

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS, AND TESTING DIVISION

MATERIALS PROCEDURE

LOS ALAMOS STAINING METHOD FOR ALKALI SILICA REACTION GEL

1. PURPOSE

- 1.1. To provide a staining method of testing to detect the gel, that is a byproduct of alkali silica reactions, on concrete that may have been affected by alkali silica reactivity.
- 1.2. While this method provides a way to detect such reaction gels, it is not intended to be a standalone diagnostic, but an aide. Other factors could present the same staining, so it is recommended that a more in-depth look is made with magnification to confirm or deny the results obtained.

2. SCOPE

- 2.1. This method is applicable to fractured concrete in the field, or with concrete cores in the laboratory.
- 2.2. For our intent of testing this method will be applied to concrete cores in the laboratory.

3. REFERENCES AND APPLICABLE DOCUMENTS

- 3.1. Guthrie, G. D., and Carey, J. W., Geochemical Methods for the Identification of ASR Gel, Transportation Research Board, July 1998, [Link to Webpage](#)¹.
- 3.2. Farny, A. James., and Kerkhoff, Beatrix., Diagnosis and Control of Alkali-Aggregate Reactions in Concrete, [Link to Webpage](#)².
- 3.3. Dr. Berry, Micheal, Alkali Silica Reactivity in the State of Montana, February 2019, [Link to Webpage](#)³.
- 3.4. MP 601.03.22: Damage Rating Index for Hardened Concrete

¹ <https://www.osti.gov/servlets/purl/762098>

² https://www.cement.org/docs/default-source/fc_concrete_technology/is413-02---diagnosis-and-control-of-alkali-aggregate-reactions-in-concrete.pdf

³ https://www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/Alkali/Task_1_Report.pdf

4. APPARATUS

1. Safety glasses, rubber gloves, apron, respirator
2. Saturated Solution of Sodium Cobaltinitrite
3. Saturated solution of rhodamine B base
4. Large Stone Saw
5. Concrete Wet Polisher (50 – 3000 grit sandpaper pads)
6. Distilled water

5. SAMPLE PREPERATION

- 5.1. Secure a concrete core in accordance with ASTM C856, under section 8 (Samples). Generally, a core shall have a size minimum of 6 inches (150 mm) in diameter and 1 foot (305 mm) in length, however the sizes can be different due to the specific nature of the coring location.
- 5.2. The concrete specimens should be cut on the large stone saw so as to bisect the cylinder along its longitudinal axis. Care should be taken in avoiding, if possible, the steel reinforcing bars encountered in bridge deck cores.
- 5.3. Select the better half of the core for the next step, however, set the second half to the side for possible later inspection.
- 5.4. The half chosen for inspection is now wet polished. Using a concrete wet polisher start with the coarsest grit (50) and work your way to the finest grit (3000). Complete this step until the surface is sufficiently polished.

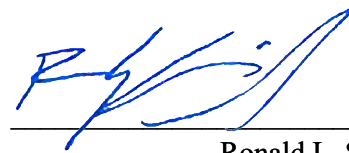
6. PROCEDURE

- 6.1. Take the polished concrete slab and rinse the surface of it with gas free, distilled water, making sure to remove any residue from the surface.
- 6.2. Cover the rinsed surface with the sodium cobaltinitrite solution and allow this to sit for 30 to 60 seconds. After allowing the reaction sufficient time to happen rinse the surface again with gas free distilled water.
- 6.3. After the rinse cover the surface with the rhodamine compound, allow to sit for 30 to 60 seconds. Once the reaction has had time to happen rinse the surface again with gas free distilled water.

7. OBSERVATIONS

- 7.1. Reaction gel that is present with alkali silica reactions is rich in potassium. The sodium cobaltinitrite reacts with this free potassium creating a yellow stain.
- 7.2. The rhodamine solution reacts with deterioration by products in concrete. One of which is a modified composition of the ASR that migrates away from the reacted aggregate and replaces its alkali constituents with calcium. This change will cause a reaction with the rhodium that causes a pink stain.

- 7.3. When all the staining on the surface has been completed make notes of the extent of staining present on the surface.
- 7.4. Record any visual damage or deterioration that is seen on the concrete. This includes the amount of cracking present and the severity of the cracking.
- 7.5. Observations of any damage present on the concrete and the staining that is seen can be a good indicator of the presence (or absence) of ASR. The person making these observations must use their good judgement and knowledge to interpret their findings.
- 7.6. Further investigation can be made on the stained core using magnification to strengthen the findings from this test, as staining is made possible through other factors that can be ruled out through further investigation. (See MP 601.03.22)



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