

NATIONAL INSTITUTE FOR TRANSPORT AND ROAD RESEARCH
CARBONATION TEST KIT

1. REAGENTS

0,4 % Phenol Red : yellow at pH < 6,8 deepest red at pH ≥ 8,4
0,5 % Phenolphthalein: colourless at pH < 8,3 deepest red at pH ≥ 10
Dilute HCl (5N) : effervesces in presence of CaCO₃

2. METHOD

Excavate hole in layer to the full depth to be tested. Clean sides of hole by brushing, or blowing. Spray side of hole to full depth with reagents in turn⁽¹⁾. The acid may be sprayed over one of the other reagents, usually the phenolphthalein, if desired. Repeat the test on the unstabilized material and the stabilizer if available⁽²⁾.

3. PRINCIPLE OF METHOD

Lime or cement present: both phenol red⁽³⁾ and phenolphthalein turn red.
CaCO₃ present : phenol red⁽³⁾ turns red and HCl effervesces.

4. INTERPRETATION

Carbonation absent⁽⁴⁾ (red colour with phenolphthalein)

- (a) CaCO₃ absent from original materials: red colour with phenolphthalein (phenol red should also turn red) and no effervescence with acid.
- (b) CaCO₃ present in original material(s): red colour with phenolphthalein (phenol red should also turn red) and effervescence with acid. In this case partial carbonation⁽⁴⁾ cannot be ruled out.

Complete carbonation⁽⁴⁾ (no colour change with phenolphthalein)

- (a) CaCO₃ absent from original materials: no colour change with phenolphthalein, but red with phenol red, and effervescence with acid.
- (b) CaCO₃ present in original material(s): as for (a). However, cannot be certain whether carbonated or stabilizer never added.

Stabilizer never added (no colour change with phenolphthalein)

- (a) CaCO₃ absent from original materials: no colour change with phenolphthalein, and absence of effervescence with acid.
- (b) CaCO₃ present in original material(s): no colour change with phenolphthalein, but red with phenol red, and effervescence with acid. However, cannot distinguish whether carbonated or stabilizer never added.

In both cases a yellow colour with phenol red is strong additional evidence that the stabilizer was never present.

5. WARNING

Phenolphthalein is a powerful laxative - wash hands after use or before eating. HCl will eat holes in clothing.

6. REFERENCES

NITRR Reports RS/2/84 and RS/3/84.

NOTES

1. Carbonation attacks the stabilized material as a "front" at all interfaces with atmospheric or soil CO_2 , e.g. an exposed layer, contacts with permeable unstabilized layers, and crack faces. All such surfaces should therefore be checked.
2. This is often not possible. However, if the stabilized material which now turns red with phenolphthalein does not effervesce with acid (i.e. CaCO_3 absent), then CaCO_3 was absent in the original materials. If it effervesces, the CaCO_3 may be due to carbonation and/or have been in one or both of the original materials (soil and/or stabilizer). If the effervescence is weaker in the red material than in the uncoloured material, the uncoloured material has probably been carbonated. In many cases a reasonable guess can be taken as to whether the untreated soil contained carbonate, while it should be remembered that limes and cements are not always carbonate-free and may contain up to about 10 % CaCO_3 .
3. Phenol red cannot always be relied upon to give clearly discernible colour changes. However, in practice phenolphthalein and acid are usually sufficient.
4. Provided that CaCO_3 was absent from the original materials partial carbonation is indicated by a red colour with phenolphthalein and effervescence with acid. Significant amounts or thicknesses of partially carbonated material seem to be rare.

OTHER POSSIBLE USES FOR TEST KIT

1. Mine rock crushed stone base material (see RR 260)
 - (a) Yellow with phenol red: danger of salt damage - check conductivity and pH.
 - (b) Red with phenolphthalein: lime or cement was added - no danger of salt damage.
 - (c) No colour change with phenolphthalein, but red with phenol red and effervesces with acid: lime added, but it carbonated - check conductivity.
2. Dispersive soils (see Ground Profile, Jan. 1980. p. 16 and USDA Handbook 60, p. 18)
 - (a) Red with phenolphthalein: ESP probably > 15, therefore probably a dispersive soil. (This does not apply to stabilized materials.) Failure to turn red does not mean that the soil is non-dispersive.
3. Deteriorated cement or lime

Fails to turn red with phenolphthalein, and effervesces strongly with acid: completely deteriorated - do not use.