

### DE-ICING CONCRETE

#### GENERAL

Technical Services Branch has recently been looking into maintenance of concrete surfaces for Property Management Division. For public safety, every effort should be made to prevent ice formation on horizontal concrete surfaces through prompt snow clearing. However, since this may not always be completely effective, the need for de-icing will inevitably arise in some cases. Since sodium chloride (rock salt) is known to have deleterious effects on concrete, all efforts should be made to avoid its use.

#### METHODS

##### CHIPPING

One obvious method of de-icing is to simply chip or scrape off the ice. We recommend against this method since it can very easily result in physical damage to the concrete surface, unless the ice is already de-bonded due to partial melting.

##### SAND/GRAVEL

Another method is to spread sand or gravel (rock chips) on the ice surface. This is effective in improving traction and is harmless to the concrete. We recommend this method wherever it is adequate from a safety point of view.

#### CHEMICALS

The most common method of de-icing, however, consists of the application of chemical de-icers. While there are many commercial brands available, almost all of them consist of one or more compounds of the following chemicals:

- Chlorides
  - Calcium chloride
  - Magnesium chloride
  - Sodium chloride (rock salt)
  - Potassium chloride
- Acetate-based de-icers
  - Potassium acetate
  - Calcium magnesium acetate (CMA)
- Fertilizers
  - Urea
  - Ammonium nitrate
  - Ammonium sulfate

These chemicals have a variety of effects on concrete.

#### EFFECTS OF CHEMICALS

All of these chemical de-icers are potentially harmful to concrete and the environment but the degree varies. Ammonium nitrate, ammonium sulfate, and urea are the most harmful since they chemically react with the concrete. In general, chloride salts lower the freezing point of water and therefore can increase the number of freeze-thaw cycles to be resisted. They also promote corrosion of reinforcing steel which in turn can result in spalling and/or loss of concrete strength. Sodium chloride is corrosive, will cause spalling of the concrete, and will inhibit vegetation growth. Calcium chloride is also corrosive but is less damaging to concrete than sodium chloride and has only a minor effect on vegetation growth. Potassium chloride is nearly harmless to vegetation, only slightly damaging to concrete, and nearly harmless to metals.

#### RECOMMENDATIONS

From the point of view of concrete durability, the ideal approach would be to avoid using chemical de-icers altogether. However, it is recognized that in some cases safety concerns may appropriately be considered to overrule this. We recommend the following procedure be followed to maintain concrete surfaces:

- First option: Clean sidewalks to bare concrete before icing occurs, and brush them frequently.
- Second option: Apply sand or gravel as required.
- Third option: If ice prevails, then apply a de-icer that has been thoroughly reviewed and found to be less harmful to concrete and the environment,
  - All efforts should be made to avoid use of de-icers with fertilizers.
  - Avoid using de-icers on concrete less than one year old. It has been shown that young concrete has significantly less freeze-thaw resistance than mature concrete.
  - Wash all concrete surfaces treated with de-icers thoroughly each spring to remove any latent salt.

#### CONTACT

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