permit the complete filling of void space without segregation of ingredients.

Consistency of grout may be measured either by slump cone (CSA A23.2-5C) with slumps of 200mm to 275mm generally required for both fine and coarse grout. The consistency of self-consolidating grout is determined by the flow test (CSA A23.2-19C). Spreads of 600mm to 750mm are generally required, with an additional requirement for visual stability Index (VSI), which evaluates the grout's ability to maintain well-dispersed aggregate with minimal segregation and bleeding.

For other types of grouts without aggregate, or only fine aggregate finer than a 2.5mm sieve, consistency is best determined with a flow cone (CSA A23.2-1B). This test is intended to be used for grouts with a flow of less than 35

seconds.

For masonry grout, often referred to as blockfill, strength tests specimens should be cast in molds formed by masonry units having the same absorption characteristics and moisture content as the units used in construction (CSA 179). Do not use non-absorbent cube or cylinder molds for this purpose. The water absorbed from this grout provides a better representation of the strength in the masonry units.

Compressive strength of grouts is determined following the procedures outlined in accordance with CSA A179 or CSA A23.2-1B. Mortar specimens shall be 50mm cubes. Grout specimens shall be cylinders 100mm diameter by 200mm in length. The specimen moulds shall be non-absorbent. Moulding of mortar specimens shall follow the procedure for moulding cube test specimens described in CSA Test Method A3004-C2. Moulding of grout specimens shall follow the procedure for moulding concrete cylinder specimens described in CSA Test Method A23.2-3C.

Special application grouts often require modification of standard test procedures. All such modifications should be noted in the specifications and discussed prior to the start of a project or placement.

References:

1. *CAN CSA A23.1-24/A23.2-24.*
2. *CAN CSA A179-14 (reaffirmed 2019).*
3. *Concrete in Practice (CIP22 - Grout), National Ready Mix Concrete Association*